Nature, Material, Culture, and the Volcano: The Archaeology of the Volcán Barú in Highland Chiriquí, Panamá

Karen Holmberg

Submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy
in the Graduate School of Arts and Sciences

COLUMBIA UNIVERSITY

2009

ABSTRACT

Nature, Material, Culture, and the Volcano:
The Archaeology of the Volcán Barú in Highland Chiriquí, Panamá

Karen Holmberg

This thesis can be seen as a dossier on one volcano and the ways in which it is currently 'thought'. I discuss a moderately bounded local area (240 km^2) on the eastern slopes of the Volcán Barú in the Chiriquí province, Panamá and examine roughly 2,000 years of human occupation within the volcanically active environment by drawing upon ethnographic, geological, historical, and palaeoecological data in a framework of landscape archaeology. The modern study of Latin American volcanoes began with the fieldwork of Alexander von Humboldt (1799-1804); I encourage a return to Humboldt's conceptions of the inextricable interconnection of natural and social sciences in the investigation of volcanic landscapes.

The chapters of the thesis build upon one another much in the way that a Geographic Information System (GIS) layers consecutive strata of data. My research focuses on an examination of the role of volcanic materials, eruptions, and objects in the volcanic landscape both in the past and in current archaeological interpretation. New data provided in the thesis include: the first AMS-dated grave context from the Chiriquí province of Panamá; locations and representations of 24 previously unknown petroglyphs in the Boquete survey area; petrographic analysis of Volcán Barú tephra; maps of looted pre-Columbian cemetery locations extrapolated from nineteenth and early twentieth-century reports and accession files; and possible quarry locations and transport paths for volcanic materials used in Barú area grave construction.

The research is influenced by aspects of social archaeology in that it examines the past and present social value of material culture and emphasizes archaeology's

unique positioning between the sciences and humanities. I highlight the epistemological link between the unstable categories of subject, object, nature and culture. While assessing and reinterpreting the timing and impact of volcanic events in the pre-Columbian past, I urge a greater emphasis on the role of human experience and the importance of the volcano in non-eruptive periods. If contemporary and pre-Columbian perspectives of landscape have any parallel, I suggest that it may be a shared uneasiness with perceptions of a reversal or inversion of the accepted order that rapid environmental change creates.

Table of Contents

List of figures iv
Acknowledgments viii
Dedication xi
Preface xii

Introduction • EARTH IN REVOLT: THE ARCHAEOLOGY OF THE VOLCÁN BARÚ 1
The nature of things: making social connections 3
The Central American land bridge and the Greater Chiriquí culture area 7
Chiriquí prehistory in a continental and regional context 8
Social value: prestige goods and inalienable objects 13
Thinking the volcano in archaeological conception 16
Scalar time and the event of eruption 18
The material of experience 24
The revolt of objects 27
Highland Chiriquí: an anti-Pompeii 31
Natures, cultures, and volcanic materials: an outline of the thesis chapters 33

Chapter 1 • TERRA MOBILIS: THE MUTABLE MATERIALITY, GEOLOGICAL UNDERSTANDING, AND ARCHAEOLOGICAL INTERPRETATIONS OF THE VOLCÁN BARÚ 37
The Volcán Barú in geological perspective 40
Early geological studies of the Volcán Barú 44
Earth in motion: plate tectonics and the Barú region 51
The Volcán Barú in archaeological perspective: the Linares-Ranere project 61
New interpretations of Barú's eruptive history: Multiple eruptions and uninterrupted occupations 80
Suggested dates for Barú eruptions 82
The fit between the Linares-Ranere hypotheses and recent archaeological data 90
The 'nature' of the Linares-Ranere project 93
Discussion: The conjunction of social and earth sciences 95

Chapter 2 • CULTURAL NATURE: TEPHRA AS ECOFACT 98
Tephrochronology 100
Tephrochronology and archaeology in Latin America 101
Cultural material from natural objects 102
Petrographic analysis 103
Description of the samples 109

Results and discussion ... *115*
'Silences' and the event of eruption ... 119

Chapter 3 • MATERIAL, CULTURE, AND THE VOLCANO: CIRCULATING THINGS ... 122
Material loss and collection ... 124
Buying, selling, giving, and stealing: the present value of the past ... *129*
Material, culture, and the Volcán Barú ... 133
Archaeological studies in the Barú area ... *134*
My survey methods ... *137*
Artifacts and eruptions in the Boquete survey area ... *143*
The first AMS-dated grave site in western Panamá ... *151*
Miniaturization, 'miscellanea', and impermanence ... *181*
Discussion: The anti-Pompeii and material nature ... 192
Objects and value ... *194*

Chapter 4 • MAPPING THE NARRATIVES OF STONES ... 201
Petroglyphs in the Boquete survey area ... 205
Three 'uses' of rock art in the Boquete survey area ... *209*
The purpose of rock art and the irritation of doubt ... 248
Lines of sight and site ... *250*
Landscape narratives ... 256
Mapping: a critique ... *256*
Oral tradition and the Barú landscape: three stories ... *262*
Discussion: oral traditions, volcanic landscapes, and exceptional events ... 270

Chapter 5 • HERITAGE AND HAZARD OF THE VOLCANIC LANDSCAPE ... 281
The place of the Volcán Barú in Chiriquí identity ... 282
Ecotourism and ecoretirement: nature, the past, and desirability ... *286*
'Panamá is a paradise for foreigners' ... *292*
Learning from the past and a de-moralized nature ... 296
The hazards of the volcanic landscape ... *296*
Protecting the volcano ... *303*
The local 'afterlife' of the past ... 306
Descendant communities and appropriating heritage ... *306*
Re-using and living with the past ... *310*
The past and future landscape ... 315

Afterword • MATERIAL NATURE: THE VOLCANO AS A THINKABLE WILDNESS....................318
THE IDEA OF NATURE.................... 320
THINKING THE WILDNESS OF THE VOLCANO.................... 322
A diseased and imbalanced nature: the event of eruption.................... 324
Reversed orders: the beginning of nature.................... 326
IN SUM: INALIENABLE MATERIAL.................... 329
The archaeology of an anti-Pompeii.................... 332

GLOSSARY.................... 334
REFERENCES.................... 337

APPENDICES.................... 395
Appendix A: Citations for geological and tephrochronological studies.................... 395
Appendix B: 14C dates associated with Barú eruptions (youngest to oldest) 397*
Appendix C: Tephra sample set C (indicated by red arrow) in relation to the Palumbo (2008) work..................... 399
Appendix D: Tephra sample characteristics.................... 400
Appendix E: Extrapolated cemetery locations in the Boquete area.................... 401
Appendix F: Overview of site locations and fieldwork completed.................... 403
Appendix G: Boquete area ceramics classification.................... 405
Appendix H: Diagnostic ceramic data (a-d).................... 411
Appendix I: Lithic counts and descriptions.................... 449
Appendix J: Stratigraphic locations of tephra in the Boquete survey sites.................... 482*
Appendix K: AMS dates from excavated units.................... 484
Appendix L: Carbon samples from excavated units.................... 485
Appendix M: Grave goods from the KOT-F unit at BE-16-KH (KOT).................... 487
Appendix N: Organic casts found in excavated contexts.................... 490
Appendix O: Locations and descriptions of the Boquete petroglyph boulders.................... 491
Appendix P: Petroglyph boulder photographs (with and without tape).................... 493
Appendix Q: Some interpretations of the Piedra Pintada designs.................... 504

List of figures

Figure 0-1: map of the suggested archaeological culture areas of southern central america. 9
Figure 0-2: Map of Greater Chiriquí in relation to contemporary national boundaries 11
Figure 0-3: Chronological chart of cultural sequences proposed for Greater Chiriquí 12
Figure 0-4: a 'vibrating string' used to illustrate the short and long-term impacts of volcanic eruptions.....20
Figure 1-1: Map of Central American volcanoes active during the holocene period. 41
Figure 1-2: Excerpt from the Physikalischer Atlas by Hermann Berghaus (1892: 14). 45
Figure 1-3: 1685 map of the Chiriquí Bay with Barú, listed only as a 'mount', in the background.....................47
Figure 1-4: Tectonic map of Central America, showing the regional geometry of tectonic plates. 53
Figure 1-5: false color Satellite image of barú...57
Figure 1-6: assessment of the available information on Barú per July 2006 as published in Alvarado et al (2007) 60
Figure 1-7: elements of the *Adaptive Radiations* hypotheses (per Cooke and Sanchez 2004)..............................62
Figure 1-8: map of the study areas discussed by A*daptive Radiations in Prehistoric Panamá (*Linares and Ranere 1980a). 66
Figure 1-9: The gulf of chiriquí site of la pitahaya from linares and ranere (1980a) 68
Figure 1-10: The Caribbean coastal sites of the Aguacate Peninsula from linares and ranere (1980a) 70
Figure 1-11: The highland sites from Linares and Ranere (1980a)..71
Figure 1-12: The Rio Chiriquí rock shelters 73
Figure 1-13: The Volcán and Cerro Punta sites 74
Figure 1-14: dates for 14C samples thought to relate to eruptions of the Volcán Barú during the period of intensive human occupation 82
Figure 1-15: Locations of lake-sediment cores 83
Figure 1-16: Dates of Barú eruptions per Behling (2000). 84
Figure 1-17: Dates of Barú eruptions per Clement and Horn (2001)...85
Figure 1-18: Dates of Barú eruptions per Anchukaitis and Horn (2005). 86
Figure 1-19: New dates for Barú eruptions from the USGS study (Sherrod et al. 2007) 88
Figure 1-20: Pollen percentage diagram for the Behling (2000) lake-sediment core...92
Figure 2-1: The source locations of the three tephra sample locations for my petrographic analyses............105
Figure 2-2: Schematic drawing of the tephra stratigraphy from the two lake-sediment cores and the archaeological stratigraphy...110
Figure 2-3: tephra sample characteristics (for full data see Apendix O) 117
Figure 3-1: map of the grave sites where j.a. mcneil obtained artifacts now in the major US collections (as recorded in collection records). 127
Figure 3-2: a sample of some of the artifacts held at the Benigno T. Argote school in Boquete 132
Figure 3-3: The 2004 Boquete survey sites in relation to the Linares-Ranere project sites (Linares and Ranere 1980a)...133
Figure 3-4: Sites examined by researchers on the western flanks of Barú...135
Figure 3-5: Locations of pre-Columbian grave sites discussed in early archaeological publications and looted grave contexts examined during the 2004 Boquete survey 136
Figure 3-6: The 2004 Boquete survey area 138
Figure 3-7: sites in the 2004 Boquete survey area in relation to heuristic tephra fall radii 141
Figure 3-8: ceramic counts and diagnostics from the boquete sites 145

FIGURE 3-9: GROUND STONE VS CHIPPED STONE ARTIFACTS FROM THE BOQUETE SITES 146
FIGURE 3-10: CHRONOLOGICAL SCHEMATIC OF THE INTERSECTION OF SITE USE AND VOLCANIC ERUPTIONS 148
FIGURE 3-11: CONSTRUCTION AND GRAVE SITE AT BE-16-KH (KOT); LOOKING WEST TOWARD BARÚ (13 KM DISTANCE TO THE SUMMIT) 152
FIGURE 3-12: BE-15-KH (KOT) SURVEY AND EXCAVATION AREA........152
FIGURE 3-13: EXCAVATED TEST PITS AT BE-16-KH (KOT)........154
FIGURE 3-14: REMNANTS OF A TIN CAN FOUND IN KOT-J (68 CM DEPTH WITHIN THE CONSTRUCTION PIT)........155
FIGURE 3-15: WALL OF BASALT COLUMNS FROM KOTJ AS SEEN FROM THE BURIAL CAVITY AND LOOKING EAST........156
FIGURE 3-16: WHOLE DACITE SLABS RETRIEVED FROM THE KOT GRAVES. THE KOT-K CONTEXT WAS TOO HEAVILY DISTURBED BY CONSTRUCTION TO OBTAIN AN ACCURATE IDEA OF THE PLACEMENT OF THE DASITIC SLABS AND IS NOT INCLUDED........157
FIGURE 3-17: PHOTOGRAPHS OF KOT-J DURING EXCAVATION SHOWING THE USE OF DACITE SLABS AND BASALT COLUMNS IN GRAVE CONSTRUCTION........158
FIGURE 3-18: STYLIZED PROFILE OF THE KOT-J GRAVE CONSTRUCTION........158
FIGURE 3-19: STYLIZED BE-16-KH (KOT) GRAVE CONSTRUCTION AS VIEWED FROM ABOVE, WITH DACITE SLABS (LEFT) AND WITHOUT (RIGHT) 159
FIGURE 3-20: A DACITE SLAB FROM KOT-F (SCALE IS 1 METER WITH 10 CM DIVISIONS) 159
FIGURE 3-21: BASALT COLUMNS FROM KOT-J 160
FIGURE 3-22: VERTICAL DACITE SLABS AT A RIGHT ANGLE AT BE-12-KH (GIO), GTESTC 161
FIGURE 3-23: BASALT COLUMN IN THE SURFACE SCATTER OF BE-12-KH (GIO) 162
FIGURE 3-24: GRAVE CONSTRUCTION SCHEMATIC PROVIDED BY WASSÉN (1949: FIGURE 6, GRAVE I) 163
FIGURE 3-25: GRAVE RE-CONSTRUCTION AS INTERPRETED BY WASSÉN (1969: FIGURE 18B, GRAVE II) 163
FIGURE 3-26: GRAVE CONSTRUCTION AS INTERPRETED BY LINNÉ (1936: FIGURE 1)........164
FIGURE 3-27: THE KOT-F BURIAL CAVITY........165
FIGURE 3-28: RIM SHERD FROM A WHOLE CERAMIC (VESSEL 8) THAT APPEARED INTENTIONALLY BROKEN IN THE KOT-F GRAVE 166
FIGURE 3-29: CACHE OF KOT-F POTS *IN SITU*........168
FIGURE 3-30: THE BONE GOUND UNDER VESSEL 4 OF THE KOT-F GRAVE CACHE (PRE-CONSERVATION MEASUREMENTS: 4.10 CM AND 2.14 CM DIAMETERS; 6.73 AND 8.18 CM LENGTHS; 0.92 CM BONE THICKNESS) 170
FIGURE 3-31: HUMAN TIBIA AS SHOWN IN GRAY'S ANATOMY (GRAY 1918) 171
FIGURE 3-32: SPHERICAL ORGANIC CASTS INTERPRETED AS EVIDENCE OF PALM NUTS USED AS GRAVE OFFERINGS 174
FIGURE 3-33: THE RITUALLY KILLED ANTHROPOMORPHIC POT FROM BE-16-KH (KOT)........176
FIGURE 3-34: A TAPIR POT ILLUSTRATED BY JOYCE 1916: 143 (SEE ALSO MACCURDY 1911: 145, FIGURE 245) 177
FIGURE 3-35: CERAMIC DOUBLE WHISTLE FROM KOT H.1 (3.63 CM X 4.5 CM). UPPER PHOTO SHOWS THE WHISTLE IN SITU WITH ASSOCIATED CARBON (AT THE UPPER POINT OF THE TOOTHPICK)........179
FIGURE 3-36: POLYCHROME SHERD FROM KOT I(EXT).4 180
FIGURE 3-37: CONTE, PASTA BEIGE VESSEL RECOVERED FROM A GRAVE IN THE AZUERO PENINSULA OF PANAMÁ (EXCAVATION AND PHOTOS BY WILLIAM LOCASCIO; PARP 2007, HE-4-D-4, STRAT 1, EXCAVATED 10/24/07) 180
FIGURE 3-38: LIFE SIZED VOLCANIC STONE FIGURES FOUND AT THE SITE OF BARRILES. FIGURES ARE NEARLY LIFE SIZED 181
FIGURE 3-39: KOT (8.2) TEPHRA OBJECT 183
FIGURE 3-40: TEPHRA OBJECT FROM KOT B.5 183
FIGURE 3-41: TEPHRA OBJECT FROM KOT D.6........183
FIGURE 3-42: TEPHRA OBJECT FROM KOT G.1 183
FIGURE 3-43: CERAMIC *ADORNOS* FROM THE BENIGNO T. ARGOTE SCHOOL (PHOTOS BY K. HOLMBERG)........185

Figure 3-44: lithic figurine made of volcanic stone from Costa Rica (photos by I. quintanilla) 185
Figure 3-45: The lithic figurine from survey at be-14-kh (gon). (110.0 x 95.8 x 61.4 mm) 187
Figure 3-46: Lithics made from volcanic stone and recovered from the Barú area by j.a. mcneil (left is from maccurdy 1911 : 37, Figure 38, recovered from Bugavita; right is from Holmes 1888: 24, Figure 7) 188
Figure 3-47: stone figures from Costa Rica (Photos by i. Quintanilla) 188
Figure 3-48: sphere recovered from the surface area near mar (photo by Lezlie milson de icaza) 189
Figure 3-49: volcanic Bomb or spheroidally weathered rock found at BE-18-kh (mar) (Left) and a pestle from the yale collection of artifacts collected by j.a. mcneil from the Barú area (from Maccurdy 1911: 34, Figure 32) 191
Figure 3-50: 'obelisk' from be-18-kh (mar) found near the bomb or bomb-like object.....................................192
Figure 4-1: the three petroglyph centers in the 2004 boquete survey area...210
Figure 4-2: the basalt column source near the bajo mono area of boquete 212
Figure 4-3: least cost path, gauging by slope, to transport basalt columns from their source to the graves at be-15-kh (gly) [a 2.8 km distance] and be-16-kh (kot) [a 3.8 km distance]...213
Figure 4-4: khp-23 and khp-24 petroglyph boulders. the north arrow is a one meter scale [for photographs of these boulders see Appendix P]..215
Figure 4-5: algarrobos dacite slab source and sulphur spring in relation to the 2004 boquete survey area and the site of bugaba..221
Figure 4-6: Overview map of the be-14-kh (gon) petroglyph concentration..223
Figure 4-7: be-14-kh (gon) petroglyphs khp-1 to khp-8 [arrow indicates north and is a 1 m scale]. Red marks indicate natural splits in the rock 224
Figure 4-8: be-14-kh (gon) petroglyphs khp-9 to khp-13 [arrow indicates north and is a 1 m scale]. Red marks indicate natural splits in the rock 225
Figure 4-9: be-14-kh (gon) petroglyphs khp-14 to khp-22, 25, 26 [arrow indicates north and is a 1 m scale]. Red marks indicate natural splits in the rock 226
Figure 4-10: photos of the 'platform' rock at be-14-kh (gon) 227
Figure 4-11: schematic of the unmarked rock at be-14-kh (gon) in relation to the *ojo de agua* and 1x1 meter excavated units a-c 227
Figure 4-12: stone artifacts collected during agricultural work by the gonzález family from the be-14-kh (gon) property. the collection includes stone spheres, *manos*, *metates*, and portable petroglyph cobbles 231
Figure 4-13: Excavated test units at the khp-9 petroglyph boulder during excavation (right photo shows the relationship of the clay-lined pit to khp-9)..232
Figure 4-14: the fire pit at khp-9, with beer bottle and dacite slab fragment *in situ* (left: photo; right: schematic) 233
Figure 4-15: Glass beer bottle embedded in the khp-9 fire pit 234
Figure 4-16: map of the caldera petroglyphs..235
Figure 4-17: schematic of the west profile of the caldera *piedra pintada*...237
Figure 4-18: profiles of the caldera piedra pintada with a schematic ofa human figure for scale...................238
Figure 4-19: Profile sketch of the *Piedra del indio*, Rivas site, Costa Rica (from photo in Quilter 2004: 147, Figure 6.5) 239
Figure 4-20: profiles of the basalt columns (i.e., *ladrillos or mojones)* from quilter and frost (2007: 50) 240
Figure 4-21: The top of the *Piedra Pintada*, looking north while sitting on the south end of the boulder 241

Figure 4-22: the split 'passage way' rock at Caldera (Left: photo taken while looking at the split boulder from the *Piedra Pintada*; right: photo taken from inside the split boulder, looking at the *Piedra Pintada*) 243
Figure 4-23: another split boulder close to the Caldera *Piedra Pintada* 243
Figure 4-24: schematic of the caldera *piedra pintada*, the split rock, and the passage of the sun 244
Figure 4-25: The 'correct' calendar on the west face of the *Piedra Pintada*, per the hypothesis of Roberto Perez-Franco (redrawn from Perez-Franco 2004) 246
Figure 4-26: two angles of the khp-27 boulder (at caldera) with a scematic of a human figure for scale 248
Figure 4-27: the linear pattern of known petroglyphs, 'rumored' petroglyphs (displayed as question marks), and prediction of an anticipated petroglyph location....253
Figure 4-28: A 3-dimensional line of 'site' for the Boquete petroglyphs....256
Figure 4-29: Augustine and his map....260
Figure 4-30: the physical and the implied aspects of Augustine's map, which was used as a mnemonic and aid for oral transmission of information 261
Figure 5-1: Panamanian stamps from 1949 showing Barú in order to denote the province of Chiriquí. Images used with permission From the collection of J.L. Whitford-Stark (Whitford-Stark 2007) 284
Figure 5-2: Communication towers and a cross at the highest point of the main crater summit of Barú....285
Figure 5-3: Charles Lindbergh (center) visiting a petroglyph in Boquete in January 1928....290
Figure 5-4: a ceramic paperweight of the khp-11 petroglyph which is designed to appeal to ecotourists 291
Figure 5-5: The first pane of the cartoon shows the newspaper headline, "Panamá is a paradise for foreigners"; in the second pane the Panamanian reader quips "no wonder it's going so badly for me". © La Prensa, dec 26, 2006 293
Figure 5-6: Natural disaster data for panamá between the period of 1900-2008, as reported by em-dat 299
Figure 5-7: map and chart of seismic stations currently monitoring the Volcán Barú (longitude and latitude were provided by Eduardo Comacho, Geoscience Institute, University of Panamá, November 2007) 302
Figure 5-8: flags on car windows (left) and sales of t-shirts, calendars, and buttons (right) were used to promote the anti-road movement 306
Figure 5-9: a miniature ceramic vessel recovered at the be-14-kh (gon) site. The pre-Columbian vessel has been decorated with traditional ngöbe designs....309
Figure 5-10: Ngöbe dancers at the Caldera *Piedra Pintada.* Photo is by Howard Hill....310
Figure 5-11: re-uses of dacite slabs from looted graves....311
Figure 5-12: The owner of finca Kotowa, Ricardo Koyner, stands over the location of the excavated graves at the be-16-kh (kot) site in March 2005....313
Figure 5-13: Contemporary 'petroglyphs' ? Painted boulders from the Boquete area. Left: advertising for a brand of beer; right: advertising for tourist services 314

Acknowledgments

The fieldwork and research represented by this thesis was possible through the financial support provided by a Wenner-Gren Individual Research Grant, Fulbright IIE Fellowship and extension, SMART Seed Grant for interdisciplinary research from the Columbia Earth Institute, and funding from Columbia University's Tinker Fund of the Institute for Latin American Studies and the Stigler Fund of the anthropology department.

My committee members each provided something unique to my project and made me think in directions I otherwise might not have considered. Nan Rothschild and Terence D'Altroy allowed me into the Columbia program and were unfazed - even supportive - when I stated my overall research interest as simply 'working with a volcano'. Nan thoughtfully guided me through my chapter writing. Paige West nudged me to think of the broader implications of working with concepts of *nature* through her own exemplary work in Papua New Guinea. Richard Cooke provided institutional affiliation at the Smithsonian Tropical Research Institute (STRI) for my Fulbright year, advice, and integral radiocarbon dates. In particular, I must acknowledge how unflagging and inspirational Lynn Meskell has been in her support, guidance, and encouragement. She is much loved by her students with good reason. The seeds of my research interests began in my undergraduate education at the University of Virginia, and it would be remiss to not acknowledge the encouragement I received there from James Deetz, Jeffrey Hantman, Stephen Plog, and H.L. Seneviratne.

Robin Torrence allowed me to work with her on Garua and Payson Sheets allowed me to work at Ceren. Both sites and researchers are iconic within volcanic region archaeology and I am grateful for those experiences. Olga Linares provided much appreciated opinions on ceramics during my fieldwork. Without her work and that of those who worked with her – Anthony Ranere, Payson Sheets, Bruce Dahlin, Sara Spang, Jane Rosenthal, and Catherine Shelton – my research would not have been possible.

The archaeological and anthropological community in Panamá-Costa Rica was a source of support both in my fieldwork and analysis periods. Luz Graciela Joly Adames was a vibrant font of energy and ideas and provided many opportunities and experiences that I otherwise would not have had. My research was richer with her contributions. Francisco Corrales Ulloa gave much appreciated and very helpful thoughts on ceramics. Ifigenia Quintanilla Jiménez was instrumental in my understanding of the lithics from my survey. Michael Snarskis shared helpful, unpublished information regarding Costa Rican sites. Martin Künne provided multiple stimulating discussions of rock art and provided useful edits. Tomas Mendizabal, Juan Guillermo Martin Rincon, Beatriz Rovira, Carlos Fitzgerald, Alvaro Brizuela, Mikael Haller, Scott Palumbo, Adam Menzies, Bill Locascio, John Griggs, John Hoopes, and Tom Wake have all added to my work through field visits or fielding of email questions (or both) and were an appreciated part of my experience.

At STRI, Aureliano (Yeyo) Valencia conserved the zoomorphic pot and human bone discussed in Chapter three and Conrado Tapia provided a cool head in guiding me through the maze of paperwork and bureaucracy I would not have otherwise survived. On that front, Dalys de Gracia and Belsi Medina from the US Embassy in Panamá were also guardians. Enrique Moreno at STRI helped me locate, open, and sample the lake sediment cores and provided me lab space and direction. I spent two years following my fieldwork in Rio de Janeiro, Brazil, and am grateful to Apareçida Vilaça and Carlos Fausto at the Museu Nacional of the Universidade

Federal do Rio de Janeiro for including me in their seminars and providing a much appreciated academic community. The Amazonian boat trip that I took in January 2007 with the *Projeto Bagagem* arm of the *Saúde e Alegria* non-governmental organization was a wonderful applied example of nature/culture and I thank Mônica Barroso Keel and Marcio Babi for their admirable work.

A number of people provided permission for me to use figures, graphics, or images that are reproduced in this thesis: Hermann Behling, Jelle de Boer, Jeffrey Marshall, J.L. Whitford-Stark, Roberto Perez-Franco, and Wren Grigore. Members of the volcanology and geophysics communities have been unfailingly patient and helpful. Chris Small at Lamont-Doherty guided the remote sensing project through which I originally found Barú and accompanied me in the field during an early visit. Kristi Wallace of the USGS provided a tephra protocol and consultation. Michael Ort and Nancy Riggs at Northern Arizona University provided tephra analysis direction, lab space, and equipment as well as a place to stay and the wonderful company of Marisa. Wendell Duffield, David Chester, and Mark Elson all provided information and entertainment throughout several conference sessions and many email exchanges. Eduardo Comacho of the University of Panamá Institute of Geosciences, José Luis Macias from the Geophysics Institute of the Autonomous National University of México (UNAM), and Guillermo Alvarado at the University of Costa Rica helpfully shared information and ideas. Lee Siebert at the Smithsonian Global Volcanism Project tolerantly allowed me to pepper him with Barú questions over the years and I thank him as well as the late and missed Jim Luhr. David Sherrod of the USGS deserves particular thanks for insightful responses to many questions and for very generously sharing Barú theories and GIS layers. As I'm told he's a 'hard as nails' geologist I'm even the more appreciative.

A number of people have provided important help at just the right time. Rosemary Joyce and Russell Sheptak gave me historical map data that I otherwise would not have found. Rosemary Joyce, additionally, did careful and incisive editing that greatly improved work that is incorporated in this thesis. Sturt Manning sorted through radiocarbon intricacies with me. Kevin Anchukaitis gave a close and insightful editing to my palaeoecology discussion. Sally Horn sent me useful pre-publications and permission to use them. Anabel Ford sent me research proposals and ideas on tephra and Rebecca Stone shared articles and thoughts on rock art and ritual killing. Bill Lockhart helped in identifying a historic bottle that found its way into my otherwise prehistoric artifact collection.

The active intellectual and environmentalist communities of the Barú area were instrumental during my time there. Some of these people include Milagros Pinzón Sanchéz, Dra. Maria Elisa Ruiz A., Ezekiel Miranda, Máximo Miranda, Mario José Molina Castillo, Angel Rodriguez, and Carla Black. It is impossible to overstate how important the landowners and residents of Boquete were to my ability to conduct the field survey. Clavdia Etzel Quiroz Moreno and Jorge Antonio González Quiel stand out especially. They not only provided permission to excavate in their fields but also asked thought provoking questions and participated in the fieldwork. Génesis and Gabriel González proved to be talented petroglyph hunters and my results are greatly enriched by their eyes. Ricardo MacIntyre Koyner provided permission to excavate on his property and slowed construction to allow excavation. He also is storing all of the excavated material from the entire survey project due to the lack of space at the official facilities in Panamá and David. Giovanna Boutet de Serracin, Maria Natividad Velasquez and Gilberto Serracin, Guillermo Bell and Niviavde Bell Arce, and Terry Van Niekerk and Hans Van

Der Moren in particular deserve mention for their helpfulness. I thank all the Boquete residents who allowed me to interview them on film to discuss their collections of artifacts. I did not use those data in this dissertation, though have discussed them in an earlier conference paper (Holmberg 2007b) and plan to incorporate them a different project.

The field work was not possible without the team members of what we quickly dubbed the *equipo ojalá* ('team inshallah/god willing'); *ojalá* it wouldn't rain any harder, *ojalá* we would find something, *ojalá* the cattle wouldn't stampede…. The composition of the team shifted and changed continually, though members who deserve special mention for their hard work and good spirits include Ibeth Caballero Miranda, Yaritza González, Abel and Antonio Cordoba Moreno, and Trista Delamere. José Feliciano Gonzalez G. should be considered a team member through his indefatigable artifact washing and petroglyph documenting. He and his wife, Ana Cecilia Gutierres Del Cid, were a wonderful component of my time in Boquete.

Friends in Boquete and Panamá made my time there richer and better. These included Ann and Gunnar Lindahl, Elba Landau, Chichita Landau, the late Pepe Landau, the late Gerardo Arias, Lenin and Maribel Cordoba, Jennifer and Merrill Bennett, Francisco Bech, Scott and Sonia Yates, Marla Palacios, Cecilio González, and Rafael Pitty. Frank Glavas included me in family meals and only allowed me to pay for a fraction of the nights I spent at the Pension Marilos. Penny Barrett was a wonderful landlord and I am grateful she required all subsequent leases of *Casa Penelope* to include custodianship of my ally and former street dog, Daisy. Mario and Mariellen Serracin were gracious hosts when my lease was over but my lab work was not. They provided a place to sleep and to work and many fond memories. Howard Hill shared his photographic eye and I've used a number of his photos in this thesis. Faiza and Fazal Abbas hosted many memorable evenings in Panamá City and helped me find the 4-wheel drive I used in the field. Lezlie and Gabriel Icaza hosted me many times and allowed me to stay long periods in the haven of their home. My experience in Panamá overall would have been very, very different if I had not met them in 1999.

A number of friends gave great support and input throughout the dissertation process and deserve thanks: Carolyn Dillian, Carrie Nakamura, Felipe Gaitán Ammann, Kristen Drybread, Lindsay Weiss, and Slobodon Mitrovic. Jeff Frost shared articles, maps, and thoughts and became a valued friend and colleague. Mark Smith visited in the field to help me set up my GIS and offered untiring consultation and friendship throughout the write-up process. Jimmy Fang gave me a place to stay when I most needed it. Kenny Tang was a kind, generous, and restorative presence during the writing process. I am eternally grateful for his patience. Finally, I thank my parents, Beverly and Neil Holmberg. The time I spent with them while writing on their farm in Virginia should have been traumatic but was a special and unique period of my life.

Dedication

For my parents;
and the intrepid R.H.

Preface

My father was given Richard Halliburton's *Book of Marvels* when he was a child in 1942; the descriptions of Pompeii and 79 AD Vesuvius were as evocative for me in the 1970's as for they were for him in the 1940's and for Halliburton in the 1930's. This was my introduction to the compression and expansion possible in the perception of time in a volcanic landscape and how material objects are linked to that perception. Charles Dickens (1846: 230) touched on the complex nature of past volcanic landscapes as viewed from the present when he described Pompeii and Vesuvius: they make one 'lose all count of time, and heed of other things, in the strange and melancholy sensation of seeing the Destroyed and the Destroyer'.

Prior to the fieldwork represented in this thesis I had invaluable field experiences as a team member on projects in Virginia, Belize, Athens, Papua New Guinea, and El Salvador and formed conceptions of what my ideal research area would be for my own project. The mountain town of Boquete in the Chiriquí province of western Panamá offered exactly what I was looking for in a dissertation project. It is a shockingly landscape-rich place; rocky streams, colorful epiphytes, sideways misting *bajareque* rains, double rainbows, frequent earthquakes, and a complex mixture of cultures, histories, and people all shift and move under and presiding shadow of the Volcán Barú.

My approach to volcanic landscapes is focused on *things*, or objects of material culture and how we view them. One of my personal prized things is a letter from Gordon Willey that is dated by happy coincidence on my birthday in 1999. The letter was a reply to my request for research ideas for fieldwork in western Panamá. On Harvard Peabody Museum letterhead, using a manual typewriter, he explained that it had been a very long time since his fieldwork in western Panamá in 1952. He guessed that the roads must certainly be better now than they were 50 years ago and stated that,

> It is my impression that Panamá – like much of Lower Central America and the whole of the 'Intermediate Area' – is still in need of old-fashioned time-space systematics.

Willey then wrote,

> Of course, I am sure there are more 'advanced' problems to attack down there – going beyond relative chronologies and ceramic style distributions.

Willey rightly pointed out the many gaps in time-space understanding in the 'Intermediate Area', and a great deal more work is required to elucidate the many questions that arise from these lacunae (see Lange 1996a). My research neither amends these gaps nor approaches questions that are more 'advanced', though it does attempt a social focus that is integrated with physical science data. Catherine Shelton (1994: 95), who capably followed the work begun by the team of researchers represented by the edited volume *Adaptive Radiations in Prehistoric Panamá* (Linares and Ranere 1980a), called for a fusion of both social questions and chronology in future work. This call is apt, as social questions cannot be inserted in later stages of research but are crucial elements of the early stage research that this thesis represents (Dobres 2000, Hodder 2000, Jones 2002, Lucas 2001: 189). Ideally, the gaps in the chronologies that still exist will be amended by shorter periods between research projects and a multiplicity of theoretical vantages and foci in this new century.

Wolfgang Haberland, the German archaeologist who conducted considerable amounts of fieldwork in Chiriquí, also wrote a thoughtful and greatly appreciated letter in response to my 1999 request for his input on research topics. He stated that,

> When I began my investigations fifty years ago, everybody thought that everything was known about that region, due to the investigations by Holmes and MacCurdy, forgetting, that neither of them did any fieldwork there but published from museum collections and hear-say-reports of travelers and collectors. To a certain extent, that is still the case!

As Haberland points out, though a great amount of good work has been done in Chiriquí, many stones are still left unturned and new forms of data exist that we have yet to consider.

Introduction • EARTH IN REVOLT: THE ARCHAEOLOGY OF THE VOLCÁN BARÚ

Central America bristles with a prominent spine of volcanoes. The region is a locus of constant tectonic mutability and dramatically catastrophic volcanic eruptions have impacted human settlements for over ten millennia. Many eruptions, however, are not catastrophic yet still vividly impact memory, oral traditions, and material practices. While volcanic eruptions are important, the interstices between eruptions also provide rich sources of information regarding the intersection of volcanism and human life.

The massive Barú volcano (3477 m) in western Panamá forms the southern terminus of the arc of Central American volcanoes and is located near the complex junction of seismically active tectonic plates. Archaeological fieldwork led by Olga Linares and Anthony Ranere between 1969-1974 identified pre-Columbian sites near Barú covered by volcanic tephra and the researchers formed hypotheses regarding the possible role of volcanic eruption in major settlement pattern changes in the region (Linares and Ranere 1980a). In this thesis, I build upon and extend this prior work in that I address the archaeological and contemporary presence of Barú in conjunction with the most recent understanding of the volcano's eruption history. I re-examine the role of volcanic eruption in the Barú context and argue that the volcano's presence in the past was constitutive of a lived space that was produced by a variety of processes. As with the production of all spaces, these processes were discursive, mental, material, and social (Lefebvre 1991).

In essence, this thesis can be seen as a dossier on one volcano and the ways in which it is currently 'thought' in geological, archaeological, and ethnographic terms. The bibliography, hence, is meant to provide a moderately exhaustive compilation of Barú references. The chapters of the thesis each build on one another much in the way that a Geographic Information System (GIS) layers consecutive strata of data. The new data provided by my archaeological survey work include the following: the first AMS-dated grave context from the Chiriquí province of Panamá; locations and representations of 24 previously unknown petroglyphs that I identified and recorded in the Boquete survey area; petrographic analysis of Volcán Barú tephra (volcanic ejecta) that I sampled from lake-sediment cores and the archaeological site of Barriles in an examination of the utility of tephra as a chronological marker; maps of looted pre-Columbian cemetery locations I extrapolated from nineteenth and early twentieth-century reports and accession files; and possible quarry locations and transport paths for volcanic materials used in Barú area grave construction.

The fieldwork represented in this thesis reflects the interactivity, immediacy, and fluidity of a reflexive approach to excavation as called for by Berggren and Hodder (2003: 19) in the sense that all excavation, analysis, and interpretation were undertaken by myself and a small team of local field and lab assistants who worked in close conjunction with me. These data are the result of three preliminary field visits (1999, 2000, 2001) as well as a fourteen-month stretch of extensive and purposive survey, excavation, and field lab analysis (January 2004-March 2005) that I completed with the help of paid local assistants and a small number of intermittent volunteers.

The project incorporates satellite remote sensing work I completed at the Lamont-Doherty Earth Observatory as part of a larger project on volcanic hazards and a GIS that I compiled in the field. The thesis also draws from ethnographic interviews I conducted during and following archaeological fieldwork, a graduate seminar on archaeology and tourism that I taught through the *Universidad Autónoma de Chiriquí* (UNACHI) in Davíd, Panamá; archival research of colonial records and maps; and petrography analysis of tephra samples conducted at Northern Arizona University using my fieldwork samples and samples from lake cores held in cold storage at the Smithsonian Tropical Research Institute (STRI) in Panama City.

I examined a number of artifact collections in order to better understand my excavated materials; these included: un-cataloged artifacts from excavations by Matthew Stirling that are held at Suitland, Maryland facility of the Smithsonian National Museum of Natural History; artifacts in household and school collections in Boquete, Panamá; the José de Obaldia museum in David, the Reina Torres de Araúz museum in Panamá City; the collection held at Yale in the Peabody Museum of Natural History; and the excellent online catalogs of artifacts held at Harvard in the Peabody Museum of Archaeology and Ethnology.[1] Following the fieldwork in Panamá, my theoretical conceptions benefited from ethnography seminars at the *Museu Nacional* in Rio de Janeiro, Brazil in 2005-6 and a trip in January 2007 with the non-governmental organization *Saúde e Alegria* on the Tapajós and Arapiuns tributaries of the Amazon. Preliminary portions of my analysis were published as chapters in edited volumes (Holmberg 2005, 2007a, Holmberg, Stanton, and Hutson 2006), though this thesis represents my more recent interpretations.

In the following introduction I will briefly outline the theoretical bases of my research. I provide a broad overview of the study area and delineate the way in which I view objects and time in my interpretation of the volcanic landscape.

The nature of things: making social connections

Despite the heavy emphasis upon empiricism in archaeological thought, facts and data do not speak for themselves without intervening theory (Johnson 2009, Wylie 2002b). In the sense that this thesis queries the ways in which people 'make and use, collect and discard, value or take for granted' material culture both in the past and in current archaeological interpretation, my project can be seen as being influenced by the body of literature and vantage defined as social archaeology (Hall 2001, Preucel and

[1] For a list of museums that hold Chiriquí artifacts, see Shelton (1984: 11-12).

Meskell 2007a: 3). The word *social* can be used in myriad ways to the point of abstraction (Latour 2007b), hence requires explication.

Social archaeology in Latin America can take a number of forms (Meskell et al. 2001: 353, Politis and Pérez Gollán 2007: 353). As utilized by work in Cuba, Mexico, Peru, and Venezuela, particularly in the 1970's and 1980's, 'social archaeology' implied interpretations based upon a Marxist materialist dialectic (Matos Medieta 1994, Oyuela-Caycedo et al. 1997). Published work in this rubric at times could be extremely polemical (e.g., see Lizarrága 1999, Patterson 1994, 1999).

The social implications and political dimension of archaeological work are difficult to evade in Latin American contexts due to colonialism, globalization and free trade debates, and the disproportionate number of foreign researchers interpreting the pre-Columbian past (Politis and Pérez Gollán 2007). At its most basic level, my employment of social archaeology vantages has its roots in the call that Walter Taylor made a half century ago in *A Study of Archaeology* (1948) for archaeologists to preference the recovery and recording of cultural contexts rather than time-space chronicling (see Watson 1983: x). My use of social archaeology is intended to emphasize archaeology's unique positioning between the sciences and humanities through its grounding in 'things' and the epistemological link between the unstable categories of subject, object, nature and culture (Webmoor and Witmore 2008).

A recurring point that I make in this thesis is that the social sciences and natural sciences are more tightly bound to one another than the current academic context of research hyper-specialization indicates. While most recent archaeological projects conducted throughout the Americas and Europe espouse multi-disciplinary teams of researchers, individual researchers can and should also push past rigid definitions of disciplinary boundaries in their vantages and interpretations. A model of this intellectual openness and breadth is provided by the nineteenth-century German naturalist, Alexander von Humboldt. Humboldt firmly emphasized the interconnection and indivisibility of social and natural studies and the interconnection of diverse phenomena. Humboldt's work is garnering a deserved increase in interest (e.g., Harvey 1998, 2000, Helferich 2004, Rupke 2008, Sachs 2006) in a recent turn toward cosmopolitanism. While Humboldt promoted highly egalitarian ideals and was adamantly opposed to slavery, he still held some problematically racist perspectives and cannot be treated uncritically (Reilly, Kaufman, and Bodino 2003: 128, 194, though see Rupke 2008: 81, 128).[2] Importantly, however, Humboldt urged the close integration of natural and social studies and his ambitious five-volume work *Cosmos* (1997 [1851]) was a highly interdisciplinary account of his exploration of the Americas that intended to unify branches of scientific knowledge.[3] In this intention, Humboldt can be seen as a role model for the reversal of the extreme disciplinary narrowness that characterized twentieth-century scholarship (Harvey 1998: 724, Zeldin 1995: 198-202).

My invocation of Humboldt's work and influence is particularly appropriate for the research represented by this thesis as he shaped our current understanding of volcanoes and of landscapes in Latin America. Humboldt created the base of our understanding of Central American volcanism through fieldwork he conducted from 1799-1804. Humboldt's work strongly influenced the US geographer Carl Sauer, whose work with phenomenological aspects of human-environment interactions in Latin America provides an important foundation of Latin American landscape studies (Sachs 2006: 341). My work in part draws upon this genealogy of prior research with Latin

[2] In writing *Cosmos*, Humboldt was heavily influenced by Kant's *Geography*. Kant's work contained highly prejudicial racial judgments and stereotypes which Kant assembled from second and third-hand sources; for examples see Harvey (2000: 533). Humboldt, in contrast, traveled widely for his exploration and scientific observations and was, unlike Kant, more sensitive in his understandings and descriptions of people he encountered in his geographical exploration.

[3] Humboldt greatly increased European awareness of the Americas, but was impactive within Latin America as well through his close association with Simón Bolívar. With another Argentinean, José de San Martín, Bolivar led colonial Spanish America's struggle for independence and helped form the modern countries of Venezuela, Colombia, Ecuador, Peru, Panamá, and Bolivia.

American volcanoes and landscapes, though I urge a more 'cultured nature' than Humboldt envisioned from his Kantian influence.

My perspective throughout this thesis is that there is no way to provide a full idea or description of a volcanic region from either a hard science or humanities vantage. The body of fieldwork and publications by Olga Linares and Anthony Ranere (from this point to be referred to as the Linares-Ranere project) in western Panamá and the many researchers affiliated with the project also sought to investigate the interaction between natural and cultural worlds (Linares 1980e: 14).[4] In this sense I am continuing the research project that the Linares-Ranere project began, though I explore a number of new directions.

I write with the perspective that the fragmentation of archaeological theory into antagonistic camps of processual and postprocessual proponents is outdated and unproductive. Culture history, positivist archaeology, and postprocessual archaeology are non-exclusionary and do not discount one another (Deetz 1983, Trigger 1978, Wylie 2002c: 16). Processual and postprocessual archaeologies are complementary (Flannery 2006, Trigger 2007, Wylie 2002b), particularly in the multi-disciplinary context of environmental change studies (Hardesty 2007: 3, McGovern et al. 2007: 27-8).[5] I consider a mutable volcanic landscape – like many other equally dynamic and potentially threatening landscapes (e.g., coastlines, deserts, etc.) – to be an encapsulation of rapid environmental change. Understanding the physical world is a precondition of understanding social worlds; the social world in turn discursively produces, physically manipulates, and tangibly alters the physical world and is the basis for how we understand the physical world.

[4] I use the 'Linares-Ranere project' to imply the body of fieldwork as well as the numerous publications that resulted from the fieldwork, which will be discussed in Chapter one. This body of work has also been referred to as the 'Linares-Ranere project in western Panamá' (Cooke 2005) and the 'Western Panamá Project' (Shelton 1994).

[5] For a discussion of the importance of integrating ecological and humanistic vantages see Flannery (2006).

The Central American land bridge and the Greater Chiriquí culture area

The Central American land bridge formed between 3.2 and 3.7 million years ago and extends between southern Nicaragua and northern Colombia (see Cooke 2005: Figure 1). If people reached Venezuela, Brazil and southern Chile by roughly 14,000 BP (Dillehay 2009), they almost certainly traversed the Central American land bridge to do so. Archaeological data for such early crossings are limited to two possible surface-collected fragments of a type of lanceolate bifacial projectile point ('Jobo') that were being used in southern Chile and Venezuela at this time (Cooke and Sánchez Herrera 2004b: Figure 4, j, Pearson 2002: Figure 38, c).

A human presence on the isthmus is considerably more visible at several Costa Rican and Panamanian sites during the period of manufacture of Clovis and Fish-Tail fluted projectile points (Ranere and Cooke 2003, Ranere and López 2007). It is assumed now that the Clovis technology in North America dates to roughly 13000 BP while occupations with Fish-Tail points date to roughly 13000-11000 BP in South America. Only one Panamanian site with fluted points - Cueva de los Vampiros (Vampiros-1) on the central Pacific coast - has provided stratified information (Pearson and Cooke 2008).[6] Archaeological data from this and other rock-shelters in conjunction with vegetation history derived from lake-core sediments at sites such as La Yeguada show that people remained continuously in some areas of Panama after the Paleoindian period (Piperno 2006c, Ranere and Cooke 2003).

Evidence from lake cores in central and eastern Panamá (La Yeguada and Cana) point to extensive forest clearance by roughly 7000 BP (Cooke 2005: 140-42, Piperno 2006c). This clearance was directly related to the dispersal and intensification of food production. Many of the tropical plants that subsequently became New World staples – such as maize (*Zea mays*), cassava (*Manihot esculenta*), yams (*Discorea spp*.) and squash (*Cucurbita*) - were being widely planted in Panama by the Late Preceramic period of

[6] Two fragments of fluted points, possible of the Fish-Tail type, were found between a thin occupation floor dated to 11,550 ± 40 BP (ca. 13500 BP) and a charcoal date of 9100 ± 40 BP (ca. 10200 BP).

7000-4500 BP (Dickau, Ranere, and Cooke 2007, Piperno, Andres, and Stothert 2000, Piperno et al. 2000).

People moved into the humid highlands of western Panama around the Barú volcano by roughly 2800 BP (Behling 2000). Evidence for permanent villages and population nucleation is apparent in this region and several others along the Pacific watershed of Panama by at least 200 BC (Cooke 2005). The archaeological record contains increasing evidence for social differentiation and wealth disparity, which is apparent in the record for mortuary art distribution at the contiguous and coeval sites of Sitio Conte and El Caño (AD 750-950) and in the statuary of Barriles (AD 200-600?) (Briggs 1989, Cooke 2005, Cooke, Sanchez, and Udagawa 2000, Linares 1977b, Mayo and Mayo 2009).

Chiriquí prehistory in a continental and regional context

Within the isthmus of Panamá, a number of distinct pre-Columbian culture areas are suggested by ceramic assemblages (Figure 0-1). As is noted by Cooke (2005: 149-50), these culture areas were not static in time or space and waxed and waned in ways that are not necessarily discernible in the archaeological record. The boundaries between cultural areas were likely indistinct and fluid in ways that a printed map cannot adequately portray.

FIGURE 0-1: MAP OF THE SUGGESTED ARCHAEOLOGICAL CULTURE AREAS OF SOUTHERN CENTRAL AMERICA

The sub-regions of Veraguas, Coclé, and Conte form the 'Central Panamá' area in the cultural sequence shown in Figure 0-3 and Greater Chiriquí is comprised of the Chiriquí and Diquís sub-regions. This map was created by Jeff Frost and is adapted from Quilter and Hoopes (2003: vii).

Though heuristically helpful, the analysis of large culture areas is antithetical to most scholars' instincts and this frequently prompts a desire to create smaller categorizations of sub-regions and smaller local areas (Quilter 2006: 10).[7] I follow this trend in the sense that my discussion focuses on the very local area surrounding the Volcán Barú in highland western Panamá, though my findings and interpretations have ramifications for the larger cultural area of Greater Chiriquí (comprised of Chiriquí and the Diquís sub-regions) due to my reinterpretation of a volcanic eruption thought to have prompted settlement changes in a broad area of western Panamá. In Figure 0-2, I provide a map of Greater Chiriquí's position in relation to other major culture areas of Greater Nicoya, Greater Coclé, and Greater Darien.

[7] In one of the earliest published discussions of Chiriquí prehistory, the director of the Smithsonian Bureau of Ethnology, J.W. Powell suggested that the Chiriquí province of Panamá should be geographically considered part of the North American continent (Powell 1888: LI). Since that very inclusive definition, smaller geographical designations have been variously applied in archaeological discussions; these include Middle America, the Intermediate Area, Lower Central America, the Chibchan or Chocoan linguistic area, the Isthmo-Colombian area, and the Central American land bridge.

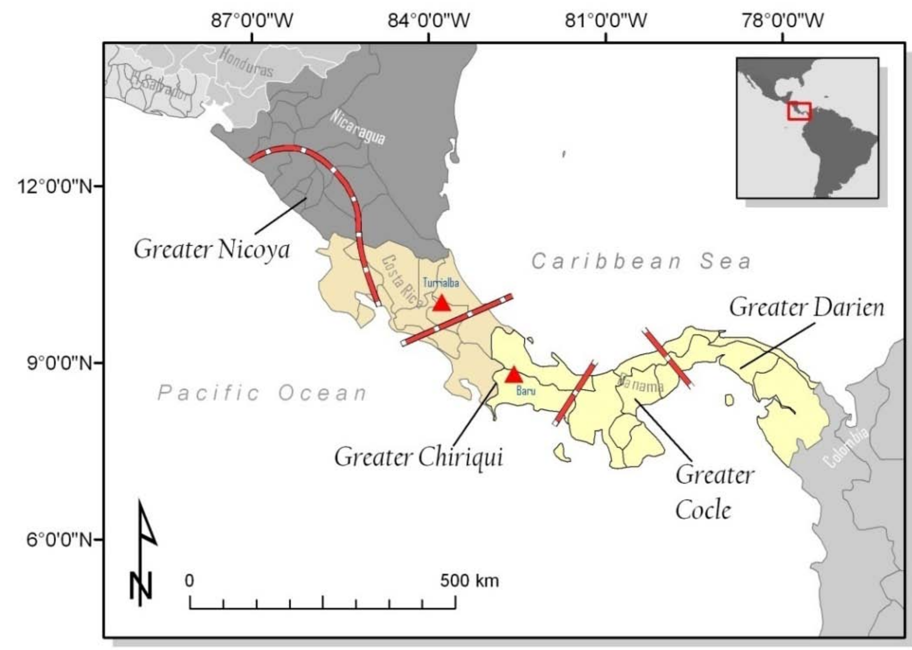


FIGURE 0-2: MAP OF GREATER CHIRIQUÍ IN RELATION TO CONTEMPORARY NATIONAL BOUNDARIES

The map shows adjacent archaeological culture areas and the Barú and Turrialba volcanoes that form bookends of the Talamanca Cordillera. This map is based upon maps by Cooke (2005: 132, Figure 2) and Quilter (2004: 9, Figure 1.5).

The cultural interaction sphere of Greater Chiriquí linked western Panamá and the Diquís area of Costa Rica most strongly during the Chiriquí culture period of AD 800-1500 (Haberland 1961a: 59-66, Quilter and Frost 2007a: 26, Snarskis 1981a: 76). Generalized development schemes flatten important differences in isthmian groups (Cooke 2005: 147-8, Hoopes 1992), though like large culture areas serve a useful heuristic purpose and allow generalizations that permit the comparison to local sequences. Figure 0-3 provides a general chronological scheme of cultural sequences for Greater Chiriquí.

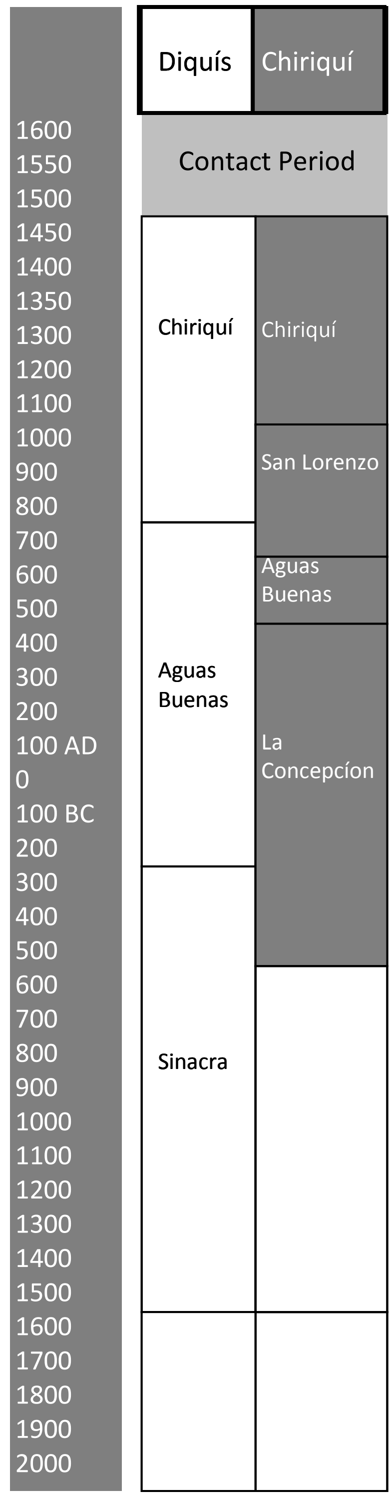


FIGURE 0-3: CHRONOLOGICAL CHART OF CULTURAL SEQUENCES PROPOSED FOR GREATER CHIRIQUÍ

The Greater Chiriquí culture area is divided into Chiriquí and the Diquís sub-regions. The Barú study area discussed in this thesis falls into the Chiriquí sub-region of Greater Chiriquí. This chart is adapted from Hoopes and Quilter (2003: viii).

Social value: prestige goods and inalienable objects

My research focuses on an examination of the role and value of volcanic materials, eruptions, and objects in the volcanic landscape both in the past and in current archaeological interpretation.[8] As I already noted, geographer Carl Sauer was influenced by the work of Alexander von Humboldt. Anthropologist Mary Helms, in turn, built upon Sauer's conception of Latin American landscapes in the development of a theory regarding the significance of exotic objects as emblems of esoteric knowledge and contacts with far-away places and people in pre-Columbian Panamá (e.g., 1988, Helms 1993).[9] Helms' theory of esoteric knowledge integrates ephemeral elements of

---

[8] The data that I collected do not allow me to address questions of cultural evolution typology and I do not focus upon issues of social complexity. Pre-Columbian societies in the isthmus are closely associated in archaeological literature with the complex chiefdom level society of culture evolutionary theory. Culture evolutionary theories of culture process borrowed from anthropologists such as Leslie White (1959) and Julian Steward (1955) formed the basis of many archaeological discussions of the isthmian area since the mid-twentieth century and the band-tribe-chiefdom typology introduced by Elman Service (1962) is particularly prevalent in the literature. The site of Sitio Conte in central Panamá, the excavation of which was directed by Samuel Lothrop and J. Alden Mason between 1931 and 1940, contributed to early conceptions of chiefly organization through the highly stratified wealth evidenced in burials (Briggs 1989: 63, Cooke et al. 2003a: 93). It's important to note, however, that while Samuel Lothrop was attuned to the social differentiation at the site he did not frame it in cultural-evolutionary vocabulary (see Lothrop 1937). The archaeological data were combined with ethnohistoric accounts of contact period groups that described the presence of hereditary authority with the opportunity to rise by individual ability, resource accumulation and redistribution, settlement hierarchy through monumental sculpture and architecture correlated, and the augmentation of chiefly power through control of prestige items (Cooke 2005: 151, Griggs 2005: 50-51, Helms 1979).

The lack of clear dividing lines between different groups in simple, non-state societies and complex, state-level societies and the variation possible in chiefdoms as a transitional stage is a well-explored issue of cultural evolution (Earle 1978, Feinman and Neitzel 1984, Yoffee 1993). Isthmian populations, in particular, showed great diversity in their socio-political organization and the category of chiefdom needs to be viewed in malleable terms to accommodate the wide variation in pre-Columbian groups that existed coevally (Cooke 2005: 150-151, Creamer and Haas 1985, Lange 1992: 426, 1996a: 312, Linares 1977a, 1979, Quilter and Hoopes 2003).

Both in the isthmian context and in the wider literature the topic of cultural evolution is the subject of recent research that asserts the need for fresh questions, cross-cultural examination, and the integral role of archaeological data in discussions of non-state societies (e.g., Fleming 2004a: 142, 2004b, Haller 2004, Hoopes 2005, Marcus 2008).

[9] Helms' work has been critiqued as overly 'humanistic' by strongly processual archaeologists (see Hohmann 1996). This critique seems unwarranted when, as I noted earlier in this chapter, processual are post-processual vantages are non-exclusionary. Though Helms does overlook critical archaeological work in her analyses (see Cooke et al. 2003, Cooke and Sánchez Herrera 2004a: 66), her work brings a needed emphasis upon the associations attached to objects outside of their *etic* functions. While much of the

social value with archaeological conceptions of material value, which hold that the higher the amount of energy required to produce or to obtain an item, the higher its social value will be (Earle 1982, Earle and Erickson 1977, Erickson and Earle 1982, Renfrew and Shennan 1982, Torrence 1986, 1989).

The concept of prestige goods upon which Helms' work relies assumes that the economy is the basis for power and that elites control the production and distribution of prestige items within hierarchically organized societies (Mills 2004). The possession of elite objects is useful in indicating inequality and differential access to prestige, however, this prestige does not necessarily translate directly into power. Authority can be dispersed in multiple layers based on gender, age, kinship, and occupation (Hendon 1999, Mills 2004: 238). Prestige goods may not provide the best way to examine status in the past (Bayman 2002, Cobb 1993, Fotiadis 1999, Mills 2000, Pauketat 1992, Saitta 1999). The theme of high-status objects and long-distance trade is widely discussed in the isthmian context, particularly in regards to gold work (see Cooke et al. 2003a). The scope and importance of long-distance trade need empirical confirmation and the archaeological data do not support some of Helms' ideas.[10]

The concept of inalienable possessions (drawn from Mauss 1980 [1925]) can provide one window into the intersection of objects and prestige that elude the formal definitions of the prestige-goods economy. Barbara Mills (2004: 239) argues that,

> Inalienable possessions are not just another class of objects to be recognized in the archaeological record. Rather, they are important in the development of a more comprehensive theory of the production and use of objects that are infused with social and symbolic meaning. Inalienable objects are goods that are not exchanged or do not circulate widely.

---

literature on isthmian prehistory is known only to regional specialists, Helms' studies of central Panamanian ceramics are cited in the larger anthropological literature (e.g., Mills 2004 Appadurai 1990).

[10] Evidence does exist along the Caribbean coast for long-distance pre-Columbian trade contacts. The ongoing research by Tom Wake in Bocas del Toro will hopefully provide further data.

Inalienable objects differ from commodities, which are easily given away (Weiner 1992: 239). While inalienable goods can circulate widely, such as in the Polynesian cases cited by Annette Weiner (1992) or Maurice Godelier (1999 [1996]) they more frequently do not circulate at all. Inalienable possessions do not necessarily have to be exotic or made from long-distance materials (Mills 2004).

In this thesis I focus not on special things from far-away places, per Helms' prestige good conception, but upon somewhat mundane things from nearby places. Barring a single polychrome ceramic sherd from central Panamá, the archaeological material from my fieldwork indicates the 'social relevance and constant demand for everyday and sumptuary materials and objects' rather than far-away objects (Cooke 2005: 162, see also Drennan 1991: 280). Though some small objects in my archaeological sample may have travelled long distances, most production evidenced by my archaeological survey was done for local consumption.

Unlike Helms, who examined the status afforded to the person who owned the object, I flip the gaze and look at the status of the materials and objects themselves both within the past and in archaeological interpretation. I propose that volcanic materials, particularly the distinctive basalt columns (locally known as *ladrillos)*, dacite slabs (locally known as *lajas*), and bombs shot out during eruptions were afforded a different status than other materials such as clay, wood, metal, or non-volcanic stones. These objects were carefully chosen and transported within the local area and provide an untapped source of archaeological information in the sense that – unlike the gold and ceramic artifacts that were removed by looting – the 'natural' objects were not afforded a contemporary monetary value and still remain within the landscape. In essence, the materials were 'inalienable' from the landscape from which they were derived.

Thinking the volcano in archaeological conception

The starting point of my research was the question 'how does one *think* the volcano?' Anthropological conceptions can potentially provide a window to the archaeological consideration of the volcanic landscape, though the exact encapsulation of the volcano is difficult. The volcano is not a product, good, or artifact in the sense discussed by Arjun Appadurai (1986). It can, however, be attributed a biography in the sense of authors such as Janet Hoskins (1998). The volcano is already anthropomorphized to the point of being considered active, sleeping, or dead, and hence already is easily viewed as having a lifespan and life history. Perhaps the volcano is best seen, at least archaeologically, as a material *thing* that is enmeshed within the social world (per Attfield 2000: 15).

As a thing, the volcano can be seen easily to have the agency that Alfred Gell (1998) attributes to material objects. Agency is particularly blatant in the event of eruption, but operates in more nuanced but just as powerful ways during non-eruptive periods. The overly strong display of eruptive agency, however, overshadows archaeological assessments of the lived experience during non-eruptive time periods. People and cultures are placed as passive recipients of this over-weighted agency and seen as capable of responding only as systemic pawns or monolithic cultural units, when in fact a much richer and more textured social relationship exists in volcanic regions over the *longue durée*.

Archaeological literature that investigates how people interacted with the environment in the past can unhelpfully categorize some data as solely 'cultural', or the domain of the archaeologist, and other data as 'ecological', or the domain of the palaeoecologist (Head 2008). The vast majority of archaeological research that engages with the role of volcanism, however, is comprised of exceptionally multidisciplinary or interdisciplinary teams and data sources. Volcanism and the human past have been deeply entwined to a level that interpretation and data do not fit cleanly in any one particular field (de Boer and Sanders 2002). This inter-disciplinary treatment of volcanic data can be extended to hybrid sub-disciplines such as cultural geography, biogeography, and social geography which frequently work in close conjunction with archaeological data (e.g., Anchukaitis and Horn 2005, Horn in press). Integrated archaeological projects in volcanic contexts are most successful when they integrate complex data, theory, and methods across the spectrum of both social and natural sciences (e.g., Grattan, Gilbertson, and Dill 2000, Grattan and Torrence 2007a, López and Cano 2008, López, Cano, and Rodríguez 2007, Manning 1999, Manning et al. 2006, Manning and Sewell 2002, McGovern et al. 2007, Mothes 1998, Plunket and Uruñuela 2008, Sheets 1983, 2002, 2007, Torrence 2008, Torrence and Doelman 2007).

A significant number of long-term archaeological projects and edited volumes very capably engage with a wide breadth of topics regarding the uniqueness of volcanic regions. General trends in these studies include a focus upon the physical impacts, timing, or cultural change associated with volcanic eruption (e.g., Balmuth, Chester, and Johnston 2005, Chester 1993, Cook 2007, Grattan and Torrence 2007b, Jashemski and Meyer 2002, Manning 1999, McGuire et al. 2000, Mothes 1998, Reycraft and Bawden 2000, Sheets 1983, 2002, 2006, Sheets and Grayson 1979, Sheets and McKee 1994, Torrence and Grattan 2002). The way in which archaeologists interpret the cultural role of volcanism in the past can be seen in context of larger theoretical conceptions of social transformation, settlement change, and human-environment interactions and are shaped by the conception of volcanic eruption as a natural disaster. The weighting of the event of eruption and concept of 'disaster', however, largely precludes aspects of memory and perception that are attached to volcanic landscapes in the non-eruptive interstices.

While the research I present in this thesis does not purport to remedy the over-emphasis upon eruption, I do seek to explore ways to further query the non-eruptive role of the volcano in the landscape. Current volcanological discussions encourage a greater focus on human perception in the study of volcanic activity (e.g., Cronin et al.

2004, Dove 2007, 2008, Gaillard and Dibben 2008). I urge a similar focus upon the lived experience of the volcanic landscape in archaeological investigation, which requires a more holistic, interdisciplinary, and theory rich approach in order to address larger questions than the simple environmental impact of volcanoes. I propose that archaeology as a field is well suited to grappling with the wide range of roles a volcano can have through the ability to integrate large time scales, material culture, and social theory within a single interpretive web. One challenge within archaeological conception, however, is the role and weighting of events within large flows of time.

Scalar time and the event of eruption

> The history of any one part of the earth, like the life of a soldier, consists of long periods of boredom and short periods of terror.
>
> British geologist Derek Ager, as quoted in *A Trip Through Time: Principles of Historical Geology* (1986), p. 8 [11]

The definition and role of the event and overall conceptions of time form the center of several recent archaeological discussions (e.g., Bailey 2007, Beck et al. 2007, Lucas 2005, 2008). Marshall Sahlins provided the precursor for these studies with his attention to the eventful arrival of Captain Cook's arrival in Oceania (Sahlins 1981, 1985, 1991). Captain Cook's landfall, however, is generally assumed to be a 'cultural' event; particularly in the context of global climate change discussions, researchers are now trying to grapple with discourse that can address large-scale 'natural' events (e.g., Hulme 2008).

The scale at which events occur and the scale at which we can detect those events form a central dilemma in archaeological research (Ramenofsky and Steffen

---

[11] This quote is also used by Sachs (2006: 253).

1998).[12] This problem in detection is further compounded by a lack of consensus regarding what an 'event' actually is. The term is applied to the varied durations and actions: the agricultural revolution, the Maya collapse, or the act of interring a burial can all be seen as single events or broken into smaller stages (Lucas 2008: 60). Each of these past occurrences spanned time periods and a range of actions that can be collapsed or expanded and are not easily defined or linked. Similarly, the 'event' of a volcanic eruption can last an exceptionally long time if one includes the years of earthquakes and explosions that presage most eruptions. Even the main eruption can itself contain myriad phases and be spread over a period of years.

A recent article discussing events of violence in Sierra Leone argues that the events themselves need to be seen as narrative blocks that are 'configurations of agency, time, imagery, and articulation' (Hoffman 2005: 329). The author (ibid.) states that, 'this formulation stands in contrast to the way violent events are often treated, as exceptional moments of outburst or eruption resulting from abnormal circumstances but meaningless in themselves'. I find this phrasing remarkably pertinent to the archaeology of volcanism.[13] The volcanic eruption, in essence, also can be treated as an abnormal and meaningless event outside of its physical impact. Upon closer

[12] Processual and post-processual archaeological approaches both tend to incorporate a temporal disjunct between the event and larger structures of beliefs or practices (Lucas 2008: 61). In processual thought, the search for general processes sought to correct the particularistic focus of traditional history and culture historical archaeology by de-emphasizing singular events. New Archaeology approaches did not replace the culture-history focus on events with process, despite its claims and intentions to do so, but instead subordinated events and negated any significant explanatory power for them (see Binford 1972: 117, per Lucas 2008: 62). Post-processual vantages utilized the concept of *agency* to infuse some of the historical particularism removed by processual frameworks (Dobres and Robb 2000). The 'event' for post-processualists, however, still maintains as uncomfortable a position to overall interpretation as in processual approaches. The *Annales* historical approach utilized a scalar model of long, middle, and short-term time (Braudel 1973, Le Roy Ladurie 1974), which influenced a number of post-processual vantages (e.g., Bintliff 1991, Hodder 1987, Knapp 1992). Though it is acknowledged by *Annales* perspectives, the role of the event - or short-term scale in relation to medium and long-term scales - is difficult and the non-particular event was still 'stripped of any explanatory power' (see Lucas 2008: 61).

[13] The volcano in eruption is also commonly described as a 'violent' event both in popular and scientific literature.

examination, however, eruption can be viewed as a 'narrative block' that is a more complex configuration.

The narrative block that in turn can occur long *after* an eruption is represented by volcanologists Jelle de Boer and Donald Sanders (2002: xiii) as a 'vibrating string' (Figure 0-2). The string illustrates the long-lasting impacts that eruption can have and highlights the multiple research disciplines that their detection would require.[14]

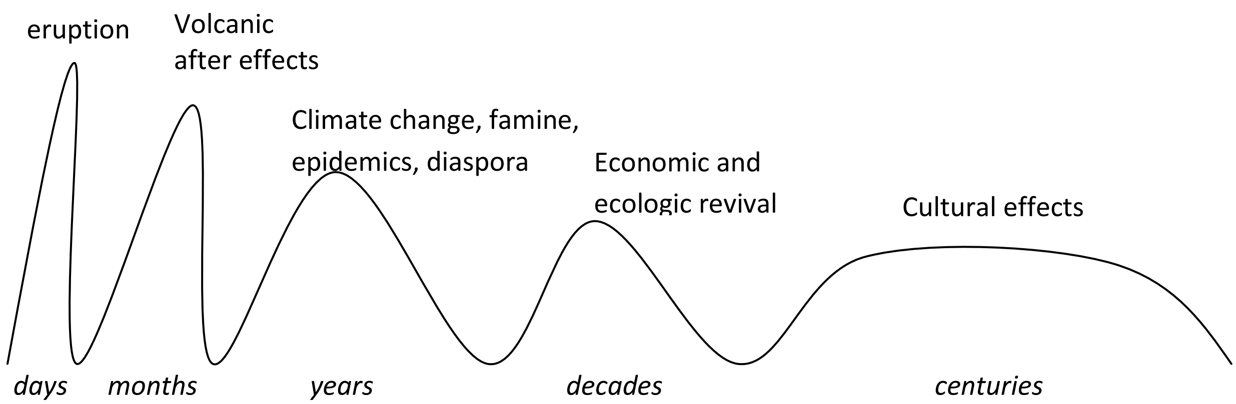


FIGURE 0-4: A 'VIBRATING STRING' USED TO ILLUSTRATE THE SHORT AND LONG-TERM IMPACTS OF VOLCANIC ERUPTIONS.

In the conceptualization of de Boer and Sanders, the 'cultural effects' placed to the far right node of the string are unique from the 'natural effects' of the eruption, yet all are connected in a single string and inseparable. These effects can be difficult to assess in many research structures, and as Frederick Lange (1984: 51) aptly states in reference to the pre-Columbian archaeological record, 'The impact of volcanic eruption on persons or populations in close proximity is immediate, but longer-term effects may be more subtle'.

What I find most illustrative in the string analogy is that an extremely varied number of possibilities exist regarding where a researcher truncates an investigation and how much of the 'string' is included in analysis. Additionally, years of precursor

[14] I thank Jelle de Boer (Wesleyan University Department of Earth and Environmental Sciences) for permission to reproduce this graphic.

events, such as earthquakes and gas releases, could be added to the left of the 'eruption' node, as could prior eruptions and the 'cultural effects' of stories, memories, and practices that invoke the eruption. This makes the decision of where to begin and end research of a volcanic eruption a very complex one as neither the beginning nor end of an eruption are necessarily clear. The vibrating string invokes the conceptions of Henri Bergson of time as a flow rather than a series of discontinuities; as Bergson (1911: 4-5) states, 'Duration is the continuous progress of the past which gnaws into the future and which swells as it advances' (per Ingold and Hallam 2007: 11). In this sense, we can assume that the duration of a pre-Columbian volcanic landscape such as highland Chiriquí was swollen with the memory and residues of the volcanic events that occurred on the scale of every several human life spans.

Archaeologists working on research questions that explicitly address volcanism are forced to address the plasticity of appropriate study periods when examining the relationship between the singular *event* – as embodied by volcanic eruption – and the archaeological record. This conceptualization of the event and the varying time scales is necessarily explicit when trying to examine volcanic eruption in the context of settlement and occupation records. An unusually well preserved site like Ceren, El Salvador, may require the careful delineation of different phases of a single eruption, hence splitting the event into multiple events with a known season and time of day (Miller 2002). In studying the Willaumez Peninsula of Papua New Guinea, however, Torrence and Doelman (2007: 60) state that they view a 10,000 year period 'as a single entity, rather than an ordered set of events' (see also Connolly 1999). The role of contingent, chance events are necessarily made explicit in volcanic contexts (e.g., Isaacson and Zeidler 1998, Torrence 2008). Other researchers use archaeology and history to examine long-term effects from eruption, which can be unexpected and geographically dispersed (e.g., Grattan, Michnowicz, and Rabartin 2007, Grattan and Gilbertson 1994).

Archaeologists who work in volcanic contexts often avoid a site-centered approach and focus upon geographically large-scale investigations (Cronin and Neall 2000, Elson et al. 2007, McGovern et al. 2007, Sheets 1983, Sheets and McKee 1994, Torrence 2008, Torrence et al. 2000, Zeidler 2003). Temporally large-scale vantages are also quite common in projects that seek to look at the extremely long-term interactions (Connolly 1999, Neall, Wallace, and Torrence 2008, Sheets 1999, Torrence and Doelman 2007). In this thesis I discuss a moderately bounded local area and examine roughly 2,000 years of human occupation within the volcanically active environment by drawing upon ethnographic, geological, and palaeoecological data.

Volcanism and cultural change, abandonment, and collapse

The focus on social, cultural, or political change within the larger field of anthropology is a corrective to earlier portrayals of societies as static and timeless (Scheele 2007). One of the most controversial themes in archaeology overall, however, entails the ascription of causality between environmental events and changes such as abandonments, migrations, or societal collapse. Despite the general backlash against environmental determinism that began in the 1980’s, environmental factors continue to be implicated in causing large-scale cultural changes (e.g., Bawden and Reycraft 2000, Gill 1994, 2000a, b, Gill and Keating 2002, Haug et al. 2003, Hodell et al. 2001, 1995, Hoffman and Oliver-Smith 2002, McCoy and Heiken 2000, McGuire et al. 2000, Oliver-Smith and Hoffman 1999, Sandweiss and Quilter 2008).

A number of studies propose volcanic eruption as a prime mover for cultural changes. The eruption of Thera in the ancient Aegean is linked to the destruction of Akrotiri and demise of Minoan civilization (Hoffman 1999). The eruption of Xitle volcano in México buried the site of Cuicuilco and was linked to demographic changes that promoted the rise of Teotihuacán (Blanton et al. 1997, Cowgill 2000, Sarmiento 2000) though others link this to an eruption of Popocatépetl (Siebe 2000, Siebe et al. 2004).

Ilopango volcano in El Salvador is proposed as the cause of large-scale demographic collapse in the Early Classic Maya period (Dull, Southon, and Sheets 2001, Sheets 1984). As I will discuss more fully in Chapter one, an eruption of the Volcán Barú was also implicated as the cause for important cultural changes.

In general, studies that link environmental events and cultural changes approach those changes 'negatively, as a kind of entropy' in the social order (per Demian and Wastell 2007: 124, Wagner 1981: 29). Stability and continuity, conversely, are seen as ideals. This is a tendency of processual-based archaeology, which tends to be conservative, 'valuing equilibrium and changelessness' (Thomas 2004a). For archaeologists working with eruption and its role in human life, it is appropriate to heed the opinion of Demian and Wastell (2007: 120), who point out that, 'the phrase [social change] once popular in anthropology, has now fallen somewhat from favor, if only because of a growing recognition that if it describes anything, it describes a tautology: change is a categorical constituent of sociality'.[15]

Environmental change can most certainly lead to cultural change in the past and present (Hardesty 2007: 37, Knight 2006). Little empirical evidence for volcanically forced cultural or demographic changes or societal collapse, however, is found in the archaeological record and hence a focus upon volcanically-induced change can be largely unwarranted or at best tenuous (Grattan and Torrence 2007a, Plunket and Uruñuela 2006, 2008). Volcanic eruption and other natural events more frequently only accelerate changes that are already in place (e.g., Burgess 1989, Driessen and McDonald 2000, Grattan and Torrence 2007a, Hoffman 1999, Nolan 1979, Plunket and Uruñuela 2006: 24, 2008: 118). Multi-causal analyses of the environment and human action are more appropriate explanations for changes in the archaeological record (Bintliff 2002, Williams 2002). Volcanic eruption is more aptly viewed as a *catalyst* of change rather than an agent of change (Blong 1984: 180, Dove 2008: 335, cf. Oliver-Smith 1996). In this thesis I reconsider the archaeological interpretation of Barú as a catastrophic source

[15] Though see Cherry, Scarre, and Shennen (2004) and Kristiansen and Rowlands (1998).

of cultural change and try to query the experience of the non-eruptive volcanic landscape.

The material of experience

Archaeology is defined by its focus on objects and material culture. What, then, are the material correlates of 'experience' in the volcanic context? French sociologist Maurice Halbwachs (1980 [1950]) proposed that memories and stories survive when they accrue to material objects to which they are linked. Using this conceptualization and the idea that places accumulate experiences and histories, landscape itself can be seen as an event rather than a thing (Casey 1996: 24-6, Hrobat 2007: 32-3). Three evocative examples of material remnants of volcanic experience in the prehistoric Americas include material culture related to eruptions of Popocatépetl (México), Sunset Crater (Arizona), and Augustine (Alaska).

Over a decade of fieldwork at the site of Tetimpa, México, directly engaged with both the physical and more experiential role of volcanism (Plunket and Urunuela 1998a, b, c, 2000, 2005b, 2006, 2008). Plunket and Uruñuela interpret the presence of small, smoke-producing volcano effigies at the Terminal Preclassic site as evidence of domestic ritual linked to the nearby volcano, Popocatépetl. The volcano models, which they interpret as shrines, were capable of imitating 'Popo's' puffing of ash and vapor through the use of chimneys and chambers for burning wood underneath them. The interpretation of these effigies as being linked to ideological beliefs mirrors similarly interpreted effigies from other pre-Columbian sites in Latin America (Abel-Vidor 1981, Guerrero and Solís 1997, Stone-Miller 2002: 91). Drawing from the concept of mimesis (Taussig 1993), the creation of these mini-volcanoes in direct sight of Popocatépetl can be seen in the terms Meskell (2005: 59) uses to describe mimetic objects that are,

> the nature that culture uses to create second nature… This second nature is foundering and highly unstable, spiraling between nature and culture, essentialism and constructivism.

The Tetimpa volcano effigies were most certainly an unstable *nature*, and the site was buried under eruptions of Popocatépetl around the first century AD and again between AD 700 and AD 850.

The eleventh-century AD eruption of Sunset Crater volcano in the southwest US provides another striking example of volcanism's material incorporation into human experience. Fifty-five pieces of lava with impressions of prehistoric corn were discovered in northern Arizona, approximately six km from the volcanic crater at a site (NA 860) first identified in 1928 by Colton (1932). These are interpreted to potentially represent offerings of husked corn ears that were placed in the path of encroaching lava during the eruption then transported four km away where the impressions were removed from the hardened basalt molds (Elson and Ort 2003, Elson et al. 2007, 2002). The resulting casts, dubbed 'corn rocks', are posited as apotropaic offerings to the forces responsible for the eruption. This positions the volcanic objects as powerful talismans and appropriations of power larger than the human realm such as are found throughout larger archaeological record (e.g., Nakamura 2005).

A painted Kodiak Island box panel was recovered by archaeologists in 1987 from the site of Karluk One in Alaska (Steffian, Beget, and Saltonstall 1996). The wooden panel, from the Koniag-era (~AD 1550) Alutiiq culture, portrays a prehistoric volcanic eruption of the nearby Augustine volcano. Steffian et al. (ibid.) interpret the images through analogy with ethnographically recorded practices among the Yup'ik Eskimo, the closest cultural group to the Alutiiq, who use such paintings to illustrate stories based on events experienced by family members. These paintings both marked personal property and served as a form of information storage (see also Béget 2000). The material objects were used to augment Alutiiq myths, which are known to make frequent mention of volcanic eruptions (Himmelheber 1993). In the terms of Hoskins (1998: 178-9), the Alutiiq box can be seen as a 'biographical object' that records both a natural event and a component of family history for which the box is meant to act as a mnemonic device.

Artifacts such as the Tetimpa effigies, corn rocks, or Alutiiq memory box are clearly exceptionally rare. Extrapolation from modern eruptions is another way some studies have considered the experience of the volcanic event. To query the experience of repeated prehistoric eruptions of Witori volcano in West New Britain, Papua New Guinea, Neall et al. (2008: 11) utilize a similar 1991 Pinatubo eruption in the Philippines to consider the collapse of house roofs, damage to coral reefs utilized for food, the floods of pumice that would have clogged rivers and the pumiceous dust that would have flown in the air for years and inhibited eyes and lungs, making daily tasks difficult. The West New Britain area devastated by this extrapolated eruption 'may not have been conceived as an empty space but as a culturally meaningful place that was physically and/or spiritually "dangerous" because of the volcanic activity' (Torrence 2008: 339).

Torrence (ibid.: 334) suggests a thought-provoking layering of volcanic materials and memory within the landscape if people left and returned to find the ground surface and markers they recognized covered or changed. In examples such as the island of Garua in Papua New Guinea she describes, eruptions occurred relatively frequently and the series of ground surfaces and constant shifting of the familiar landscape lead her to term it an ‘unstable’ landscape. In such a landscape the construction of place would be constantly reworked and formed by memory attached to the eruption materials that were left behind as mnemonics for the event. This concept of a destabilized nature is one that I will return to in the afterword to this thesis.

The revolt of objects

> Even hard scientists work partly from descriptive analogy to the body – lava tongues and toes, veins, throats.
>
> Pamela Frierson, *The Burning Island* (1991), p. 45

People, past and present, tend to create narratives based on what is familiar in order to interpret and convey information about the unfamiliar. Scientific descriptions, for example, parallel volcanoes to living creatures that are born, are young and active, sleep, and then die. In both past and present, volcanoes and volcanic eruptions are rich sources of *geomythology*, or the conjunction of memory, legend, ritual, and narrative to geological phenomena (Alvarado and Soto 2008, Blong 1982, Chester and Duncan 2007a, b, Chester, Duncan, and Dibben 2008, Chester et al. 2007, Chester 2005, Cronin and Cashman 2007, Dillian 2007, Elson et al. 2002, Holmberg 2007a, Piccardi and Masse 2007, Plunket and Uruñuela 2006, Vitaliano 1973). Archaeology can benefit from the incorporation of oral tradition that is linked to a particular landscape, though with the caveat that even if the scale of place is bounded the scale of time is not and memory of past events can be highly compressed and layered (Hrobat 2007). In my discussion of the Barú landscape, I incorporate oral traditions and query whether they may link to the volcano or to eruption as one way of considering the past experience of volcanic activity in the Barú area. I propose that stories comprise long-term nodes on the vibrating string analogy; not only do they follow eruptions, but they then presage future eruptions. Stories provide a way to remember events that occurred in the past and understand similar events when they occur again. While many stories are highly local, some have extremely wide spatial and temporal re-telling, which indicates their broad appeal and utility. Like the Alutiiq memory box from Alaska, at times stories are directly linked to objects that are linked to events.

US archaeologist Jeffrey Quilter (1990, 1997) provides a well-documented essay linking oral narratives of a common Amerindian myth - called the Revolt of the Objects - to Moche iconography and those in turn to political and social events. Quilter discusses imagery from a mural and two pottery vessels in which objects literally become animated; the objects grow arms and legs and attack humans. He links the imagery to the following seventeenth-century account compiled by Francisco de Avila from the Huarochiri region of the highlands east of Lima, Peru:

> They recount that in remote times the sun died. Because of its [the sun's] death five days passed like nights. And then the rocks banged against each other. Furthermore, the mortars and grinding stones began to eat men. And the male llamas began to drive humans. Respecting this legend we who are Christians are of the following opinion: These events probably speak of the darkness which occurred at the death of Our Lord Jesus Christ. This could be it [the explanation for these events]. [Translation by the author]. (Quilter 1990: 46, Uriost 1983).

In Maya examples of the same Amerindian myth, *manos* and *metates* grind people instead of being used by people to grind corn, pots scorch cooks, houses and trees shake themselves free from people and caves shut their mouths so that people trying to flee into them die or are turned into monkeys (Edmonson 1971: 21-5, Quilter 1990: 46). In the Moche case, Quilter suggests that the post-contact Moche saw their last days as potentially disastrous, hence the iconography and mythological past represented in the story of the Revolt of the Objects linked past and future in consideration of their present context and desire for revolt.

This concept of order and its reversal is a cross-cultural component in many narratives. In ancient Egypt, for example, the reversal of the normal order of things is recorded by the Turin Papyrus of the nineteenth or twentieth Dynasty, in which animals enact human actions and mice attack cats (Meskell 2004: 168). In an example from western Nigerian Yoruba oral tradition, a poem discussed by Karin Barber (2007: 38) collected in 1898 but passed down for hundreds of years prior relates,

> Hoes can't hoe the farm by themselves/If it were not for us humans who back them up/ If it were not for us humans./Axes could not blaze their way through the wood/If it were not for us humans who back them up/If it were not for us humans./Cutlasses can't slash through the forest by themselves/It's we human beings who support them and back them up,/We human beings./We bring the yams home, the mortar can't pound the yam by itself/But only with the help of humans who back it up./Only us humans./And what is it that backs human beings up?/Only god, only people.
> [slashes are line breaks in the original].

The Yoruba poem shows the proper order of relations in many human cultures: things only have agency when given it by people.

The Revolt of the Objects myth characterizes the 'violation of categories due to extraordinary circumstances' (Quilter 1990: 60); in many retellings it includes not only the animation of things but also the transformation of people into animals or vice versa and hence represents a blurring and transgression of boundaries between species, bodies, and taxonomies. I find Quilter's Revolt of the Objects discussion provocative when the story collected by Francisco de Avila, cited in an earlier paragraph, is read as a description of volcanic eruption rather than of Spanish conquest. The volcano, as a thing that is normally a stable and durable component of the landscape, reverses its normal order when its quiet stability turns to disquieted unpredictability. Rocks *do* bang against one another in eruptions and the sun *is* often eclipsed by ash for extended periods of time. Houses and rock shelters that normally protect people from the cold and the rain suddenly kill people when they collapse in eruption-related earthquakes. River channels that normally carry cool water to people and crops suddenly carry dangerous, superheated flows of volcanic materials. Normal orders are reversed and the earth that otherwise nurtures humans becomes destructive; in this case, it is the Earth itself that is in revolt.

Such a reading of the Revolt of Objects - linking the myth to natural phenomena - correlates easily with the discussion of the Revolt of Objects myth by Claude Levi-

Strauss (1969: 299, note 11) that Quilter (1990) does not cite. Levi-Strauss links various iterations of the myth to eclipses and the moon, which is given a role in ordering chaos in the world. This addition of the moon to the story is particularly interesting to me, as volcanic eruption is proposed to have correlation to cycles of the moon by a range of scientific and non-scientific observers (e.g., Gordon et al. 2005, Hamilton 1998 [1776]: 16, Handwerk 2002). This is not to suggest that volcanic eruption is the sole source of the Revolt of Objects myth, or even that ethnohistoric stories necessarily have direct material or phenomenal correlations. More simply, I wish to point out that a volcanic event could have been easily adapted to the myth or vice versa throughout the many incidences of volcanic activity throughout the Americas and retellings of the common story. [16] My main interest in the Revolt of the Objects, in this thesis, is the metaphor it provides through which the volcano itself can be repositioned as a subjectified object and eruption as a graphic case of the object (or nature) in revolt.

Alfred Gell (1998:12-22) influentially suggested that objects have a dispersed agency. This dispersal of agency prevents an object from having direct agency, which remains within the scope of human action. Eruption turns this on its head and temporarily relocates primary agency within the volcano as an object of nature. In so doing, volcanoes join a number of other landscape features that are provided sentience in indigenous conception and allowed to listen, smell, and take action against humans. Alaskan glaciers (Cruikshank 2005a), Chinese stones (Parkes 2005), and Australian Aboriginal Dreaming rocks (Povinelli 1995) are a small sample of these sentient landscapes and animated natures. These active landscapes are very melded and inseparable combinations of nature and culture. While eruption is not required to provide animation to the volcano, it does provide a graphic example of object-as-agent. As I will discuss throughout this thesis, however, eruption does not represent the only important social role of the volcano within human experience.

[16] For one example of the valid hesitation archaeologists feel in linking myths with artifacts see Hoopes (1996a).

Highland Chiriquí: an anti-Pompeii

> Next to the wonder of going up and down the streets, and in and out of the houses, and traversing the secret chambers of the temples of a religion that has vanished from the earth, and finding so many fresh traces of remote antiquity: as if the course of Time had been stopped after this desolation, and there had been no nights and days, months, years, and centuries, since: nothing is more impressive and terrible than the many evidences of the searching nature of the ashes, as bespeaking their irresistible power, and the impossibility of escaping them.
>
> Charles Dickens, *Pictures from Italy* (1846), p. 231

Charles Dickens, like many writers and artists of the modern era, described Pompeii as remarkable for its uncanny preservation of past objects and the material closeness it provides both to quotidian elements of past life and to its catastrophic destruction. In speaking of the 'fresh traces of remote antiquity', Dickens and many other writers from the Romantic period to the present (e.g., Bulwer-Lytton 2003 [1834], Byron 2007 [1869], Conrad 2004 [1919], de Stael 1998 [1805], Derrida 1996, Freud 2007 [1917], Harris 2003, Jensen 2001 [1903], Lowry 1961, Shelley 1985, Twain 2007 [1869]), viewed Pompeii and its destruction as a material metaphor of human consciousness, the fragility of social life in comparison to the power of nature, and the uncomfortable relationship between past and present.[17]

The AD 79 eruption of Mt. Vesuvius that buried the Roman cities of Pompeii and Herculaneum caused little cultural change at the time. The eruption, however, had a direct and continuing impact on the development of modern archaeology and can be seen as culturally more impactive in the modern world than in the ancient one (Allison

---

[17] The impact of Pompeii on art cannot be overstated. As George Landow states in a discussion of the artist John Martin (1806-70) and his *The Destruction of Pompeii and Herculaneum*, "Martin's visions of crisis and catastrophe, like those of so many other artists and writers of his time, received a powerful impetus from the rediscovery of Pompeii in the previous century. See Bergmann (2006: 496).

2002).[18] The way in which Herculaneum and Pompeii were excavated became a polarizing topic for intellectuals interested in ethical and practical elements of archaeology in the later eighteenth century (Ramage 1992). German art historian J.J. Winckelmann, in particular, critiqued the destructive practices favored by antiquaries in his *Open Letter on the Discoveries of Herculaneum* (Winckelmann 1762). The influence of Winckelmann's argument led to the first systematic archaeological field methods, which were implemented by Swiss army engineer Karl Weber and his successor, Spanish engineer Francesco La Vega. This eighteenth-century debate and fieldwork at Pompeii helped transform antiquarian studies into classical archaeology (Trigger 2006: 60).[19]

The site of Pompeii is used in popular and archaeological cultures as an iconic example of the uniqueness of volcanic contexts. The site connotes images of preternatural preservation and a vibrant culture cataclysmically arrested by nature. Pompeii is utilized as the quintessential example of a frozen moment or 'snapshot' of the past.[20] Other sites referenced to the Roman city to highlight their exceptional level of preservation include Ceren, El Salvador ('the Pompeii of the Americas'), Tambora, Indonesia ('the Pompeii of the East'), Biskupin, Poland ('the Polish Pompeii'), Santorini, Greece ('the Pompeii of the prehistoric Aegean') Nola-Croce del Papa, Italy ('the first Pompeii'), and Thorjsardalur ('the Pompeii of Iceland'). This fetishization of nearly complete or pristine artifacts stems from a sense of awe inspired by the recognition 'that the passage of time should take its toll on objects and yet, here it is, complete and almost as if it was made yesterday' (Lucas 2005: 128).

---

[18] The individuals and families of first century AD Pompeii and Herculaneum clearly were themselves catastrophically impacted; Roman life, however, continued without major change.

[19] While Pompeii provided the locus for the founding of modern archaeological method, the site is primarily interpreted through an art historical or classicist vantage. One example of a more archaeological treatment, however, is Jashemski and Meyer (2002).

[20] Pompeii was memorably and pejoratively used in a debate between Michael Schiffer and Louis Binford over site formation processes. Binford (1981) borrowed the phrase, 'Pompeii premise' from Ascher (1962) Gavin Lucas states that Pompeii invokes 'archaeological envy' due to its unusual preservation, see Lucas (2005: 128).

In these terms, as a volcanic context the Barú area can be seen as an anti-Pompeii. Unlike Vesuvius, volcanic eruptions of Barú did not halt occupation but instead were seemingly incorporated into the pre-Columbian experience. The acidic volcanic soils and rapid degradation of organic materials of highland Chiriquí leave little trace of the rich pre-Columbian cultures that lived in the area. Rampant looting has removed a great deal of the material culture that did survive. In this thesis, I urge the examination of new forms of data regarding the volcanic landscape, particularly those that bridge the nature/culture or artifact/ecofact divides. These objects were not valued by looters and collectors in recent centuries, though their value in the pre-Columbian past is evident due to the care and effort required to transport, create, or curate them.

Natures, cultures, and volcanic materials: an outline of the thesis chapters

In this introduction I outlined the theoretical bases of this thesis. While I draw most heavily upon social archaeology vantages and an interdisciplinary, cosmopolitan approach drawn from Alexander von Humboldt's groundbreaking research of Latin American volcanism, I incorporate aspects from culture history, processual, post-processual, and more recent theory approaches. I discussed my positioning of the volcano as a *thing* that is socially important both in the event of eruption and in the long interstices between eruptions. The experience of the volcano in these non-eruptive periods is an archaeologically under-examined topic. In periods of non-eruption, the volcano provides physical and perceptual stability. Eruption then reverses this stability or order and I have argued that the common Amerindian myth of the Revolt of Objects was likely adapted to explain volcanic eruptions, if not derived directly from eruption. In each of the chapters that follow, I examine different aspects of *nature* and ways to study and understand it.

Chapter one situates the Volcán Barú in the history of geological studies in Central America. Although Spanish chroniclers provide the first written accounts of

Central American volcanism (e.g., see Figure 1-3 and footnote), the modern study of Latin American volcanoes began with the fieldwork of Alexander von Humboldt at the turn of the nineteenth century. I provide a description of current geological understanding of the tectonic history of western Panamá and a compendium of the important geological studies. I then describe the archaeological interpretations of the Linares-Ranere project; I focus in particular upon the Linares-Ranere project hypotheses regarding settlement changes that the researchers proposed were caused by a catastrophic Barú eruption in roughly AD 600. Recent geological and palaeoecological data indicate that three or perhaps four Barú eruptions occurred during intensive occupation of the Barú area but that the only catastrophic volcanic eruption likely occurred roughly 700 years later than the Linares-Ranere suggestion. Archaeological understanding of the Chiriquí culture area and the intersection of volcanism and pre-Columbian life, hence, requires reassessment in light of the recent data.

Chapter two examines the role of tephra, or volcanic ejecta, as *ecofact*. I provide a summary discussion of tephrochronology in Latin America and provide petrographic data from analyses I conducted on juvenile clasts from lake-sediment cores and the archaeological site of Barriles. This work is intended as a starting point and guide for future archaeological work in the area in order to find an affordable and reproducible means of utilizing tephra as a chronostratigraphic marker. As influentially described by Michel-Rolph Trouillot (1997), historical narratives can show 'silences' or gaps in the creation and interpretation of archives. If stratigraphy provides a form of archive, the tephra of the Barú region can be seen as evidencing similar gaps and silences regarding past volcanic events. When not 'silent', it can even more confusingly provide a contemporary version of the revolt of objects by reversing the normal order of stratigraphy.

Chapter three details the methods and results of archaeological field survey I conducted in a 240 km^2 area on the eastern flanks of the Volcán Barú. I examine the issues of material loss and collection that are linked to the looting of artifacts in the study area and are intimately paired with contemporary conceptions of social value. These valuations can vary dramatically between past and present. I examine concepts of miniaturization and ritual killing of objects suggested by the artifacts as important components of grave contexts. Volcanic eruptions of Barú occurred relatively regularly in the pre-Columbian past and I question whether one result of these events was a purposeful utilization of volcanic materials in artifacts and grave construction. These materials are ambiguously placed in the nature-culture continuum and hence have not been removed by looting through their perceived lower social value. The durability of these materials makes them potentially powerful sources of data if we are able to formulate archaeological questions that incorporate them.

Chapter four addresses the long periods of time when the volcano was not in eruption yet was still an important component of the landscape as a monument and reference point. I discuss the rock art in my survey area, provide a critical discussion of mapping and GIS, and discuss the role of oral tradition in archaeological interpretation. I suggest that at least three possible 'uses' of rock art are possible in the survey area; these include the lining of paths by which volcanic materials were transported, the marking of burial areas, and calendrical measurements. I examine the possibility that Chiriquí period rock art indicates a departure from shamanism towards a more routinized cult. The timing of such changes could or could not be related to non-catastrophic but experientially impactive eruptions of Barú that were kept vibrant in communal memory through oral traditions. The establishment of an exact 'purpose' for the rock art, however, is marked by what Charles Peirce (1992 [1877]: 114) called 'the irritation of doubt'.

Chapter five shifts the lens from the pre-Columbian Barú landscape to that of the contemporary period. The Volcán Barú and the pre-Columbian past are both utilized as ways by which people establish the local sense of place and identity in Boquete. The volcano and archaeological past are utilized by hazards studies that examine the future eruption potential of the volcano and ecotourism proponents who seek to harness the uniqueness of the area for future economic gain. The volcano, in these vantages, is posed as both commodity and source of danger; though polar opposites to one another, neither vantage suffers from a sense of stasis that can sometimes plague landscape studies (per Massey 2006: 42). Issues of heritage in the Barú area are complexly linked with the identity of the local community, disputes over how to best protect the natural environment, and an influx of expatriate retirees.

In the Afterword I describe the varied ways in which nature was portrayed in the thesis chapters. The different tones and vocabulary used in each chapter are particular to the discipline or literature that was invoked in the discussion of the data. The thread running through the thesis chapters is my belief in the importance of volcanic phenomena to the understanding of human life in the physical world and my agreement with Humboldt's belief that there is a unity to the vast phenomena of the nature-social interface. Nature and culture cannot be adequately studied as separate topics and are inextricably linked.

I use the term 'material nature' as a way to theorize a dynamic and transformative natural world; in doing so I draw on a number of recent contributions to the discussion of nature and culture (e.g., Haraway 1991, Smith 2008, West 2006). I incorporate the concepts of *wild* and *socialized* as possible ways to conceive of the perceptual shifts between eruptive and non-eruptive volcanic landscapes. If contemporary western landscapes and pre-Columbian landscapes have any parallels, I suggest that a commonality in pre-Columbian and modern perceptions of the natural environment could stem from a discomfort inherent to reversals of familiar orders or the balance of the wild and socialized continuum. While the common Amerindian myth that I discussed in this introduction invokes the revolt of objects, this shared uneasiness between past and present is derived from the revolt of Earth.

Chapter 1 • TERRA MOBILIS: THE MUTABLE MATERIALITY, GEOLOGICAL UNDERSTANDING, AND ARCHAEOLOGICAL INTERPRETATIONS OF THE VOLCÁN BARÚ

The great cone of the long-dormant volcano, Chiriquí, towered 12,000 feet into the tropical air. At the bottom of the crater was a deep clear lake…. In this well-watered region the rich volcanic soil supported a dense and prosperous population…. Then, one day, came calamity – a savage earthquake shook the entire region. It was followed quickly by others even more violent…. Eventually came a convulsion greater than all the rest. The side of the crater was breached, and the waters of the lake rushed out in a great avalanche of mud and enormous stones. Tearing down the mountainside, the flood destroyed or buried everything in its path. The Indians fled a desolate waste of sterile ash and naked tree trunks. They never returned. By the time Nature had restored the forest and the rains had leached out the ash layer to a thin deposit that would permit cultivation of the soil again, a much greater catastrophe came. The Spaniards had arrived and begun the conquest of the people who so obviously were rich in gold .

Matthew Stirling, 'Exploring Ancient Panamá by Helicopter', *National Geographic* (1950), p. 227

A multi-disciplinary understanding of the eruptive history of the Volcán Barú is crucial to an improved conception of the pre-Columbian landscape and environment in the highlands of western Panamá. [21] Matthew Stirling's 1950 *National Geographic* account, excerpted above, places the Volcán Barú prominently at the center of his archaeological assessment of western Panamá as a source of both fertile soils and catastrophe.[22] Stirling unfortunately did not publish data from his excavations at the site of Barriles outside of this popular account.[23] The first concerted archaeological assessment of the Volcán Barú's role in pre-Columbian life was the product of archaeological survey and excavation conducted in 1972. The fieldwork was part of the Linares-Ranere project fieldwork completed in 1969-74, which I will discuss in more detail later in this chapter. Similarly to Stirling (1950), the Linares-Ranere project researchers hypothesized that the volcano was a source of fertile agricultural soils and raw material for the stone tools which permitted the initial settlement of the Barú area. The contributors also proposed that the last eruption of Barú, which they placed at roughly AD 600, was a potential prime mover for abandonment of the Barú area and the initial occupation of the Caribbean coastal area of Bocas del Toro.

The popular interpretations of Stirling and academic interpretations of the Linares-Ranere project, per the norm, are now subject to reanalysis due to new data generated since their publications. Both examples, however, evidence the multiple-scaled temporality that is inherent to all landscapes - yet very graphically and sometimes catastrophically at play in the volcanic landscape - between long-term process and localized events. The careful definition of the relationship between the long-term and the event is important to the overall understanding of the volcanic

---

[21] Opening photo shows the inside of the Barú crater from the rim its current summit; looking towards Cerro Punta. Photo by K. Holmberg.

[22] Volcanism has been invoked within popular interpretations of Panamanian prehistory throughout the 20th century (see Verrill 1928a, b, Verrill and Verrill 1929).

[23] Stirling began a manuscript on his Panama fieldwork, though it was destroyed. For a discussion of Stirling's 1949 excavation and artifacts see Wood and Shelton (1996). Wood and Shelton (ibid.: 6-17, note 2) state that the destruction of the Stirling manuscript is referenced in the National Museum of Natural History Department of Anthropology Accession File 364365. Stirling did create a list of 'Typical Barriles Wares', which is included in the same file.

context. As I touched upon in the introduction to this thesis by using the analogy of the vibrating string, the narrative block of events in a volcanic region can be difficult to delineate and can have remarkably long spans.

My original interest in examining Barú's eruptive history stemmed from preliminary field examinations of tephra stratigraphy from the Boquete area on Barú's eastern flanks in 1999 and 2000. The evidence that I saw suggested that the eruption history of Barú was considerably more complex than was suggested by the publications from the Linares-Ranere project, which only identified one Barú eruption. The initial basis of my thesis was a desire to mesh my initial field observations with late nineteenth-century volcanological literature that cite historical period eruptions of Barú and the archaeological data in order to try and more clearly define the role of the volcano during pre-Columbian occupation of the Chiriquí area.

In this chapter I examine the tectonic background and eruption history of the Volcán Barú. Much of the geological data for western Panamá, particularly prior to the digital age, was unpublished or unread within the social sciences due to disciplinary boundaries. A good portion of it was in German, Spanish, or French and required translation. One function of this chapter, therefore, is to provide a bibliography and overview for the current understanding of the Volcán Barú's role in both geological and archaeological interpretations. I also situate the understanding of Barú in the historical context of isthmian geology and current archaeological understanding.

My research was aided by significant new earth science publications that discuss Barú. These include the synoptic monograph edited by German geologist Jochen Bundschuh and Costa Rican geologist Alvarado Guillermo, entitled *Central America: Geology, Resources, and Hazards* (2007) and a recent United States Geological Survey (USGS) Open File report (Sherrod et al. 2007). The USGS report, building upon and greatly expanding an earlier hazards report completed by the Universidad Tecnológica in Panamá (1992), provides the most detailed examination of Barú's eruption history during human occupation and future hazards and incorporates the first Geographic Information System (GIS) maps of the impact areas from past eruptions. The USGS report did incorporate a palaeoecological study by Hermann Behling (2000) in Panamá but did not include important work in Costa Rica led by Sally Horn (i.e., Anchukaitis and Horn 2005, Clement and Horn 2001). I draw upon all of these publications. This thesis attempts to draw together the previously disparate references, citations, and information from prior volcanological studies of Barú and explicitly queries how the archaeological data intersects with the geophysical data.

The Volcán Barú in geological perspective

Geologically, a volcano is simply defined as 'an accumulation of volcanic deposits around a source vent' (Van Wyk de Vries, Grosse, and Alvarado 2007: 126). The deposits that form the volcano can vary widely from lava flows to unconsolidated tephra, but the volcano creates a new topographic landform on the existing surface. Central America has 81 known volcanoes and 593 known Holocene eruptions; three of these volcanoes (Barú, La Yeguada, and El Valle) are in Panamá (Siebert et al. 2006b), though it should be noted that the attribution of Holocene activity at La Yeguada could be inaccurate (Richard Cooke, personal communication).

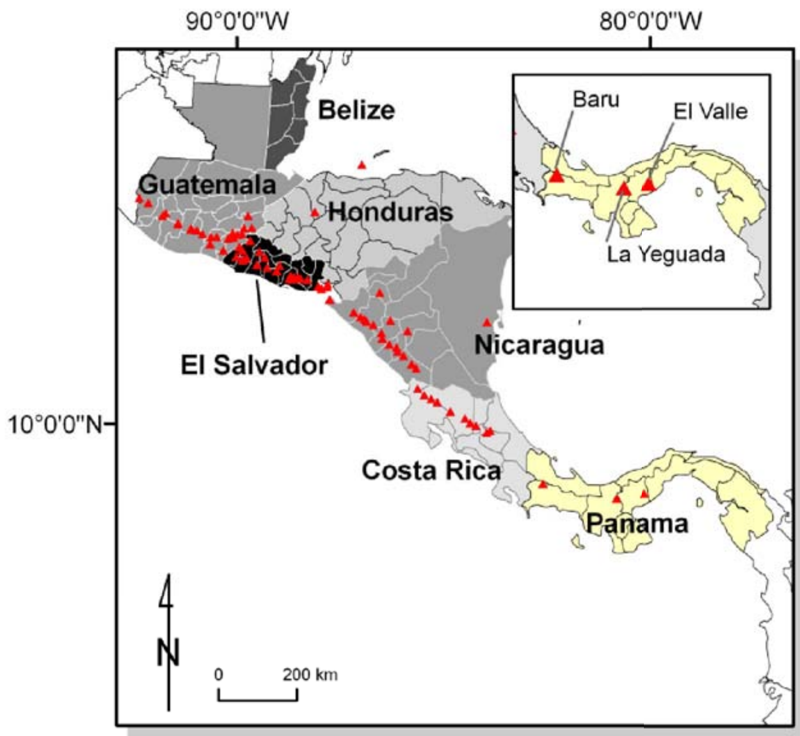


FIGURE 1-1: MAP OF CENTRAL AMERICAN VOLCANOES ACTIVE DURING THE HOLOCENE PERIOD

The insert map shows the three volcanoes that were active in Panamá during the Holocene period [data are from the Smithsonian Global Volcanism Project]. Note that La Yeguada's Holocene activity, however, is questioned.

Central American volcanoes extend in an 1100-km long linear front along the subducting Cocos plate. Volcanoes group into segments that are 100-300 km long; within those segments volcanoes cluster into centers that are on average spaced roughly 27 km from one another, though the actual spacing can vary (Bundschuh et al. 2007b: 9, Carr et al. 2003: 153). Recent assessments of the number of volcano centers vary between 39 (Carr et al. 2003), 40 (Bundschuh et al. 2007b: 9), and 50 (Alvarado et al. 2007: 1156).

A 175-km gap exists between the Turrialba volcano complex in eastern Costa Rica and the Volcán Barú in western Panamá. This extinct portion of the Central

American volcanic front, known as the Cordillera de Talamanca (or Talamanca Range), coincides with the northern boundary of the Panamá microplate (Morell, Fisher, and Gardner 2008: 84). The Talamanca Range (3800 m at its highest point) is not the product of volcanism as its base is comprised of folded and fractured marine sediments from the Eocene and early Miocene periods. The Talamanca is correlated with shallow subduction of the Cocos plate and a shallowing of the Benioff zone, which is the earthquake zone created when one plate subducts under another (Protti, Guendel, and McNally 1994, 1995). There are Neogene (~23 million years ago to 2.5 million years ago) volcanic products above this base, but these did not accumulate into stratovolcanic cones (de Boer et al. 1988: 277). The two volcanoes on either side of the Talamanca - Barú (3477 m) in western Panamá and Turrialba (3340 m) in eastern Costa Rica - form the highest points in the lower Central American front of volcanoes as they are closest to the ridge axis of the subducted Cocos plate. The volcanoes then decrease in size to the northwest in Costa Rica and southeast in Panamá to create a mirror image known as bilateral symmetry. Southeast of the Cordillera de Talamanca, ten stratovolcanoes and 15-20 domes are spread along a 400 km stretch of Panamá (Alvarado et al. 2007: 1156, de Boer et al. 1988: 276).

The beginning of geology in Central America

The first written accounts of Central American volcanism are by Spanish chroniclers.[24] These accounts can be used to elucidate eruptive histories, as was done in the Andean context for Huaynaputina volcano in southern Peru (Thouret et al. 2002). The depiction of volcanism in these colonial texts tends to be descriptive and tinged with exoticism. Pascual de Andagoya (1548 [1865]: 34-5), for example, describes the historically [and presently, as of 2008] active Masaya caldera in Nicaragua in this way:

[24] Other non-volcanic geological phenomena were also discussed. For example, Gaspar de Espinoza noted a strong earth tremor on the Azuero Peninsula in 1519.

> In this province there is a volcano from which smoke constantly issues, and at night it may be seen for three leagues round. At night it looks like flame, and in the day time like smoke. The mouth is round like that of a well, and half way down there is a ledge round the mouth; as when they make a well, the upper half is wider, and the lower half, being faced with masonry, is narrower, and ends upwards in a sort of ledge. At times the fire comes out with great fury, and sends forth many stones, that look like great fiery pieces of iron. I have seen this, and it seems that the fire has worked on them, and left them as cinders. They destroy the herbage for half a league round; and the Indians, to appease the fire so that it may not come and destroy them, bring a virgin there, at certain times of the year, to offer her up, and they throw her in. They are then joyful, for they believe that they are saved.

Andagoya wrote in the two pages following this quote about travels through the Chiriquí province of Panamá, but he makes no mention of Barú.

Modern western scientific investigations of Central American volcanism began with the research of German naturalist Alexander von Humboldt. Humboldt's study of New World volcanoes, completed during his travels in South, Central, and North America from 1799-1804, linked them to linear underground fissures and foreshadowed current theories of plate tectonics. Humboldt's work was widely published in Europe and was highly impactive; as Cuban scholar José de la Luz y Caballero famously remarked: while Columbus introduced Europe to the New World, Humboldt was the one who first provided Europe with an understanding of the physical, material, and intellectual existence of the Americas.[25] One of the largest historical era eruptions in Central America occurred in 1835 in Nicaragua. The eruption of Cosigüina sent ash throughout most of Central America and the noise of the event was heard as far as present-day Mexico, Florida, and Ecuador (see figure 38.4 of Alvarado et al. 2007: 1161). A Humboldt disciple, John Lloyd Stephens (1969 [1841]) published the richly illustrated *Incidents of Travel in Central America, Chiapas and Yucatán.* Stephens described the Central American volcanoes by stating that they were,

[25] For a recent discussion of the importance of Humboldt's work to contemporary environmental debates and ethos see Sachs (2006: 338-353). As noted in the introduction to this thesis, Humboldt did hold problematic racist views and cannot be uncritically extolled.

> each one a noble spectacle, and all together forming a chain with which no other in the world can be compared; indeed, this coast has well been described as 'bristling with volcanic cones'.

The conjunction of these events – the fame of Humboldt, the infamy of the Cosigüina event, and the adventure of the Humboldt-inspired *Incidents of Travel* - created a surge of interest in Central American geology from western researchers. Much of the research, however, focused upon exploitation of mineral resources or the search for a feasible canal route to connect the Caribbean Sea and the Pacific Ocean (Escalante and Soto 2007: 63).

Early geological studies of the Volcán Barú

The first geological map that included the isthmus of Panamá was published in 1858 by Herman Karsten (1858 [1947]). Karsten's map showed very little detail for Panamá, which was then a part of Colombia.[26] A thematic atlas by Hermann Berghaus (1852), who was a collaborator of Humboldt's, included a map of volcanoes in Central America. In an 1892 edition of the Berghaus atlas, a portion of which is pictured in Figure 1-2, no volcanoes are listed at all for Panamá and many of the active Holocene volcanoes in Costa Rica are not marked. I interpret the two southernmost volcanoes indicated in the isthmian area as Turrialba and Irazú, or perhaps Arenal and Poás, all of which are in Costa Rica. The scale and slight distortion of the drawing make it difficult to gauge precisely which volcanoes are indicated, though it is clear that for Berghaus the volcanic chain ended roughly 200 km northwest of Barú. It is evident that the arc of volcanoes through Guatemala, El Salvador, and Nicaragua seem better known to Berghaus than those of the isthmian area. The area of present-day Panamá was a blank

[26] From 1821-1830 Panama was a part of Gran Colombia, comprised of Colombia, Venezuela, and Ecuador, and Panama. When this union dissolved in 1830 Panama remained a part of Colombia, then succeeded from Colombia in 1903 with US support. The US began construction of the Panama Canal the following year.

in the 1892 volcano map, though Berghaus indicated numerous volcanoes in present-day Colombia and Ecuador.

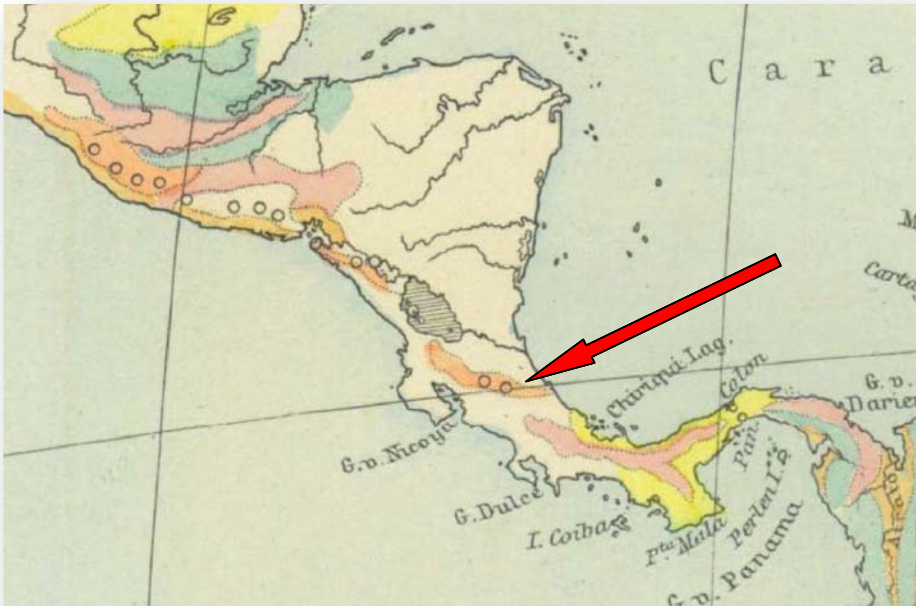


FIGURE 1-2: EXCERPT FROM THE PHYSIKALISCHER ATLAS BY HERMANN BERGHAUS (1892: 14)

Known volcanoes are portrayed on the map by circles. The red arrow is added for emphasis and points to what Berghaus indicated were the most southernmost volcanoes in Central America.

German geologist Karl von Seebach provided the first detailed, systematic descriptions of Central American volcanoes in 1864 and 1892 (Escalante and Soto 2007: 63). William Gabb (1913 [1874]: 127), who explored the Talamanca region in the late 1800's both as a mineral prospector and for the Costa Rican government, was uncertain in his definition of nearby peaks as volcanic,

> From *Cabécar*, we could see the fine peak, called by the Indians "*U-jum*", a term applied to all naked and rocky mountain peaks… From a distance it has the appearance of a volcano, and its shape and naked sides confirm the stories of the Indians, that at times fire and smoke are seen on the summit. Of course the cone is probably clothed with the low bushy vegetation, which we found on the apparently naked peak of *Kamuk*, but its shape is not less marked than *Turrialba*. A similar peak on the highest part of the ridge

> between the *Lari* and *Dipari*, also called "*U-jum"* by the people, but named by us *Mt. Lyon*, for purpose of distinction, is also said to be a volcano. Nothing short of a personal visit by a competent observer, will settle the question finally. One old man, whom I cross questioned minutely, told me that in the dry season (February) of the year of the small pox (1855) he crossed the road from *Bribrí* to *Térraba;* that the mountain was burning at the time; that there was much smoke and "bad smell"; that it was the *rocks* burning, *not* the bushes. He remained in *Térraba* about ten days, and on his return the fire and smoke still continued and the bushes on the mountain top were not burnt off….
>
> The fires seen may have been in the sage bushes and, in short, I do not consider the evidence sufficiently strong to place these two peaks in the list of undoubted volcanoes, without more proof… [27]

This account by Gabb interestingly highlights a difference in categorization, at least linguistically, between the western and indigenous perception of volcanoes. The uncertainty that Gabb sites regarding the Costa Rican portion of the Talamancan volcanoes mirrors that in the accounts of Barú throughout the historical era accounts. In 1680 a Spanish atlas was seized by English forces and reprinted in an English translation (Hack 1685). One of the maps in the 1685 atlas shows the islands and topography of the Gulf of Chiriquí (see Figure 1-3). Barú is clearly drawn and labeled behind the coast. Whether or not the cartographer recognized Barú as a volcano or not, however, is uncertain as it is labeled only 'the Mount of Barú'. One would assume that, were it a known volcano, it would be labeled as such but this is not a certainty.

[27] Gabb may be referring to Cerro Yokou, which is the nearest labeled mountain, though it could more likely be a smaller peak to the northwest (Jeff Frost, personal communication).

FIGURE 1-3: 1685 MAP OF THE CHIRIQUÍ BAY WITH BARÚ, LISTED ONLY AS A 'MOUNT', IN THE BACKGROUND [28]

Alexander von Frantzius (1861: 329, 1979 [1861]: 11), like Gabb, pointed out the lack of consensus existed regarding the designation of particular isthmian peaks as volcanic or non-volcanic in late nineteenth-century geology literature. In the same year, Humboldt listed the isthmian volcanoes and stated that nothing was known of Barú's geological composition and that it was potentially a closed trachyte cone (Humboldt

[28] © National Maritime Museum, Greenwich, London, 'P/33(40) Chiriquí, Hack'. Repro ID F1838. My thanks to Russ Sheptak for directing me to this map and to the National Maritime Museum in Greenwich, London, for granting permission to reproduce it in this thesis. The atlas was seized by Captain Bartholomew Sharpe from the Spanish ship, *Rosario*. William Hack, a prolific draughtsman in the late 17th century and member of the Thames School, made multiple copies of the atlas. The copy held by the Maritime Museum was presented to James II.

1861: 307, 539).[29] An 1856 publication by W. Wagner, however, listed Barú as a volcano (Wagner and Scherzer 1856: 261).

Many of the nineteenth and early twentieth-century descriptions of isthmian volcanism were published in German or French and were not widely distributed in Spanish. A compilation of Spanish translations of the descriptions of the Poás volcano in Costa Rica provides a chronological collection of its geological understanding beginning in the mid-nineteenth-century descriptions (Vargas 1979).[30] No such volume yet exists for Barú, though in this chapter I provide translated summations for a number of the non-English references I found in the course of my research.

The "apocryphal' eruption of Barú in the historical period

The Panamá Canal has played a central and ongoing role in geological study of the isthmus. An 1882 earthquake originally attributed to an eruption of Barú additionally played an important role in modern geological monitoring of the isthmus. The 1882 seismic events were prefaced on June 26, 1871, when a strong jolt (*secousse*) was felt in Panamá; these were followed by tremors beginning in October 1871 (Montessus de Ballore 1888: 288). A large earthquake was then reported in Panamá at 3:18 a.m. on September 7, 1882. Smaller tremors followed at 11:20 am, 2:15 pm, and 11:19 pm and then another strong jolt occurred September 9, 1882 (ibid. 1888: 292).

Fuchs attributed these earthquakes to the first eruption of the Volcán Barú since the mid-sixteenth century (Fuchs 1882: 343). The seismic tremors from this event were reportedly felt across an immense area of Latin America, including Caracas, Buenaventura, Maracaïbo, Cartagena, Greytown, Rivas, and Guayaquil (Montessus de Ballore 1888: 292). Dollfus and de Montserrat (1868) did not believe that Barú had

[29] Trachyte is an igneous volcanic rock comprised primarily of feldspar.

[30] Another interesting book that focuses on historical period earthquakes in Costa Rica and utilizes a wide number of historical maps and records was written by Peraldo and Montero (1994).

erupted since the conquest, though Montessus de Ballore (1888: 89) suggested that as the region is so sparsely inhabited perhaps an eruption could have occurred and simply not been recorded. This is certainly a possibility, as historical records of eruptions are not always incorporated into official geological records (see Guidoboni and Ciuccarelli 2008, Le Pennec et al. 2008). Montessus de Ballore (ibid.) critically notes that Fuchs (1882) provided no source of information for information regarding the sixteenth-century eruption. The 1882 earthquakes prompted the French, who were attempting to build the canal, to install Central America's first seismoscope in Panamá City in order to monitor the seismic activity. In 1900 the French additionally installed a seismograph.

Montessus de Ballore (1888: 292) disagreed with Fuchs' 1882 designation of the earthquakes as being related to an eruption of Barú, stating that Barú is 'far too eccentric' (*on voit que ce volcan est beaucoup trop excentrique*) and surmised that if volcanism was the source of the widely experienced tremors then perhaps it came from the Atrato area of Colombia, which was at the time the 'seat of powerful eruptive demonstrations' (*qui était alors le siege de puissantes manifestations eruptives*). [31] Recent studies uphold Montessus de Ballore's interpretation of the 1882 earthquake epicenter, placing the 1882 earthquake as an M ~ 7.7 event that generated a 4 meter tsunami rather than from Barú (Arvidsson, Toral Boutet, and Kulhanek 2004: 3, Mendoza and Nishenko 1989).

The work of German geologist Karl Sapper (1913, 1917a, 1917b, 1925, 1937) represents some of the most significant early volcanological work in Central America (see Escalante and Soto 2007:65-66, Maldonado-Koerdel 1958, Siebert et al. 2006b). Sapper conducted decades of fieldwork, spanning from 1888 through the late 1930's and published a summary of his fieldwork in 1937 under the title *Mittelamerika* (Sapper

[31] The Atrato valley region of northwestern Colombia is located near the boundary between the Panama and North Andes blocks and close to the Panama-Colombia boundary. It is a highly active seismic area from which more than 20 large earthquakes have originated in the last century. For a recent overview of the region's historical activity see Arvidsson, Toral Boutet, and Kulhanek (2004).

1937). In an 1887 publication, Fuchs recanted from his citation of an 1882 Barú eruption and notes that Barú has not erupted since the sixteenth century (Fuchs 1887: 254). In a 1925 publication, however, Karl Sapper returned to the question of Fuchs' attribution of the September 1882 earthquakes to Barú and stated that he had not found any vestiges of such a recent eruption and as local residents told him nothing about one, it was 'necessary to judge this eruption as apocryphal' (*hay que juzgar esta erupción como apócrifa*) (Sapper 1925: 111). Sapper (ibid., also Montessus de Ballore 1888: 89) additionally questioned Fuchs' citation of a sixteenth-century eruption due to his lack of sources for the citation. Manuel María Alba (1929) restates both opinions in his 1929 book on Panamanian volcanoes, also referring to the 1882 eruption of Barú as 'apocryphal' in an un-cited paraphrase of Sapper. Angel Rubio (1950) provides one of the most recent re-citations of a sixteenth-century eruption (see also Peraldo and Montero 1994: 50).

The catastrophic 1902 eruption of Mount Pelée in the West Indies prompted the United States, which had recently taken over canal building from the French, to become wary of volcanic threat to their investment.[32] In 1914, soon after the canal's completion, the US installed a seismological station (Escalante and Soto 2007: 65). Geological study and monitoring focused almost exclusively on the canal area, however, and a geological map that covered the entire country of Panamá was not published until 1956 when US geologists began exploring the region for oil reserves (see Escalante and Soto 2007, Terry 1956).[33] The canal continues to provide a locus of geological study, as recent expansion of the canal and formations exposed at the Gaillard Cut have

[32] Infamously, this eruption and the publication of a Nicaraguan stamp showing Mount Momotombo in eruption that ended a 1902 debate in the US Senate over whether the canal should be located in Panama or Nicaragua. The stamp convinced lawmakers that Nicaragua was too volcanically active and hence hazardous to the canal investment.

[33] This is in accordance with the opinion of Escalante and Soto (2007), though I would note that Karl Sapper provided carefully drawn geological maps of Panamá in plates VIII, IX, and X of Sapper (1937). While the entirety of Panamá is not shown on a single map, Sapper provides remarkable detail.

contributed new ideas to the formation of the isthmus (Kirby, Jones, and MacFadden 2008).

Earth in motion: plate tectonics and the Barú region

> Although geological processes are comprehended within the framework of mechanics and thermodynamics, precise quantification of Earth systems is exceptionally difficult, or even impossible, owing to difficulties of access and observation, sparsity of data, multiplicity of spatial and temporal scales, heterogeneity, coupling among diverse processes, feed-back among system components, and unknown forcing functions such as climate.
>
> T.N. Narasimhan, 'Limitations of science and adapting to Nature' (2007), *Environmental Research Letters,* p.1

The theory of plate tectonics provides the most plausible explanation for the movement of the earth's surface. Plate tectonic theory builds upon concepts of continental drift that were proposed by German meteorologist Alfred Wegener (1966 [1915]). Wegener influentially noted that fossils and land forms indicate that the earth's continents were once joined, though he was unable to locate the explanation for continental drift. The precise motor and action of plate motion is in constant revision and debate amongst geophysicists, though the core belief of plate tectonics theory is that the lithosphere, or earth surface, is divided into seven major and numerous minor plates. These plates move in relation to one another in one of three ways, which are defined as *convergent boundaries* (where plates move toward one another), *divergent boundaries* (where plates move away from one another), and *transform boundaries* (where plates move laterally past one another).

Central America provides a dynamic laboratory for plate tectonic study as it is comprised of four active tectonic plates and a microplate (see Figure 1-4). The land mass of Central America is located on the western edge of the Caribbean plate. The Cocos plate is in the process of subducting under the Caribbean plate at the convergent boundary between them, which is called the Middle America Trench. The Caribbean plate simultaneously has a transform boundary with the North American plate, which like the South American plate is being pushed west due to seafloor spreading along the mid-Atlantic ridge. The Panamá Fracture Zone forms the divergent boundary between the Cocos and Nazca plates. The isthmus of Panamá is located on a tectonic microplate known as the Panamá Block, which separated from the Caribbean plate. Unlike the Chortis block, which is located on a continental plate, Costa Rica and Panamá are built upon a volcanic belt overlying oceanic basement which is called the Chorotega block. The Nazca plate is subducting beneath Panamá.

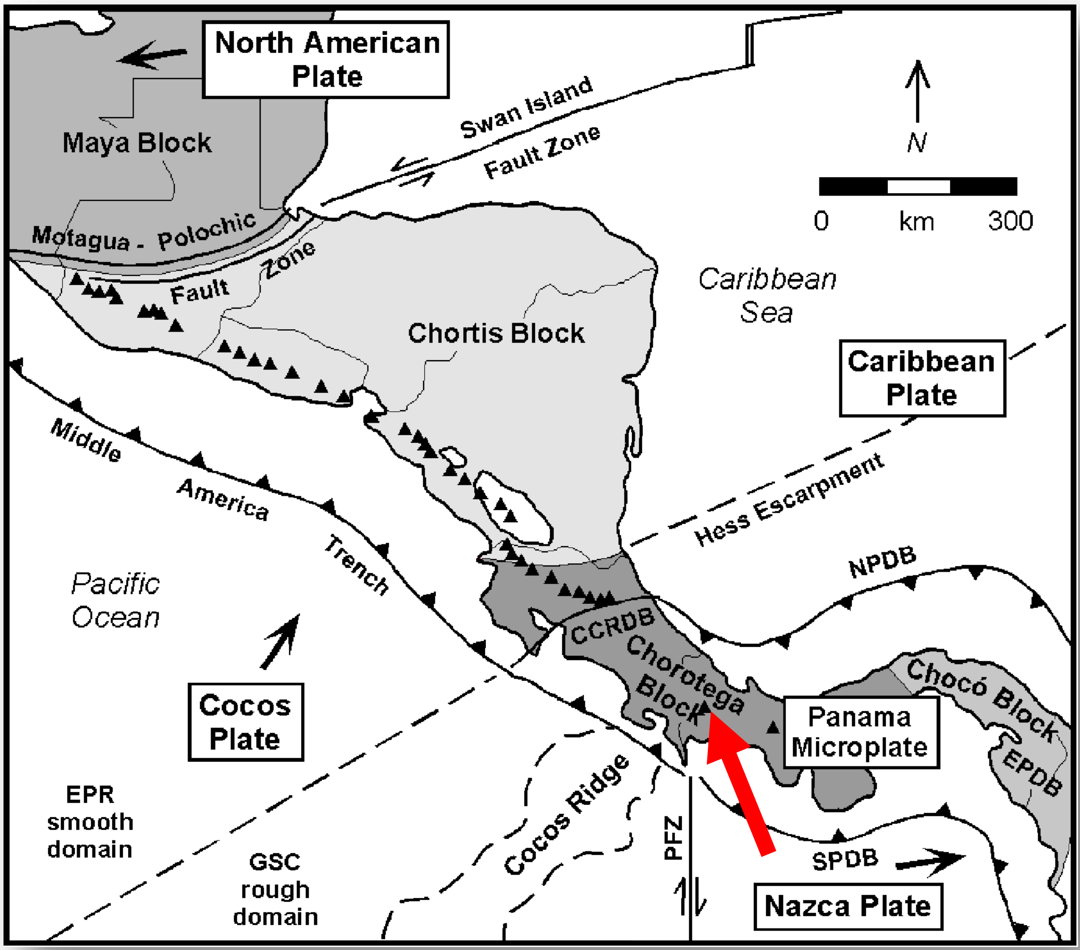


FIGURE 1-4: TECTONIC MAP OF CENTRAL AMERICA, SHOWING THE REGIONAL GEOMETRY OF TECTONIC PLATES

Reprinted with permission from Jeffrey Marshall from Marshall (2007: Figure 3.1). The red arrow (not in the original image) indicates Barú's location. The large black arrows indicate the direction of plate movement in relation to the Caribbean plate. Active plate boundaries are indicated with solid lines; teeth indicate the upper plate of convergent margins and opposing arrows indicate transform boundaries. The abbreviations indicate the following; EPR: East Pacific Rise; GSC: Galapagos Spreading Center; PFZ: Panamá Fracture Zone; CCRDB: Central Costa Rica deformed belt; NPDB: North Panamá deformed belt; SPDB: South Panamá deformed belt; EPDB: East Panamá deformed belt.

Until very recently, the geological understanding of the isthmus posited that it formed by volcanic islands that slowly joined.[34] Until extremely recently, the established belief was that the Panamá arc collided with South America from 12.8 to 9.5 million years ago, which is when the volcanic arc of the Panamá Canal Basin and the Bocas del Toro Basin emerged (Coates et al. 2003, 2004). Volcanism in western Panamá and southeastern Costa Rica was then significantly reduced between 6 and 2 million years ago (de Boer et al. 1991: 650). New data suggest, alternatively, that the isthmus was instead a peninsula and was attached to central America as early as 19 million years ago (Kirby, Jones, and MacFadden 2008). This hypothesis is based upon lithostratigraphic, biostratigraphic and strontium chemostratigraphic analyses of the Gaillard Cut of the Panamá Canal permitted by newly exposed surfaces from widening of the canal by the Panamá Canal Authority.[35]

In either scenario, the joining of the two continents allowed mass migrations of animals and the development of new marine species separated by the isthmus. The linkage of the continents and separation of the oceans also created significant climate change throughout the Americas due to the subsequent redirection of ocean currents (Broecker and Denton 1989, Haug and Tiedmann 1998, Marshall 2007: 4, Weyl 1968). Animals were able to traverse the land bridge by 3.2-3.7 million years ago (Cooke 2005, Kirby, Jones, and MacFadden 2008, Webb 1997). By the Late Glacial Stage of 14,000-10,000 BP, humans and their dogs (Cooke 2005, Ranere and Cooke 2003) and plants

---

[34] For a well done schematic representation of the paleogeography of the isthmus at 15-16 million years ago and then 11-12 million years ago, see Coates et al. (Coates et al. 2003: 285, Figure 7) For a list of recent publications that provide detailed discussions of our current, evolving understanding of how these plates interact with one another and link to volcanic activity please see Appendix A.

[35] Also known as the Culebra Cut, this is an artificial valley cut through the continental divide to connect Lake Gatún and the Atlantic Ocean to the Pacific Ocean and Gulf of Panamá.

(Cooke 2005, Dickau, Ranere, and Cooke 2007, Stehli and Webb 1985) were also traveling up and down the land bridge.[36]

Recent studies of human dispersal across the Americas have utilized mitochondrial DNA from groups such as the Ngöbe, Kuna, Embera, and Waunana in Panamá (Tamm et al. 2007) and Chibchan and Arawak groups in Colombia (Melton et al. 2007); these add to genetic studies of Panamanian populations (Kolman et al. 1995). Though estimates of modern human occupation of the Americas have varied widely between 11,000-40,000 years, current theories narrow the time frame to 15,000-20,000 years (Schurr and Sherry 2004). The isthmus has played an instrumental role in the prehistory of the Americas during that time period. Stone tool assemblages from several sites in Panamá are remarkably similar to the Clovis tradition of North America and are assumed to be synchronous and culturally related to it (Cooke and Ranere 1992b, Pearson and Cooke 2002, Ranere 1996, Ranere and Cooke 1991, Ranere and Cooke 1995, 2003: 220).

In the *Illustrated History of the Panamá Railroad*, Fesseden Otis (1861: 120) states that,

> This whole region gives unmistakable evidence that great and comparatively recent volcanic forces have been instrumental in its formation.

This statement applies to the entire isthmus, which is frequently described as being *dominated* by volcanoes, which are the most striking physical feature (e.g.; Coates 1997b: 2, 24, 26, Heckadon-Moreno 1997: 177).

The Volcán Barú is part of a volcanic complex and shares a common magma chamber with another volcano, the nearby Tisingal. Tisingal can be considered extinct as

---

[36] The Sherrod et al. (2007) geological study suggests that multiple Barú eruptions may have occurred during the Late Glacial Stage; if this is the case, people traveling along the land bridge likely heard or saw the eruptions.

it has not erupted in the last million years.[37] Barú is a stratovolcano, meaning that it is a composite formation created by layers of lava, tephra, and volcanic ash. Its volcanic rocks are generally andesitic and basaltic andesitic with some dacite. Like other andesitic stratovolcanoes, such as Vesuvius or Mt. St. Helens, Barú is characterized by periodic, explosive eruptions interspersed amidst long periods of acquiescence. Barú, however, has some significant distinctions from other Central American volcanoes in its formation and deformation history.

Barú's large cone covers 280 km^2 and represents an overlapping series of pyroclastic flows, lahars, and lava flows (Sherrod et al. 2007: 10). The palimpsest of forms, flows, and deposits prevent the earliest part of the volcano from being accessible or dateable. This variety of forms prompted the German geographer and natural scientist Moritz Wagner to admiringly state that Barú carries the name *volcano* proudly [or 'with every reason'] and that none of the active volcanoes in Central America exhibit the same richness and variety in form or show the large-scale evidence of ancient eruptions through well marked lava flows and ash and tephra fans from its multiple cones (Sapper 1925: 110).[38] Wagner published widely on his studies of New World geography (Wagner 1861, 1862, 1863, 1870), and spent 19 days in 1858 investigating Barú and the surrounding area and created the first reliable map for the region. Wagner began the ascent of the volcano on the western flanks, however, and found it impossible to reach the summit. In 1859 Wagner made another attempt, this time ascending from the Boquete side of Barú from the southeast of the caldera, but was only able to spend five days studying the volcano. Sapper (1925: 109) noted that Pittier, Lutz, MacDonald and others also visited Barú, though Sapper preferenced Wagner's descriptions of Barú over those of others.

[37] Tisingal is also known as Cerro Colorado or Cerro Pelón. Sherrod et al (2007 : 12) suggest for clarity that the name Cerro Colorado be applied to a porphyry copper deposit 80 km southeast, noting that the name Tisingal is used most commonly for the volcano.

[38] This is my translation from the German. Sapper does not provide a reference for this Wagner quote.

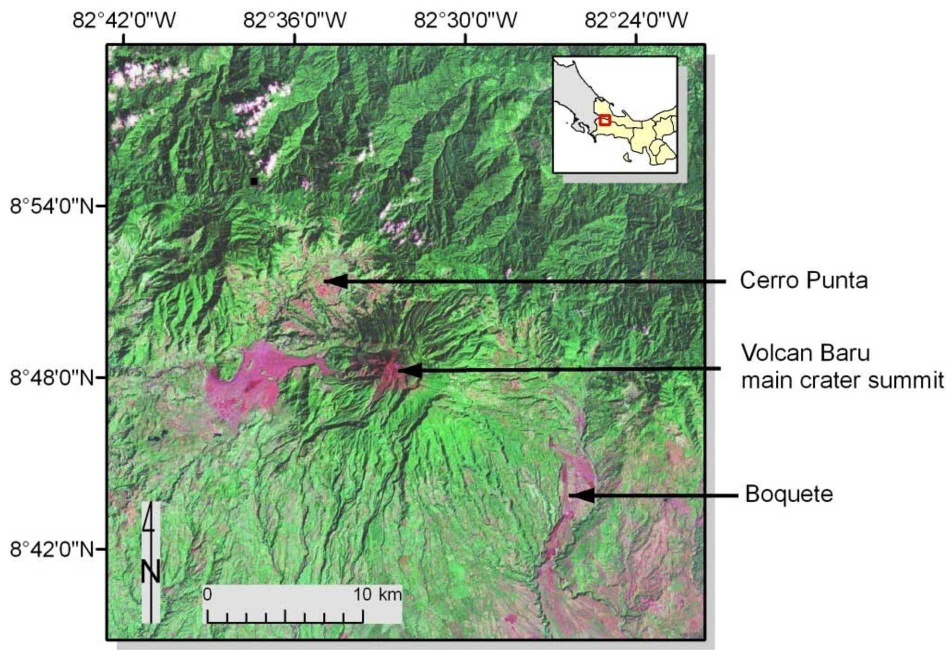


FIGURE 1-5: FALSE COLOR SATELLITE IMAGE OF BARÚ

This Landsat image shows the horseshoe-shaped caldera created by the collapse of the crater wall and the flow of block-and-ash (in pink) to the west and southwest of Barú.[39]

Barú was the site of what was possibly the largest volcano debris avalanche in Central America, resulting in a 6 x 10 km horseshoe-shaped caldera that is breached to the west (Siebert et al. 2006a, Siebert, Kimberly, and Pullinger 2004). The more eroded western flank is characteristic of isthmian area volcanoes due to the higher rainfall on the Caribbean-side slopes (Van Wyk de Vries, Grosse, and Alvarado 2007: 128). The large amount of water from both rainfall and streams makes lahars a common phenomenon of Barú eruptions, and a ~40 km wide radial lahar extends across the

[39] This 1987 Landsat imagery is a base layer for the GIS that I created for this thesis. I used a Maximum Likelihood classification (RGB = bands 7,4,2) that I processed as part of a remote sensing project investigating 27 volcanoes in 9 countries. The false color classification indicates ash and fallow fields with magenta and vegetation in green. I completed the classification at Lamont-Doherty Earth Observatory through funding from a SMART grant administered by CIESEN (Center for International Earth Science Information Network).

forearc of western Panamá (Morell, Fisher, and Gardner 2008).[40] Prior to the collapse the Barú summit was possibly ~4,000 m elevation, or roughly 500 m higher than it is now (Siebert, Kimberly, and Pullinger 2004). As much as 30 km^3 of the caldera collapsed (ibid.), though roughly 5 km^3 of the material slid as a units, or Toreva blocks, and are located at the base of the collapse scarp today (Siebert et al. 2006a). Sherrod et al. (2007: 13) provide a helpful sense of scale to the enormity of this debris avalanche by noting that it produced roughly ten times the extent of material from the well-known 1980 eruption of Mt. St. Helens. Material from this debris avalanche potentially spread as far as to the Atlantic coast, more than 50 km away (ibid.).

This collapse is presumably the one that Stirling (1950) was describing in the quote that began this chapter, though placing it within the period of human occupation is pure speculation and Stirling's suggested fifteenth-century date for the collapse is not supported by the data.[41] The <12.4 thousand year estimated maximum date (IRHE 1987) estimated during geothermal analysis and the 2860 +/- 50 BP date from the lowest sediment layer of a lake core examined by Behling (2000) likely provide rough bounding dates for the collapse according to Siebert et al (Siebert et al. 2006a). Sherrod et al. (2007: 4), however, state that the debris avalanche probably occurred more than 50,000 years ago. Sherrod et al. (2007: 13) believe that the avalanche occurred earlier than the 8,740 +/- 90 14C yr BP (9540 cal BP) date of silt found below a terrace where a redirection of the Río Chiriquí Viejo cut into an alluvial fan. The fan likely formed after the debris avalanche. A tree found in a deposit beneath the debris avalanche was too old to be dated by radiocarbon (i.e., older than 40,000-50,000 years) and represents a

[40] A lahar is a mudflow or landslide composed of pyroclastic material (superheated clouds of ash, lava fragments, and vapor carried through the air) and water that flows from a volcano, typically through river valleys.

[41] Alternately, Stirling (1950) was possibly describing a non-volcanic lahar, or mudflow, that occurred roughly a thousand years ago and deposited the block and ash flow. Sherrod et al. (2007), however, believe that this lahar was caused by weather conditions rather than an earthquake.

possible bounding date for Sherrod et al. (2007), though they do not accept this uncritically.[42]

The investigation of volcanic rim collapse is still extremely new and many details are yet unexplored (Merle, Michon, and Bachèlery 2008). It is certain, however, that the delineation of a single avalanche event at Barú is problematic and Siebert et al (2006a: 17) suggest that more than one generation of collapse possibly occurred. The avalanche of debris material extends roughly 20 km from the collapse site (Instituto de Recursos Hidraulicos y Electrificacion (IHRE) 1987, Siebert, Kimberly, and Pullinger 2004, Universidad Tecnológica de Panamá 1992). The inclusion of water was likely a factor in the intensity of the avalanche (Hidalgo, Alvarado, and Linkimer 2004, Siebert et al. 2006a: 20), hence Matthew Stirling's popular account of the collapse, which began this chapter, was accurate in that aspect. The hummocks (small hills) to the west of Barú's caldera were produced by the collapsing avalanche material, which deflected the course of the Rio Chiriquí Viejo to the west. Nearly 30 km^3 of material spread over a 45 km^2 area, leveling as much as 500 m off of the height of Barú's prior height of ~4000 m and altering its shape from conical to jagged (Siebert et al. 2006a: 16-17, Siebert, Kimberly, and Pullinger 2004). Barú's current form, as estimated from 90-m resolution Shuttle Radar Topography Mission (SRTM) data, has a volume of roughly 140x km^3 and an area of approximately 394 km^2 (Van Wyk de Vries, Grosse, and Alvarado 2007: 135).

Despite these distinctions from other Central American volcanoes, relatively little is known about Barú. Using the information available in July 2006, Alvarado et al (2007: 1184) assigned Barú a cumulative score of 2.5 out of a possible 7 in an assessment of knowledge available through geological maps (moderate or in some detail), geomorphological maps and studies (moderate or in some detail), deep stratigraphy (non-existent), radiometric dates (general or incipient), tephrostratigraphy and ^{14}C dates

---

[42] Doctoral fieldwork is currently planned by Peace Corp volunteer Julie Herrick (under the direction of Bill Rose, Michigan Tech) to define the age, area, and sequences of the debris avalanche.

(general or incipient), petrography and geochemistry (moderate or in some detail), and volcanic hazards map (moderate or in some detail).

TOTAL SCORE OF DATA	*Geological map and studies*	*Geomorphological map and studies*	*Deep stratigraphy (boreholes depth 100-2000 m)*	*Radiometric dates (K-Ar, Ar-Ar, U-Th)*	*Tephrostratigraphy and ^{14}C dates*	*Petrography and geochemistry*	*Volcanic hazards map*
2.5	0.5	0.5	0	0.25	0.25	0.5	0.5

0 = non-existent 0.25 = general or incipient 0.50 = moderate or in some detail 0.75 = well detailed 1 = very well detailed

FIGURE 1-6: ASSESSMENT OF THE AVAILABLE INFORMATION ON BARÚ PER JULY 2006 AS PUBLISHED IN ALVARADO ET AL (2007)

For comparison, Alvarado et al (2007) ranked the Costa Rican volcano that bookends the other side of the Cordillera de Talamanca, Turrialba, with a score of 3.75. The other two volcanoes in Panamá that have possibly been active during the Holocene, La Yeguada and El Valle, scored 1.5 and a 1.75 respectively.[43] The highest ranked volcano in Central America, Arenal in northwest Costa Rica, scored 5.75. A higher ranking of 'knowledge' regarding a volcano does not necessarily mean that it will be easier to predict future eruptions, though it does indicate that more is known about past eruption behavior.

Following a series of seismic swarms in May 2006, the USGS conducted fourteen days of fieldwork that resulted in Open File Report 2007-1401 in order to provide USAID and the Panamanian government with an assessment of volcanic hazards at the Volcán Barú (Sherrod et al. 2007). Their efforts undoubtedly raise the score that should be assigned to Barú in the criteria used by Alvarado et al (2007) to at least the range of 3.5-4.5 (Alvarado, written communication 2008). While the USGS data have some self-contradictions (David Sherrod, personal communication 2008), they also provide the most detailed and accessible data to date for Barú. The hazards associated with future eruption events from Barú will be discussed in Chapter five; the present chapter will focus on Barú's past activity and how it imbricates with archaeological interpretation.

[43] As noted earlier in this chapter, La Yeguada potentially was not active during the Holocene.

The Volcán Barú in archaeological perspective: the Linares-Ranere project

The body of fieldwork that I have termed the Linares-Ranere project was a survey and excavation project conducted between 1969-74 under the direction of Olga Linares and Anthony Ranere. The project grew from fieldwork that Linares completed in the Gulf of Chiriquí islands under the direction of Charles McGimsey in 1961 (Linares 1964, 1968). Linares-Ranere project data were included in a number of publications (Linares 1977a, 1977b, Linares and Ranere 1971, 1980a, Linares, Sheets, and Rosenthal 1975, Sheets 1975), of which the edited volume *Adaptive Radiations in Prehistoric Panamá* (Linares and Ranere 1980a) is the most comprehensive. This work forms the basis of current archaeological understanding of western Panamá and its importance in the regional archaeological understanding cannot be overstated.

The Linares-Ranere project publications, and particularly the *Adaptive Radiations* volume, represent a unique contribution. Prior archaeological assessments of western Panamá stemmed primarily from collections studies (e.g., Holmes 1888, MacCurdy 1911), large cemetery sites (e.g.; Haberland 1957), or brief investigation of the exceptional site of Barriles (Ichon 1968a). The Linares-Ranere project provided the first systematic data from domestic contexts in the highlands of western Panamá.

Linares and Ranere (1980b: 5), in broad stroke, proposed that the history of human occupation on the isthmus was older in the highland interior and along the Pacific Coast than in the Caribbean coastal area of Bocas del Toro (see also Linares 1977a: 311). The specific focus of the *Adaptive Radiations* research was upon occupation by ceramic-using agriculturalists. In *Historia General de Panamá: Las Sociedades Originarias*, Richard Cooke and Luis Alberto Sánchez (2004b: 25) helpfully schematize the *Adaptive Radiations* hypotheses into five stages (Figure 1-7).

Stage 1	3000-2150 BP	Preceramic horticulturalist practices developed into sedentary, maize-based agriculture in the lower elevations of Chiqiruí and Costa Rica.
Stage 2	2150-1750 BP	Peoples from the lower elevations of stage 1 moved into elevations up to 1000 m, simultaneously dispersing to the Chiriquí coast and Gulf of Chiriquí islands. They brought with them maize that was already adapted to a cool, humid climate.
Stage 3	1750-1350 BP	The highland population of the El Hato area grew and expanded into nearby areas in the neighboring valley of Cerro Punta. The Volcán Barú erupted in AD 600 (1350 BP), by which point there were many villages and hamlets in the area and an estimated population of 2430 people (with a density of 39 people/ km2). The El Hato area contained the largest villages; one of them, Barriles, became the social and political center of the region.
Stage 4	1350 BP	Potentially forced by the eruption of Barú, people settled the coastal area of Bocas del Toro. These people used the same ceramic styles as highland peoples.
Stage 5	post 1350 BP	Groups on the Pacific and Atlantic slopes diverged culturally due to environmental differences. The size, nucleation density, and permanence of their settlements and their subsistence practices differentiated. Despite this, the communities maintained trade relations, kinship bonds, and remembrance of shared traditions and common origins.

FIGURE 1-7: ELEMENTS OF THE *ADAPTIVE RADIATIONS* HYPOTHESES (PER COOKE AND SANCHEZ 2004)

Linares and Ranere (1980c: 3) state that the *Adaptive Radiations* project was,

> An attempt to reconstruct a prehistoric example of adaptive radiation among human populations in the New World tropics and to evaluate divergent settlement and subsistence systems resulting from different ecological and social conditions.

In basic terms, an adaptive radiation is a rapid increase in diversity of a single population in response to the environment that is driven by natural selection. To explain the mechanism behind their hypotheses, Linares and Ranere (1980b: 3) reference the work of American paleontologist George Gaylord Simpson who suggested that:

> Groups moving into new places in the economy of nature do not simply occupy it broadly. They radiate into it; they split into distinct types and populations, each of which specializes in the occupation of some part of the new sphere (Simpson 1949: 117).

Linares (1977a: 304) cites biological concepts of divergent adaptation (Hamilton 1967) and socio-cultural anthropology studies of related groups in differing environments (Kottak 1971, 1972, Sahlins 1958) in the construction of the adaptive radiations argument. Linares (1980e: 14) defines adaptation as response to new and stressful conditions and states that in the framework of the *Adaptive Radiations* research, cultural systems were defined as 'the processes that in human groups regulate the interaction between natural and social phenomena'. Maize-based agricultural technology and the development of maize races adapted to cool, wet conditions was proposed as the factor that allowed people to move into the colder environment of the Chiriquí highlands in significant numbers. As Linares, Sheets, and Rosenthal (1975: 144) state,

> Seed culture was the only system that permitted intensification from within. By eliminating the need to rely on outside protein sources, it helped men move away from a dependence on *carefully balanced ecosystems*. In western Panamá specifically, the introduction of maize agriculture increased human exploitation of special ecological niches and triggered important sociopolitical changes that led to larger and more internally ranked groupings. *This development was checked by external factors, an eruption of Volcán Barú*, and the shortage of time for recuperation before the arrival of the Spanish [I have added the italics for emphasis].

As with many important archaeological studies (e.g., Braidwood 1952, Childe 1957, Smith 1934), agriculture marked a boundary between the occupation of a natural world and one in which humans 'gained control over the material conditions of their own existence' (Thomas 2004b: 94).[44] Conceptually, that boundary was then moved in the Linares-Ranere project hypotheses when nature yet again asserted itself through the proposed AD 600 eruption. While maize agriculture allowed people to be

[44] For a critical discussion of the reliance of the adaptive radiations theory upon maize agriculture as the motor for social complexity see Hoopes (1996b: 21).

independent of 'carefully balanced ecosystems' (Linares, Sheets, and Rosenthal 1975: 144), which implies a stasis and stability to nature, the volcano represented an ultimate instability and rupture of stasis. The volcano, however, also represented a source of culture. When Smith (1934) examined agricultural development in Egypt, he viewed the environment as the source of the human capacity for culture, which was in that case wild barley on the Nile banks. Agriculture, and hence culture, then spread to other regions. Similarly, the adaptive radiations concept in western Panamá positioned agriculture as the determinant but additionally viewed the volcano - through the fertile soils, microclimates, and stone for tools - as part of the environmental 'push' factor for the diffusion of social complexity and social groups to other areas.

Linares and Ranere (1980) chose three areas in western Panamá for detailed comparative analysis: (a) the Gulf of Chiriquí on the Pacific coast, (b) the Aguacate Peninsula on the Caribbean coast near Bocas del Toro, and (c) the Chiriquí highlands surrounding the Volcán Barú (see Figure 1-7). The researchers proposed that the 'Guaymi' were descendents of pre-Columbian peoples in western Panamá and used modern subsistence patterns as frameworks to evaluate archaeological data for subsistence. [45]

The primary differences that Linares (1977a: 306, also see Linares 1980e) highlights between Caribbean coast and Chiriquí populations are in subsistence and settlement patterns.[46] The 8,000 Ngöbe who were estimated to live in Bocas del Toro in the 1970's grew tree and root crops using shifting agriculture and lived in extended-family hamlets that were regularly moved (per Gordon 1969). The 28,000 Ngöbe in the

[45]The Linares-Ranere publications refer to this group as *Guaymí*; since the publications of their study it has become more common to use the more inclusive term *Ngöbe (*also *Ngäbe*). A major problem with the 'Guaymi' analogy is that it was not the Ngöbe but other Chibchan-speaking peoples - the Doraces and Chánguenas – who were actually in the area during colonial period and ostensibly earlier periods, while the Ngöbe lived further to the east of the study area; see Cooke and Sánchez Herrera (2004a) For a map of the distribution of Chibchan speaking peoples see Hoopes (2005). For a list of Chibchan languages see Hoopes (ibid.: Table 1).

[46] For a critical view of the depiction of these groups as highly differentiated see Haberland (1983).

Chiriquí highlands or coast, however, used fire to clear land to grow maize and rice and live in towns or hamlets with multiple cognatic groups as well as hamlets (per Young 1971). Linares (1977a: 306-7) argued that Chiriquí populations were arranged into chiefdoms comprising several villages, citing sixteenth-century descriptions of village-based chiefdoms in Chiriquí, while the Bocas del Toro communities were described as dispersed and smaller. Linares (ibid.) parallels these differences to differences in rainfall and climate between the Bocas del Toro and Chiriquí provinces and suggested that macroclimatic differences between the Atlantic and Pacific watersheds influenced the development of contrasting settlement and subsistence patterns. She also hypothesized that perceived similarities in ceramic styles in the earliest occupation levels at sites she excavated on the Aguacate Peninsula in Bocas del Toro and at coeval highland villages suggested that the people who first colonized the Caribbean coast descended from the Cordillera after the AD 600 eruption of Barú.

The Linares-Ranere project interpretations I have summarized are not fully harmonious with my own perspectives, particularly regarding the invocation of catastrophism through the use of an AD 600 volcanic eruption as a prime mover. I feel that a great strength of the Linares-Ranere project, however, was the very deliberate incorporation and synthesis of the most recent environmental data and archaeological theory. This contribution, in addition to the substantive archaeological fieldwork conducted, provided data that form an important foundation of current regional understanding. The classification of the distinct environments of the Pacific, Caribbean, and highland portions of the Linares-Ranere project were carefully delineated by Linares and Ranere (1980a); in the discussion below I provide a summary of their study areas categorizations and add recent contributions to the environmental classifications they utilized.[47]

[47] It should be noted that the definition of vegetation types by climate is a practice that began with Humboldt's work. The Linares-Ranere project researchers' focus upon such schema gives their work a Humboldtian genealogy as well.

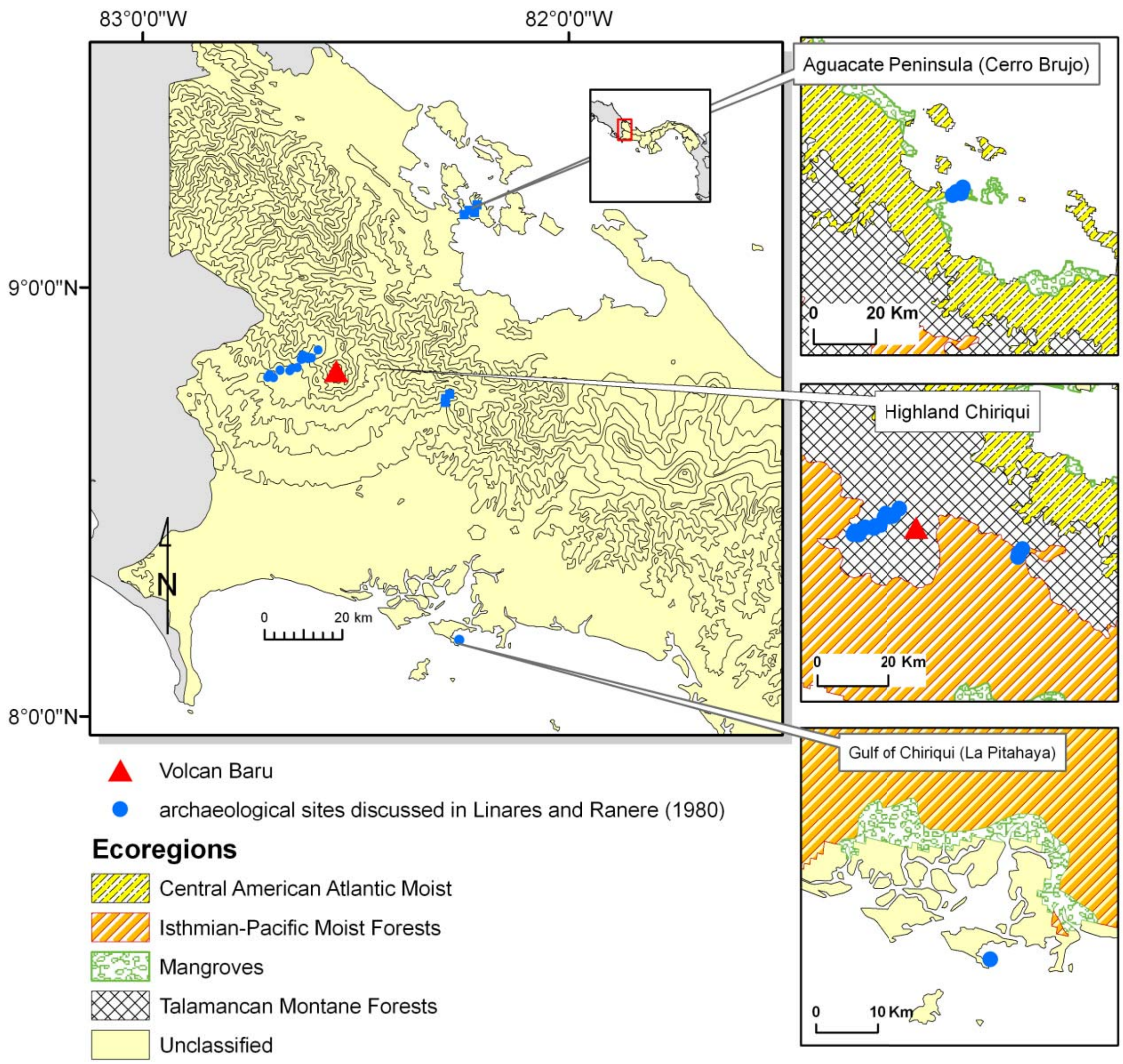


FIGURE 1-8: MAP OF THE STUDY AREAS DISCUSSED BY A*DAPTIVE RADIATIONS IN PREHISTORIC PANAMÁ (*LINARES AND RANERE 1980A)

The isthmus was considerably cooler and dryer in the late glacial period and early Holocene (Horn 2007). Throughout the Holocene itself, however, a great deal of variability and climate change occurred (Horn in press). Both the Chiriquí highland sites and the Caribbean coast sites currently fall into the *Af* category (or tropical rainforest in which the precipitation of the driest month is greater than or equal to 60 cm) of the most recent Köppen-Geiger climate classifications (cf. Linares 1977a: 307, 1980e: 8,10, see Peel, Finlayson, and McMahon 2007).[48] The pre-ceramic rock shelter sites east of the Barú summit fall within the *Af* category but closely straddle the current boundary of the *Am* classification (or tropical monsoon area that is not tropical rainforest and where precipitation of the driest month is greater than 100 cm – mean annual precipitation/25) that begins roughly 10 km east and 15 km to the south of the sites. The Gulf of Chiriquí sites fall within the *Am* classification.[49] The Pacific and Atlantic sides of higher slopes can vary significantly in highland Panamá. As Linares (1980e: 8) aptly points out,

> Generally speaking, the high mountains of western Panamá form a barrier to moisture-laden winds from the northeast, forcing them throughout the year to drop their moisture on the slopes facing the northern or Atlantic side. Hence, the slopes and coastal plains of the Pacific side of western Panamá tend to be drier and exhibit greater seasonal differences on the average than those on the Atlantic side.

Recent vegetation and ecoregion classifications derived from AVHRR (Advanced Very High Resolution Radiometer) imagery at a one kilometer resolution identified 17 natural vegetation types and 16 ecoregions in Central America (SEDAC 1998).[50] These data provide additional detail to prior discussions of anthropogenic and non-anthropogenic modern vegetation types in Central America (see Piperno and Pearsall 1998: Figure 2.2, Ranere and Cooke 2003: Figure 7.1).

[48] The Köppen-Geiger climate map from 2007, using data collected from 1951-2000, is available at http://www.hydrol-earth-syst-sci.net/11/1633/2007/hess-11-1633-2007-supplement.zip.
While arguments are made to replace the Köppen classification system this has yet to happen; for discussion of these arguments see Peel, Finlayson, and McMahon (2007).

[49] Linares (1977: 307, 1980e: 8, 10) states that Bocas del Toro is in the *Af* tropics and that the province of Chiriquí is in the *Aw* tropics. Her data are derived from Estadística Panameña (1973, 1975).

[50] Classification of ecoregions and vegetation types in the discussion and in Figure 1-8 are derived from a study by the Socioeconomic Data and Applications Center (SEDAC). This work was funded by PROARCA/CAPAS (Proyecto Ambiental Regional de Centroamerica/Central America Protected Areas Systems). The classification accuracy of the map is estimated to exceed 80%. I downloaded the digital data in August 2008 in Raster GRID and Shape File format.

The Gulf of Chiriquí

The Linares-Ranere project surveyed a total of 37 sites in the Gulf of Chiriquí islands and surrounding mainland in 1961 and recorded an additional two sites in 1975 (Linares 1968, 1980d, Ranere 1968). The Gulf of Chiriquí data included in *Adaptive Radiations* were from a single site, La Pitahaya (IS-3), excavated in 1971 (see Figure 1-8). La Pitahaya was interpreted to represent five activity areas spread over 260 m x 330 m (Linares 1980a, d). Of the three areas discussed, Linares (1980d: 76) notes that the site density in the Gulf of Chiriquí was by far the highest:

> Whereas a few hundred sherds and a few tools per excavation unit came out of the Volcán deposits, and perhaps twice as much from the Cerro Brujo excavations, the Pitahaya deposits yielded several thousands of sherds and several hundred stone tools per excavation unit.

Over a million ceramic sherds were excavated from La Pitahaya (Linares 1980a: 101).

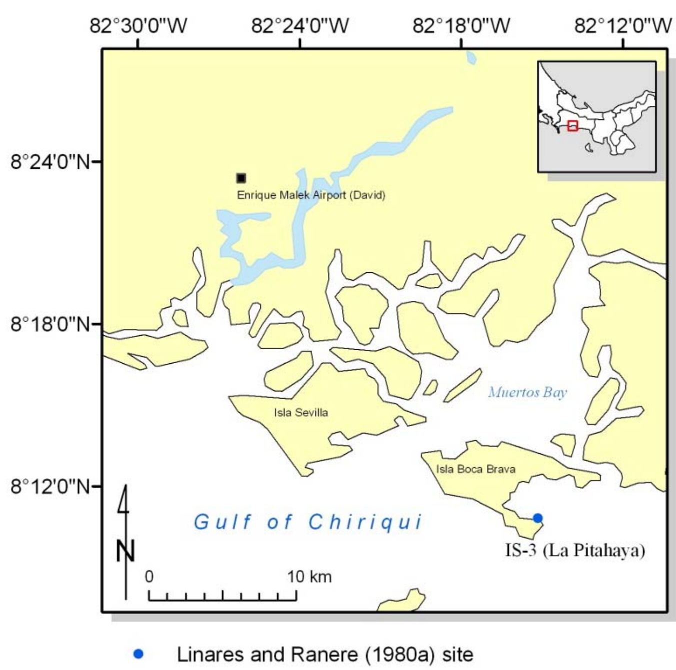


FIGURE 1-9: THE GULF OF CHIRIQUÍ SITE OF LA PITAHAYA FROM LINARES AND RANERE (1980A)

The SEDAC (1998) satellite imagery classification I used to define ecoregions in western Panamá did not have sufficient resolution to define the individual Gulf of Chiriquí islands, but the surrounding coastal area is a mixture of Isthmian-Moist Forest ringed with mangroves. The modern vegetation cover in the area is a patchwork of swamps, swampy tropical bushes, tropical wooded savanna with needle-leafed evergreens, and agriculture (SEDAC 1998). As Linares (1980d: 70) points out, in pre-Columbian periods of high occupation, much of the islands were likely cleared for dwellings, house orchards, palm stands, and fields. She notes that the modern vegetation of a number of the islands is comprised of the small trees that colonize soils degraded by frequent burning but that prior to heavy pre-Columbian occupation the islands likely hosted semi-deciduous forest.

The Aguacate Peninsula of the Caribbean Coast

The Aguacate Peninsula data were derived from four closely spaced sites surveyed as part of the Linares-Ranere project in 1969 and 1970. Only one of the sites, Cerro Brujo (CA-3) was extensively excavated in 1970 (see Figure 1-10). Cerro Brujo is interpreted as having been a modest hamlet of six or fewer dwellings that covered half a hectare. This work is significant in being the first systematic excavation from the Bocas del Toro area. While Matthew and Marion Stirling visited Bocas for ten days of fieldwork in April 1953 (Stirling and Stirling 1964), this work was more exploratory in nature from the descriptions as they mention that during that short time they visited “all of the principal islands and a considerable portion of the mainland coast of Almirante Bay” (ibid.: 259). They did excavate the site of BOC-3 on Colon Island, but provide very little detail of the work.

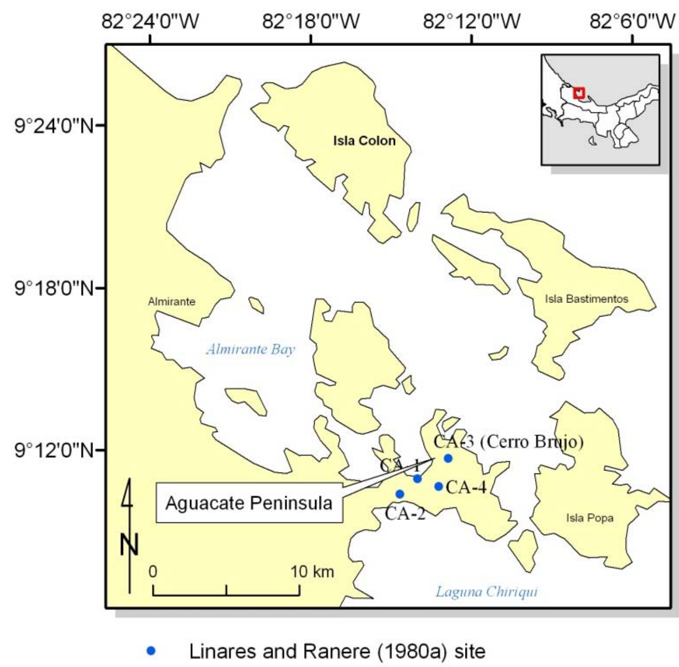


FIGURE 1-10: THE CARIBBEAN COASTAL SITES OF THE AGUACATE PENINSULA FROM LINARES AND RANERE (1980A)

The Aguacate Peninsula sites are located in the ecoregion defined as Central American Atlantic Moist; many coastal areas are ringed by mangroves (SEDAC 1998). Today the vegetation cover area is classified primarily as agricultural or cleared but is dotted with a patchwork of swampy tropical bushes, swampy forest, tropical broadleaf deciduous forest, palm forest that fades within roughly 20 km from the coast into a tropical broad leafed evergreen forest (SEDAC 1998). Linares (1980c: 58) theorizes that pre-Columbian populations would have been ideally located to utilize the differing resources of Almirante Bay and the Laguna Chiriquí and fieldwork recovered substantive data to indicate that people fished and collected shells around reef and mangrove edges (Linares and White 1980, Wing 1980).

The Volcán Barú highlands

The highland data were derived from a greater number of sites and larger area than the two coastal regions (see Figure 1-10). Sites are spread over the eastern and western flanks of the Volcán Barú.[51] This highland research area formed the link between the Pacific coast and Caribbean coast settlements in the *Adaptive Radiation* hypotheses.

The sites to the west of the Barú summit all fall within the ecoregion defined as Talamancan Montane Forest (SEDAC 1998). All of the Linares-Ranere project sites east of the volcano fall within the Isthmian-Pacific Moist Forest ecoregion (ibid.).[52] The current vegetation cover of both sides of the volcano is largely agricultural with tropical broadleaf evergreen forest, though the overall region is mixed in areas with needle-shaped evergreen forest as well (ibid.).

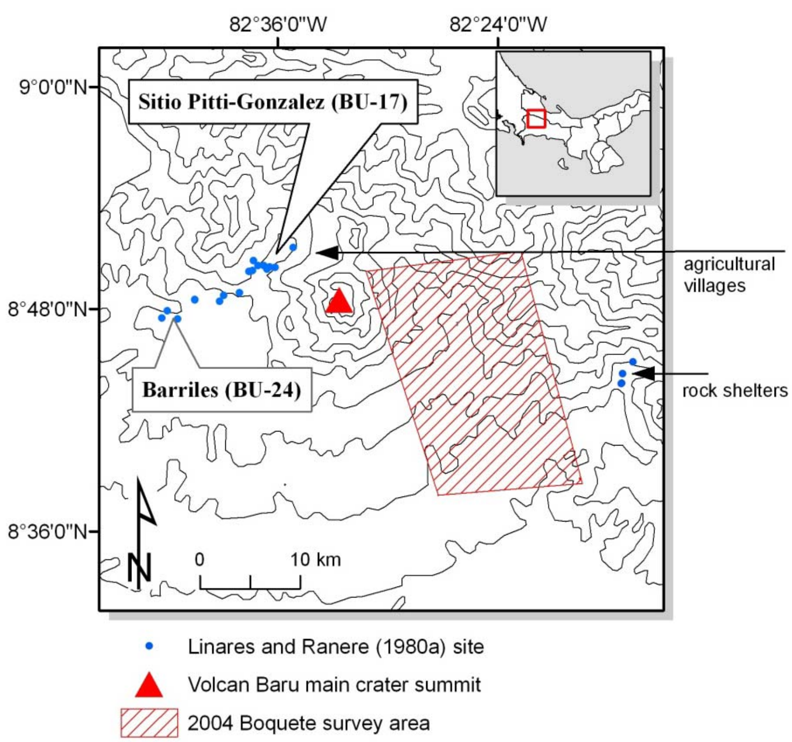


FIGURE 1-11: THE HIGHLAND SITES FROM LINARES AND RANERE (1980A)

---

[51] Methodologically the fieldwork in the highlands differed from that on the coasts as the recent agricultural development led to good site visibility and site surveys made with post hole soundings provided good areal coverage.

[52] The sites from my own fieldwork also fall within the Isthmian-Pacific Moist Forest ecoregion, barring one site that straddles the division between the two and falls slightly more firmly into the digital division of Talamancan Montane Forest.

Pre-ceramic rock shelters (east of Barú)

Anthony Ranere examined preceramic sites in four areas of highland western Panamá during a three-week survey in 1970 and in one of these areas he discovered stratified rockshelters in which he placed test pits (Ranere 1980a). Of these areas, the Rio Chiriquí drainage basin provided the most ideal preceramic time depth and was excavated in 1971 as part of the Linares-Ranere project fieldwork. Four rock shelters were excavated: Casita de Piedra, Trapiche, Horacio Gonzalez, Hornito, and Zarsaidero. An open habitation site at the Casita de Piedra schoolyard was also excavated. Ranere (1980a: 17) notes that each of the rock shelter sites is located on narrow terraces near the canyon floor and range in elevations of 645-900 m above sea level (asl). The canyon walls rise steeply from the river. Ranere (ibid.) states that resources from multiple physiographic zones were available to people in the rock shelter area (see Figure 1-11).[53] The oldest date from the excavations yielded an assay (I-6278) of roughly 6560±120 BP.[54] This gives a calibrated date ranging from 7259-7414 cal BP (2δ), or roughly 5710-5410 BC (2δ).[55] The six radiocarbon dates showed occupation from this range to roughly 2300 cal BP, or 800-930 cal BP (1030-1200 cal BC). The rock shelter artifacts continue to provide new data as recent starch grain analysis of lithics adds to the discussions of early plant domestication and new radiocarbon dates indicate that the Casita site, in particular, was occupied considerably earlier (Dickau, Ranere, and Cooke 2007).

[53] I have digitized locations for these sites using the map provided in Ranere (1980a: Figure 3.0-1) and the description of the site locations. The locations should be very close to accurate but do not reflect precise Global Positioning System (GPS) points. In this and the following highland maps, the topography lines are 100 m contours I created from SRTM (Shuttle Radar Topography Mission) data. I hand drew rivers and streams from digitized, geolocated 1:50,000 maps from the Panamanian Instituto Geogáfico Nacional "Tommy Guardia" and Landsat imagery.

[54] The date was reported as 4610±120 (Ranere 1980: 27).

[55] CALIB 5.0.2 program (Stuiver and Reimer 1993) and the INTCAL04.14C dataset (Reimer et al. 2004).

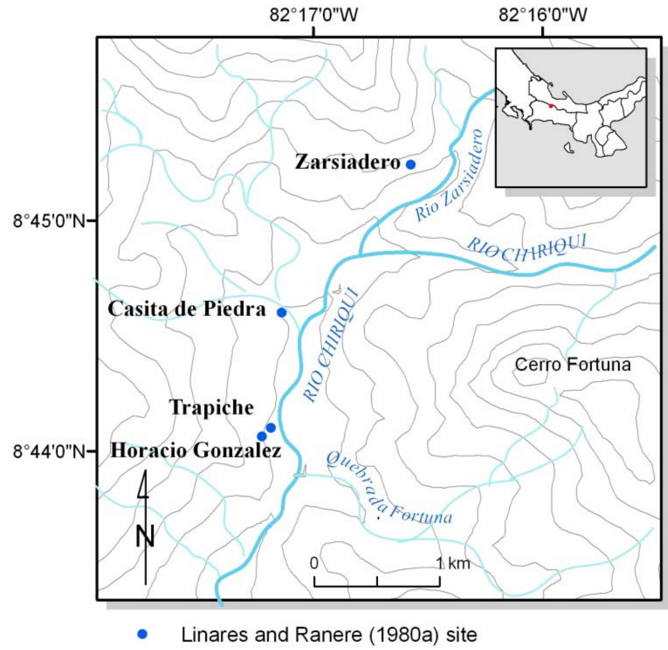


FIGURE 1-12: THE RIO CHIRIQUÍ ROCK SHELTERS

Highland agricultural villages (west of Barú)

The Linares-Ranere project fieldwork completed west of the Barú summit is from a 62 km^2 survey area and excavation completed between 1970-1972 by Bruce Dahlin, Robert McNealy, Jane Rosenthal, Payson Sheets, and Sara Spang under the direction of Olga Linares (Dahlin 1980, Linares and Sheets 1980, Rosenthal 1980, Sheets 1980). The researchers identified 45 sites spread over five microclimates (see Figure 1-12).[56] They excavated two stratified sites; the habitation site of Sitio Pitti-Gonzalez (BU-17) and the larger ceremonial center of Barriles (BU-24). Both excavated sites provided carbon, ceramics, lithics, and botanical remains.

Fifteen of the Linares-Ranere project sites west of Barú were found in the Cerro Punta valley at elevations of 1800-2000 meters. Sitio Pitti-Gonzalez (BU-17) was the largest of these. The survey recorded only a few smaller sites along the Rio Chiriquí Viejo

[56] For a larger map of the 45 sites in relation to the streams and river see Figure 3 of Linares, Sheets, and Rosenthal (1975: Figure 3). The same map is also reprinted in Sheets (1980: Figure 2.1).

through the modern areas of Bambito, Los Llanos, Paso Ancho, and Tisingal.[57] Five large sites were recorded further south on high terraces along the Rio Chiriquí Viejo between 1200-1340 meters. These sites, including Barriles (BU-24), were the largest sites in the Volcán Barú portion of the Linares-Ranere project.

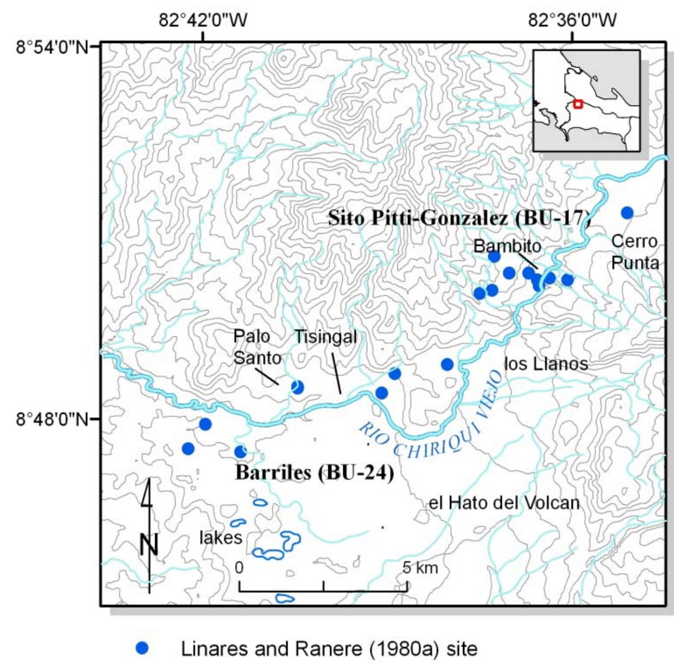


FIGURE 1-13: THE VOLCÁN AND CERRO PUNTA SITES

The importance of volcanism in the Linares-Ranere project interpretations

The Linares-Ranere project publications explicitly give the volcano importance beyond simple environmental hazard. Linares et al. (1975: 138) cite the geological assessments of Robert Terry (1956) and Robert Stewart (personal communication) to state that the damming of the Chiriquí Viejo river at Bambito by lava flows from Barú caused sedimentation to collect in the Cerro Punta basin. When this dike eroded, terraces formed in the Barriles area; the crater wall collapsed, forming the Los Llanos alluvial fan and redirecting the Chiriquí Viejo again to skirt the El Hato basin. Linares et al. (1975: 138) state that,

[57] Note that the Rio Chiriquí (Figure 1-12) and the Rio Chiriquí Viejo (Figure 1-13) are different rivers.

> As a result of Barú's activities, at least five distinct microclimates are found today within an area of about 100 square kilometers.

These Pleistocene and Holocene period Barú events 'created the conditions that eventually attracted settlers to this area' (ibid.). The Linares-Ranere project researchers highlighted the presence of fertile volcanic soils and hard volcanic stone for tools as the central attractions that drew early settlers to the volcanic landscape (Linares 1977b: 23-4, 1980b: 235, 242, Linares and Ranere 1980b: 79, 1980c: 15, Linares and Sheets 1980: 45, 52, Smith 1980: 167).

An AD 600 eruption of the Volcán Barú was proposed as the dividing line between 'stage 3' and 'stage 4' of the adaptive radiations hypotheses (see Figure 1-7). Linares et al. (1975: 144) provided the strongest statement regarding Barú's catastrophic role in western Panamá when they proposed,

> A massive eruption of Volcán Barú unquestionably terminated all human activities at Cerro Punta, around A.D. 600.

This eruption was considered responsible for the 'complete depopulation of this area some centuries before the Spanish Conquest' (ibid.: 141). Linares (1980a: 115-16) further stated that,

> Because the eruption of the Volcán Barú deposited a fairly deep layer of sterile pumice on the Cerro Punta area, the Pitti-Gonzalez site was abandoned, apparently around A.D. 600…. The highlands seem to have been avoided – or at least to have been lightly settled – following the eruption of Volcán Barú.

At the same time, Linares made it clear that this abandonment was not uniform in the Barú area due to differential impacts of the eruption; unlike the Cerro Punta sites the site of Barriles not only continued through this period but also grew in importance (ibid.: 93). Based on ceramic similarities, Linares (ibid.: 115) suggests that the initial settlers of the Bocas del Toro coastal area of Cerro Brujo were 'refugees from the highlands'. She finds no evidence, however, that the La Pitahaya area of the Gulf of Chiriquí was settled by people from the Volcán area (ibid.).

The dating of the Barú eruption by the Linares-Ranere project

As discussed previously in this chapter, numerous citations of historical period eruptions of the Volcán Barú occurred in geological literature of the late nineteenth and early to mid twentieth-century (Dollfus and de Montserrat 1868, Fuchs 1882, Montessus de Ballore 1884, 1888, Otis 1861, Rubio 1950, Sapper 1925, Stewart 1978). Linares (1980e: 7, cf. Stewart 1978), however, states that Barú 'had long been considered an extinct Pleistocene volcano (Terry 1956) until our research showed it to have been active relatively recently'. The term 'long', admittedly, is a relative one when describing geological processes. The debate over the 1882 eruption lasted at least until Sapper's 1925 publication and the mid-sixteenth-century eruption was re-cited by Rubio (1950), hence in social scientific terms was still relatively recent. In citing the Terry (1956) study, Linares joined projects such as the *Area Handbook for Panamá* (Foreign Areas Studies Division 1962: 57), which also cited Terry (1956) to state that Barú hadn't erupted within the past 10,000 years.[58] This interpretation of Terry's assessment of Barú, however, is somewhat questionable.

Upon close reading, what Terry (ibid.) wrote about Barú was more ambiguous due to his own admitted lack of field examination in the area. The exact statement Terry (ibid.: 10) made about Barú, when read in the context of the overall book, does not necessarily imply that Barú had not been active since the Pleistocene but rather that a large amount of its volcanic activity occurred during the Pleistocene. This is emphasized when Terry (ibid.) cites the debate over possible historical period eruptions. Terry (ibid.: 10-11) additionally states that 'the entire region has an appearance of extreme topographic youth'. Terry (ibid.) noted that he had seen what he had interpreted as extremely fresh ash in the area of Cerro Santiago, roughly 90 km east of Barú along the continental divide. Terry's fieldwork was conducted between 1920 and 1949 and the recent ash he saw at Irazú volcano in Costa Rica was the result of

[58] The Area Handbook was prepared by the US government to provide information on non-US people that could be useful in unconventional warfare tactics and psychological operations.

eruptions that have been ongoing since the nineteenth century. According to the data available from Simkin and Siebert (2002-2008), I anticipate that the Santiago ash distributions Terry observed in Costa Rica resulted from eruptions that occurred between 1917-1921, 1924, 1928, 1930, 1933, and 1939-40.[59] While he mistakenly interpreted Santiago to be more recently active than Barú, Terry (1956: 11, 21, 76) also left open the possibility that Barú could have been active quite recently in the Holocene period.

The Linares-Ranere project certainly cannot be faulted for utilizing the Terry (ibid.) study as it provided the most recent and complete description of Panamanian geology at the time of the fieldwork. It must be noted, however, that in volcanological literature the Terry (ibid.) study cited by the Linares-Ranere project publications 'was considered of reconnaissance nature and given little attention' (de Boer et al. 1988: 275).[60]

The disjunct of stratigraphic interpretations in the Linares-Ranere project

Upon close examination, the stratigraphic records from the Linares-Ranere project raise a number of questions. The AD 600 date was originally determined from carbonized wood posts used to construct a simple, oval house structure that was covered in tephra at the Pittí-Gonzalez site in Cerro Punta (Spang and Rosenthal 1980).[61] A 1978 geology manuscript by Robert Stewart (1978) includes three stratigraphic profiles from the Linares-Ranere project excavations at Cerro Punta (labeled 'Sitio Piti,

[59] To describe the freshness of the ash he saw in western Panamá, Terry (1956: 11) stated that it was 'so loose that the accompanying Indians insisted on spreading out to a spacing of 30 feet between men, to avoid starting a slide'.

[60] Though Sherrod et al. (2007) also use information from Terry (1956) and the work is not to be discredited.

[61] The radiocarbon dates from the BU-17b (Pitti) site that are reported in Figure 7.0-7 of Linares (1980a: 109).

BU-17 Locality 8, T.P.7') and Barriles (labeled 'BU-24, Cut 1 [at Barriles site itself]'; 'BU-24, Cut 2 [or T.P. #3]'). None of the profile drawings indicate a volcanic layer at AD 600. Stewart (ibid.: 16-17) states that he believes the last eruption of Barú took place roughly AD 1210±150 (768 BP).

The *Adaptive Radiations* volume cites Stewart in its bibliography and in assessments of Barú's eruption history (Sheets 1980: 275), though the discrepancy of roughly 600 years in their interpretations of when the last eruption of Barú occurred is not noted. Clearly, communication between the geology and the archaeology project members occurred as they shared information and cited one another's work. The vast difference in their final conclusions, however, is not explained. The archaeologists do mention a date of AD 1210± 150 at Barriles from above the pumice layer (Linares 1980a: 93, Linares, Sheets, and Rosenthal 1975: 141). No stratigraphy drawing is provided to indicate the relationship between the tephra and the radiocarbon sample or contextualize the relationship between the proposed AD 600 eruption and the carbon date that postdates it by roughly 600 years.

The archaeological stratigraphy drawings included in Stewart (1978) are not consistent with an AD 600 eruption. The Sitio Pitti-Gonzalez drawing portrays a 5 cm pumice tephra layer under 20 cm of plow zone. The tephra is associated in the drawing to roughly AD 850-900. The radiocarbon date listed as most closely associated in the drawing are from the 50-60 cm depth, or 30 cm *below* the tephra, which is dated to AD 515-685 (I-7260). The Barriles profile from Cut 1 shows a roughly 10 cm tephra layer that is below a 10 cm surface layer. The pumice is given a date of roughly AD 1000 and the closest associated radiocarbon date is from the 50-70 cm depth (I-6835), hence 30-50 cm *below* the tephra, and is dated to AD 735-905. The Barriles profile from Cut 2 provides the most directly associated radiocarbon date for a tephra layer, as both are drawn at the 10-20 cm depth in the profile. The tephra is roughly 10 cm in depth, under a 10 cm surface layer, and is associated with a radiocarbon date of AD 1060-1360 (I-7263).

An additional problem occurs in the unexplained disjunct in the archaeological interpretation of the stratigraphy. A cultural layer of 30-70 cm, as shown in the stratigraphy drawings, is interpreted to represent 200-800 years of occupation yet the roughly 1400 years the Linares-Ranere project proposed had passed since the most recent Barú eruption resulted in only 8-20 cm of surface layer (Linares, Sheets, and Rosenthal 1975: 141, Rosenthal 1980: Figure 5.2, 290-92, Spang and Rosenthal 1980: Figure 4.5, 287-88). This, of course, can potentially be the result agricultural disturbance, lacustrine deposits, or fluvial activity. It seems, however, like a very unusual transformation in depositional processes that required more explicit explanation (though note Rosenthal 1980: 292).

A final dating confusion occurs when De Boer et al (1988: 273) state that a ^{14}C date of 740 +/- 150 years BP was derived from charred wood covered by an ash layer at the Barriles site, though the authors do not mention the researchers who excavated or interpreted the material.[62] Obfuscated writing makes it seem as though this could be a citation from Linares, Sheets, and Rosenthal (1975: 141). Further confusion arises in the writing found in Linares (1975: 141), in which awkward phrasing states that the project members either found reoccupation evidence or they found a pumice zone from after AD 1200, despite the repeated statements in the same publication that an AD 600 eruption of Barú was the most recent.

The lack of close fit, clear data, or multiple radiocarbon dates should have sent up a warning flag regarding the reliability of the AD 600 eruption. The strength of the overall research project, however, led to the rapid entrenchment of the date in archaeological literature and its frequent citation (e.g., Cooke 1997b: 167, Drennan 1991: 273, Hoopes 1996b: 34, 2005, 30, Künne and Beilke-Voigt nd, Lachniet et al. 2004: 207, Sheets 2001, 2008, Shelton 1984, 1994: 80, Snarskis 1984: 225);(though see Cooke 1997b, 2005: 144-5, Hoopes 1996b: 20-21). The disjunct present in the stratigraphic

[62] De Boer (personal communication, March 2009) says that this date was from personal communication with Stewart.

relationship between the established ceramic chronology and the tephra layer from the last eruption was a source of confusion to subsequent researchers who attempted to reconcile the fact that ceramics that supposedly post-dated the AD 600 eruption by hundreds of years were found beneath the uppermost tephra lens rather than above it (e.g., Künne and Beilke-Voigt nd: 11, and personal communication).

New interpretations of Barú's eruptive history: Multiple eruptions and uninterrupted occupations

Recently published palaeoecological and geological data have added greatly to the understanding of Barú's eruption history and provided strong evidence that the last eruption of the Volcán Barú occurred considerably later than the AD 600 event proposed by the Linares-Ranere project (Anchukaitis and Horn 2005, Clement and Horn 2001, Sherrod et al. 2007).

As I will address later in this discussion, several interpretations of the eruption history now exist from research conducted over the past decade. While radiocarbon dates (at 2δ, which indicate a 95.4% probability that the date falls within that range) do show some clusters that make certain periods more likely for eruptive phases, the entire period of intensive human occupation of the Barú area coincides with an overlapping series of dated volcanic eruptions (see Figure 1-14). Palaeoecological studies, however, determine that occupation of the overall area has been nearly continuous throughout this same time period (Anchukaitis and Horn 2005, Behling 2000, Clement and Horn 2001). Eruption, then, has been an integrated part of the human experience in this area.

In addition to the eruptions portrayed in Figure 1-14 - which occurred during the occupation by intensive, maize-based agricultural groups - evidence additionally exists for several earlier eruptions (Sherrod et al. 2007).[63] Earlier eruptions - spanning from

[63] These early dates are included in Appendix B.

3,000-13,000 cal BP - should also be considered as part of the human experience of volcanism in the isthmus due to the established Late Glacial Stage time depth of human life in the region.

Figure 1-14 shows a conservative representation of a wider range of dates also proposed for Barú eruptions. I did not include a date of 980-690 BP; this date is cited by a geothermal reconnaissance group (IRHE 1987) for pyroclastic deposits outcropping south of the Aguacate Range. The authors, however, do not provide uncorrected uncertainties or a lab number for the date or dates.[64] A very brief mention of the IRHE findings on Barú is included in Ramirez (1988), stating that Barú is not useful for geothermal purposes due to the lack of high-enthalpy geothermal systems at shallow depth, but no mention of eruption history was made. I did not include the dates listed in a hazards study (Universidad Tecnológica de Panamá 1992: Figure 11). I did include one Linares-Ranere project radiocarbon date (I-7236), which was accepted by Sherrod et al. (2007); I excluded the remainder of the radiocarbon dates from the Linares-Ranere project as they do not appear associated with volcanic eruptions. I have not included dates from Silka Lasso and José Luis Macías (Universidad Nacional Autónoma de México), who believe they have found deposits from Barú eruptions that are younger than 400 BP. The USGS researchers who recently conducted fieldwork in the Barú area were not convinced by these data (Sherrod et al. 2007). The Lasso and Macías dates, however, have yet to be proven or disproven.

[64] My thanks to Lee Seibert, Smithsonian Global Volcanism Project, for this information.

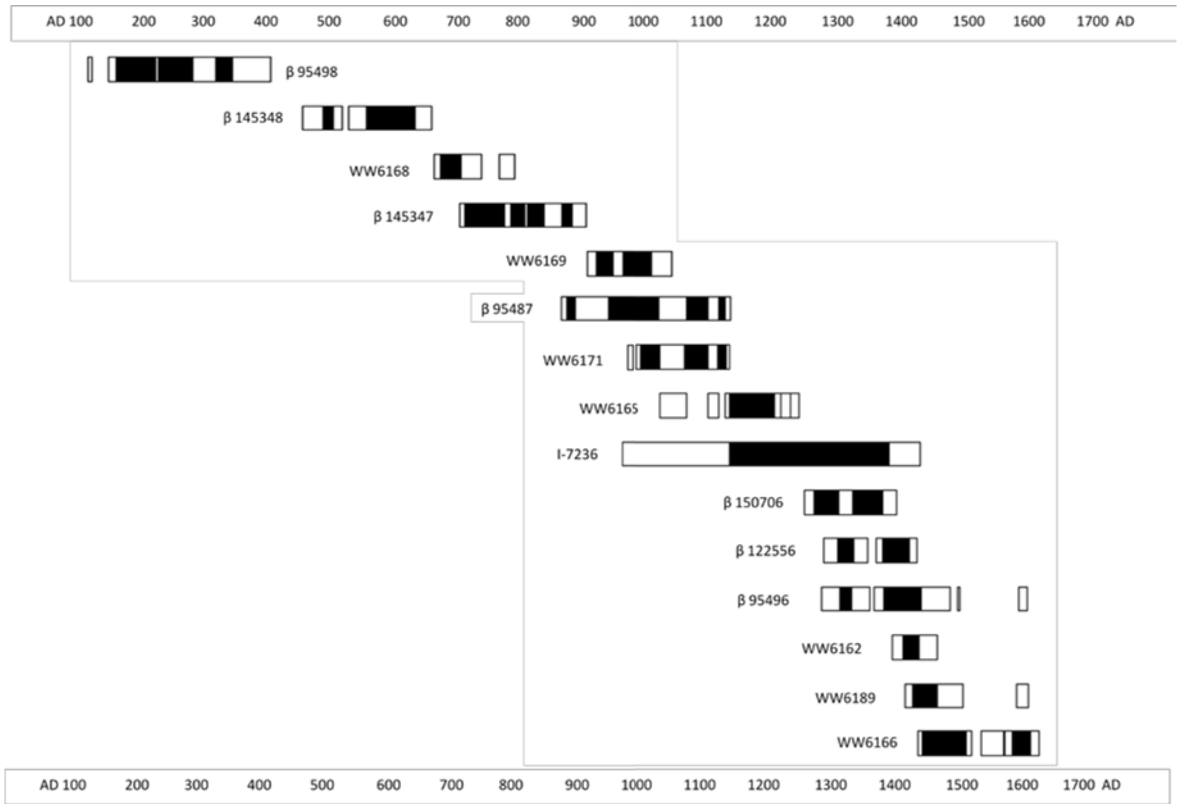


FIGURE 1-14: DATES FOR 14C SAMPLES THOUGHT TO RELATE TO ERUPTIONS OF THE VOLCÁN BARÚ DURING THE PERIOD OF INTENSIVE HUMAN OCCUPATION

White bars indicate 2δ values (95.4% likelihood), while black shading within bars indicates 1δ values (68.3% likelihood). For raw data in BP and BC/AD values as well as contextual details and publication citations for the samples see Appendix B. I calibrated and plotted dates using raw dates from the source publications, the INTCAL 04.14C dataset (Reimer et al. 2004) and the CALIB 5.0.2 calibration program (Stuiver and Reimer 1993).

Suggested dates for Barú eruptions

Interpretations of the events and their timing will continue to change as new data are derived. For the purposes of this thesis, I simply wish to highlight the multiplicity and regularity of volcanic eruption over the past 2,000 years as interpreted by recent palaeoecological and geological fieldwork by Behling (2000), Clement and Horn (2001), Anchukaitis and Horn (2005), and Sherrod et al. (2007). I discuss the studies in the order of their publications.

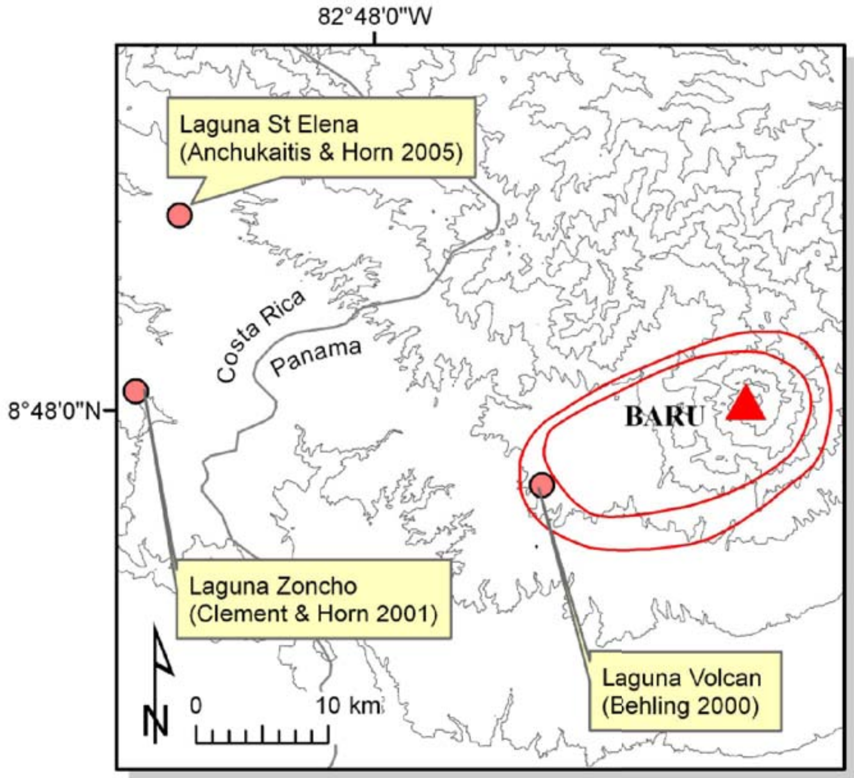


FIGURE 1-15: LOCATIONS OF LAKE-SEDIMENT CORES

Red rings around Barú indicate the main tephra fall from the most recent Barú eruption as interpreted by Sherrod et al. (2007). Note that while the lake that Behling (2000) examined falls within this area, the Costa Rican lakes examined by Clement and Horn (2001) and Anchukaitis and Horn (2005) fall well outside of it.

Behling (2000)

Behling (2000) examined pollen and charcoal evidence from a lake-sediment core from the Laguna Volcán.[65] I will discuss this core sample more in depth in the next chapter, as I took tephra samples from it for petrography analysis. Using three AMS dates from associated tephra layers just above the organic material he dated, Behling proposed Barú eruptions at roughly 1800, 1000, and 500 ^{14}C yr BP with calibrated mean

[65] Hermann Behling is currently the head of the palynology and climate dynamics department at Georg-August University in Göttingen, Germany.

calendar year dates falling at roughly AD 240, AD 1020, and AD 1420 (see Appendix B for more detail).

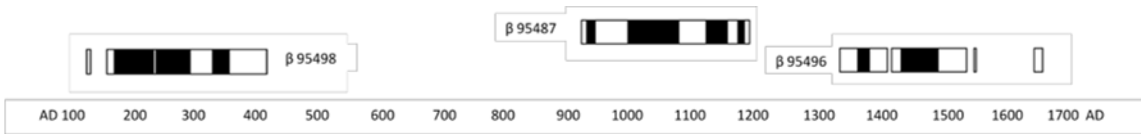


FIGURE 1-16: DATES OF BARÚ ERUPTIONS PER BEHLING (2000)

These eruptions were interspersed within clear evidence of maize (*Zea mays)* agriculture and fire from the basal layer of the core, which begins at 2860 ^{14}C yr BP. Behling determined that the first two eruptions had little impact on occupation, as evidenced by agricultural pollens and forest clearing, but that the most recent event had a catastrophic impact on human occupation as evidence for the use of fire and agriculture is absent and the forest recovery is indicated.[66] Behling also notes that the pollen indicates perceptible forest regeneration, hence decreased agriculture and by extension human populations, roughly 1000 ^{14}C yr BP. He questions (ibid.: 392) the possible link between this decrease and the drought thought to have occurred between 1300 and 1100 ^{14}C yr BP and linked to the decline of Classic Maya civilization (Hodell et al. 1995).

Clement and Horn (2001)

Clement and Horn (2001) analyzed pollen and charcoal evidence from a lake-sediment core from the Laguna Zoncho in southern Costa Rica.[67] They found maize (Z*ea mays)* pollen grains in almost all samples throughout the core, indicating continuous agricultural occupation for the past 3,000 years. The core evidenced only one tephra

[66] Note that forest recovery also occurred due to the demographic decline caused by European invasion, which may also be indicated in Behling's data.

[67] Rachel Clement and Sally Horn completed this work through the department of Geography at the University of Tennessee, where Horn is a biogeographer and faculty member. The core was recovered in March 1997.

layer (99-100.5 cm depth), which they interpret as being from Barú. This sample, which was found ~20 cm below the tephra layer, was dated to roughly 540 ^{14}C yr BP with a calibrated mean calendar date falling at roughly AD 1400. As Sherrod (written communication, 2008) points out, the large stratigraphic distance between the tephra and the sample indicated that the eruption occurred considerably later than the dated material but there is little way to know how much later.

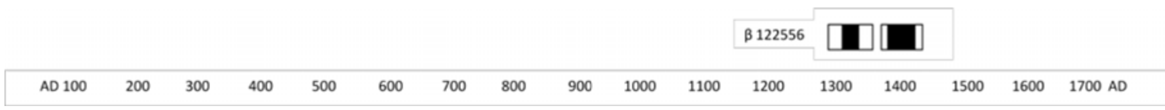


FIGURE 1-17: DATES OF BARÚ ERUPTIONS PER CLEMENT AND HORN (2001)

Clement and Horn (2001: 422) note that their findings are compatible with those of Behling (2000), whose results were published while the Clement and Horn (2001) publication was in revision. Unlike Behling's core, which yielded a 20 cm tephra layer from the most recent eruption of Barú, the Laguna Zoncho core examined by Clement and Horn had only a 1.5 cm tephra layer from the same eruption. Clement and Horn (ibid.: 425) note that population decline and forest recovery are indicated by the pollen at the beginning of the sixteenth century and note that this 'may have resulted from culture or nature, or both'. While 1.5 cm of tephra may not have impacted agricultural viability of the soils sufficiently enough to cause populations to abandon the area, Clement and Horn (ibid.) note that,

> Perhaps the rain of volcanic tephra from Volcán Barú provided further impetus for the abandonment of a site by people whose numbers were already reduced by contact-era warfare, disease, or enslavement.

Or, they note, the timing could be coincidental.

Anchukaitis and Horn (2005)

Anchukaitis and Horn (2005) analyzed pollen and charcoal in lake-core sediments from the Laguna Santa Elena in Costa Rica. Maize (*Zea mays)* pollen and charcoal from fires are evident within the entire 2,000 year span of the core, though human activity became more pronounced at least by 1400 ^{14}C yr BP. Anchukaitis and Horn (ibid.) note a brief abandonment of the area at roughly 540 ^{14}C yr BP. They date three eruptions of the Volcán Barú to roughly 610, 1080, and 1440 ^{14}C BP, or calendar dates of AD 1340, AD 870 and AD 510. These eruptions, from the sediment core evidence, had little direct effect on the Santa Elena populations. Only one of the most recent of the three proposed dates, which has a calibrated mean calendar date of roughly AD 1340, is from a radiocarbon sample. The other two dates are interpolated from the data.

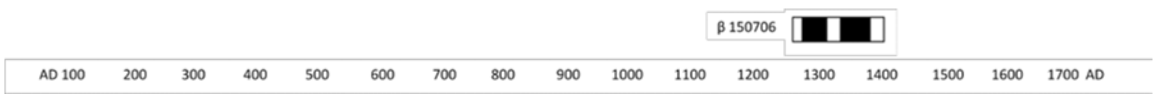


FIGURE 1-18: DATES OF BARÚ ERUPTIONS PER ANCHUKAITIS AND HORN (2005)

The oldest date suggested in the Laguna Santa Elena core does not correlate well with the oldest eruption suggested by Behling (2000). Anchukaitis and Horn (2005) suggest that Behling's dating needs adjustment as currently two tephra layers that are only 5 cm apart in the stratigraphy are interpreted as having an 800 year temporal gap. Anchukaitis and Horn (ibid.) do, however, accept Behling's three eruption interpretation as well as his description of the first two eruptions as having had little impact on the area but the most recent one as having potentially large scale impact on the area.

Like Behling, Anchukaitis and Horn (2005: 50) point to the long-term impact of people on the environment as well as the possibility of a severe, Pan-Central American drought (Haug et al. 2003, Hodell et al. 2001, Hodell et al. 1995, Horn and Sanford Jr. 1992, Lachniet et al. 2004). The deep integration of anthropogenic changes and larger, non-anthropogenic climate change, however, is difficult to disentangle due to the strong human impact in the region. Anchukaitis and Horn (2005) provocatively point out that the timing for cultural transition, as evidenced in the shift from Aguas Buenas to Chiriquí period ceramics, could correlate to a widespread climate change.

While Anchukaitis and Horn (ibid.) found no evidence that the most recent eruption directly impacted people in the Santa Elena lake area, they 'cautiously hypothesize' that the most recent Barú eruption caused regional instability as displaced peoples sought new territory. Displaced Barú area residents likely received a hostile reception as they sought new locations to settle (Sheets 2001). The internecine warfare and abandoned villages that Spanish conquistador Francisco Vásquez de Coronado observed in the Rio Grande de Térraba Valley (Drolet 1992, Fernández Guardia 1913) could have been part of a wider regional phenomenon partly caused by Barú (per Anchukaitis and Horn 2005: 49). This, in tandem with societal upheaval and disease brought by the Spanish, could account for the reduced populations or abandonment, though I would caution that cause and affect are difficult to unravel in this case. In sum, the Anchukaitis and Horn (ibid.) findings support a very similar hypothesis to that of the Linares-Ranere project regarding the role of volcanic eruption, but they do radically shift the date of the most recent eruption (by roughly 700 years) and highlight the event of more than one eruption.

Sherrod et al. (2007), USGS

The recent USGS study by Sherrod et al. (2007) provides the most complete and recent data regarding Barú's eruption history. Researchers used paleosols, or soils buried by tephra deposits, in conjunction with seven new AMS dates thought to directly relate to volcanic deposits from the past 2,000 years.[68] Sherrod et al. (2007) accepted all three of Behling's dates in their Open File Report. They additionally incorporated the Clement and Horn (2001) and Anchukaitis and Horn (2005) dates after the official release of the Open File Report, though some stratigraphic inconsistencies exist (Sherrod, personal communication).

[68] The USGS provide a total of 11 new AMS dates in total; four are for periods that by current archaeological interpretation few people lived in highland Chiriquí.

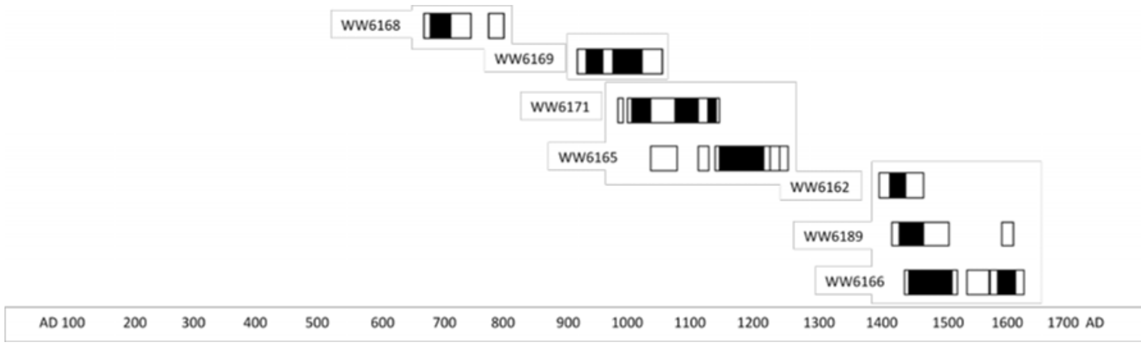


FIGURE 1-19: NEW DATES FOR BARÚ ERUPTIONS FROM THE USGS STUDY (SHERROD ET AL. 2007)

Sherrod et al. (2007) did not accept the radiocarbon date (I-7260) used by the Linares-Ranere project to propose an AD 600 eruption as related to volcanic events. Like Anchukaitis and Horn (2005) the USGS researchers believe that the I-7236 (740 ± 150 BP uncalibrated date, AD 988-1450 calibrated calendar year, 2δ) radiocarbon date from the Linares-Ranere project is associated with volcanism. The large analytical error of this date, however, makes its attribution to one of the multiple eruptions thought to have occurred during human occupation of highland Panamá uncertain (Sherrod et al. 2007: 17).

The USGS provides two extremely important new elements to the interpretation of Barú's eruptive history. The first of these is in their interpretation that four eruptions have occurred during the period of peak occupation in highland western Panamá. As only one eruption was noted by the Linares-Ranere project and palaeoecological studies only identified three eruptions, the determination of a fourth eruption is a significantly new development. The determination of a fourth event is based not on radiocarbon dates but on paleosols.

The second major contribution of the USGS interpretations with important archaeological ramifications is that each of the multiple eruptions lasted over a series of possibly many years and included widespread tephra fallout, pyroclastic flows, and lahars (Sherrod et al. 2007: 4). This removes the clear ability to designate when the 'event' of each eruption occurred as they were prolonged assemblages of phenomena.

Unlike Behling (2000), Clement and Horn (2001), or Anchukaitis and Horn (2005), who provided mean dates for the three eruptions they interpreted from lake-sediment cores, Sherrod et al. (2007) provided spans of time for the four episodes and the periods of quiescence in between each period (ibid.: Table 3, Figure 12). A 400-500 year dormancy separates the current landscape from the first episode, which they place between 420-540 cal yr BP. Roughly 250 years of dormancy divide episode one and Episode two, which is undated. Another roughly 250 year dormancy divides Episodes two and three, which is interpreted between 690-950 cal yr BP. A roughly 230 to 620 year dormancy then separates their Episodes three and four, interpreted to have occurred sometime between 1180-1310 cal yr BP.

The 540±50 ^{14}C yr BP Laguna Zoncho date from Clement and Horn (2001) likely fits into Episode 1 (Sherrod, personal communication, 2008). The 640±60 ^{14}C yr BP date from Anchukaitis and Horn (2005) possibly represents the USGS Episode two, which the USGS did not date directly (Sherrod, written communication, 2008). The 1240±40 ^{14}C yr BP date from Anchukaitis and Horn (2005) is from a sample 17 cm below the tephra layer, hence is difficult to assign, while their oldest date of 1510±40 ^{14}C yr BP date seemingly has no match in the USGS episodes (Sherrod, personal communication, 2008). This could, however, be a product of the 'stratigraphic inversion' that the USGS road cut sample exhibited as relative ages of samples were inverted and require further testing (Sherrod, personal communication, 2008).

While an eruption can last for years, the radiocarbon samples used to date them evidence one stopped moment with a statistical window of probable dates. The carbon samples used to date the tephra layers, as already touched upon, provide an indirect date that is either some point either before or after the eruption but doesn't actually define the actual eruption. Radiocarbon dating of cultural sequences in the Barú region has until recently been fraught with problems of contamination, context, and stratigraphic control (Anchukaitis and Horn 2005: 38, Hoopes 1996b, Lange and Stone 1984, Linares and Sheets 1980). The combined difficulties of integrating the 'natural' and 'cultural' sequences is not a simple task. The most significant aspect of these multi-year eruptions that occurred repeatedly throughout the past 2,000 years is the lack of interruption the eruptions prompted in the archaeological record, per the findings of Behling (2000), barring the most recent eruption.

The fit between the Linares-Ranere hypotheses and recent archaeological data

To sum up, whereas Linares et al. proposed that a catastrophic eruption in AD 600 impacted local settlement history and engendered a movement of highland people to the Caribbean coast, it now seems clear that the catastrophic eruption of Barú occurred much later (perhaps as many as 700 years). This catastrophic eruption, in turn, was not the re-awakening of a long dormant volcano; rather, eruption was a relatively frequent event during the *longue durée* of human occupation.

Recent investigations along the Caribbean coast of Panamá and Costa Rica

One of the hypotheses proposed by the Linares-Ranere project was that people from the highlands of western Panamá emigrated to the Bocas del Toro area of the Caribbean coast as a result of volcanic eruption in AD 600. Research conducted since the Linares-Ranere project, however, indicates a far greater Caribbean coastal population and make an earlier occupation of Bocas del Toro highly probably. This can be seen as part of an overall increase in knowledge regarding first millennium BC occupation of Pacific coasts of Costa Rica (Horn and Kennedy 2001, Northrop and Horn 1996), while evidence for human activity on the central Caribbean coast of Panamá now extends to roughly 6000 BC with evidence for the use of Monagrillo pottery by roughly 3600 BC (Griggs 2005). A Paleoindian presence is evident in the Caribbean and montane forests during the Late Glacial Stage forests in Panamá (Ranere and Cooke 2003). Stone tools that indicate occupation of the Caribbean coast between 10,000 and 7000 BP have been found in Costa Rica (Acuña 1983, 2000) and Panamá (Griggs et al. 2002, Ranere and Cooke 1991). Recent fieldwork led by Tom Wake at Boca del Drago on the island of Colón - roughly 25 km northwest from the Aguacate Peninsula sites discussed by Linares and Ranere (1980a) - is beginning to provide new data that will help clarify the Bocas occupation depth (Wake 2003, 2004, 2006, 2004).

Cooke and Sánchez Herrera (2004b: 23-25) propose that the dating of maize pollen in a Laguna Zoncho lake-sediment core from roughly 3240 BP by Clement and Horn (2001) is consistent with the Linares-Ranere hypothesis that Costa Rica was the source of maize found in western Panamá. Cooke and Sánchez Herrera (2004b: note 117) point out that the early dates that Linares (1980a) found anomalously early at Sitio Pittí-González due to their lack of fit with archaeological evidence (ranging from 2685±110 BP to 2310±80 BP) were in agreement with the findings of Behling (2000) that indicate deforestation for agriculture by 2860 BP.[69] On the eastern flanks of Barú, where seasons are drier, it is possible that colonization by agricultural populations was somewhat earlier (Dickau, Ranere, and Cooke 2007).

The lake-sediment core study by Behling (2000: 391) contained maize pollen in the uppermost sample of his 'zone A' portion of the lake-sediment core, which he dates to 1790±50 ^{14}C yr BP (ibid.: Figure 2). The *Zea maize* percentages in the pollen percentage diagram for Behling's sample, however, barely register in the chart (see Figure 1-20). A very small amount of maize pollen seems indicated at the top of the 'Zone A' sample (roughly 1790 ^{14}C BP). In 'Zone B' of the sample, ostensibly a period of heavy agricultural activity, only two similar increases in pollen register during the entire 1300 year span represented in the 1790—500 ^{14}C yr BP date Behling provides for the 40 cm portion of the core.[70]

[69] The discarded dates, which were accepted in Linares et al. (1975), were: I-5871, 2685±110 (2720-2960 cal BP or 770-1010 cal BC with 99% likelihood at 1δ) and SI-1833/1835, both 2380±60 (2130-2550 cal BP or 600-180 cal BC).

[70] For a discussion of the weaknesses of relying upon maize pollen for palaeoenvironmental reconstruction see Ford (2008). Also, as Lane, Horn, and Mora (2004) discuss, stable carbon isotope ratios (δ^{13}C) can provide a proxy for maize pollen, which is larger and heavier than other pollen grains and hence may only be represented if the crop is cultivated very close to the lake shore (Islebe et al. 1996, Lane, Horn, and Mora 2004, Lane et al. in press).

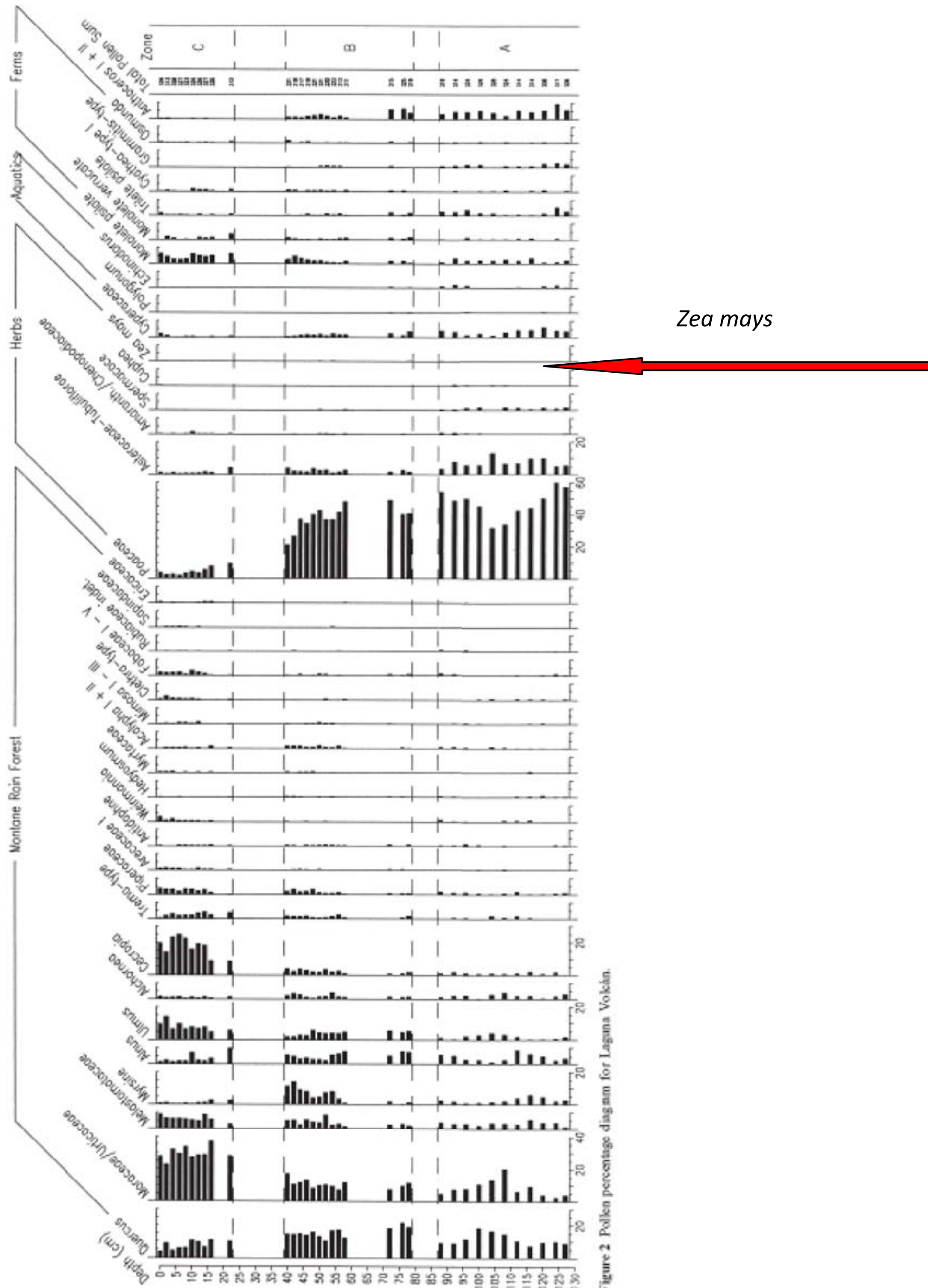


FIGURE 1-20: POLLEN PERCENTAGE DIAGRAM FOR THE BEHLING (2000) LAKE-SEDIMENT CORE

My thanks to Hermann Behling for permission to use the diagram.

Further palaeoecological investigation in the Barú area is required to understand more clearly when maize entered the biotic record. Lacustrine sediments and the pollen, charcoal, and stable isotope evidence they provide can complement and extend the material culture available to archaeologists (Horn in press). This approach has been advocated and practiced in Panamá prominently by Dolores Piperno since the 1980's and has resulted in a large and solid body of published research (e.g., Piperno 1984, 1988, 2006b, Piperno and Pearsall 1998).

In sum, maize-using people moved into montane forests near Barú by the beginning of the first millennium BC. It is very possible that maize entered the area earlier than the Behling (2000) core sample evidenced, particularly given very early dates for maize residue found on stone tools from preceramic sites in premontane forests in Chiriquí (Dickau, Ranere, and Cooke 2007).[71] Macrobotanical remains also indicate that beans, roots (likely sweet potato), and palms were consumed at the Linares-Ranere project sites on the western flanks of Barú (Smith 1980). The stone tool inventory, particularly in the form of large grinding tables at the site of Barriles, suggest that maize cultivation became integrated with ritual activities.

The 'nature' of the Linares-Ranere project

In light of recent volcanological and palaeoecological data, the AD 600 eruption suggested by the Linares-Ranere project interpretations - like the debated 1882 Barú eruption I discussed earlier in this chapter - seems to be apocryphal.[72] This does not weaken the project's notable contributions, though it does require modification of the hypothesized role that the volcano was given as a 'natural' object.

[71] Very early evidence for maize in México is discussed in important recent publications (Piperno et al. 2009, Ranere et al. 2009), though the means, timing, and speed of the spread of maize agriculture is still uncertain.

[72] Wolfgang Haberland's critical assessment of an AD 600 Volcán Barú eruption and his citation of multiple and possibly recent eruptions now appears quite prescient, see Haberland (1984a: 246).

The Linares-Ranere project can be considered an exemplar of the New Archaeology and can be framed as a cultural ecology project (Cooke and Sanchez 2004: 25-6). It is important to note, however, that the Linares-Ranere project cannot be summarily boxed into the category of sterile ecological determinism of processual archaeology approaches. Though the interpretations did in some sense invoke the 'genderless, faceless blobs' Ruth Tringham (1991: 97) critiqued as the hallmark of the processual or New Archaeology studies prominent in the 1960's and 1970's, the Linares-Ranere project researchers clearly stated that individuals and 'new intangible ideas or perceptions that leave only an indirect archaeological trace' were the source of adaptation (Linares 1980b: 233). The researchers also refuted the belief that all human decisions are rational or all social behavior is adaptive (ibid.).

More like a culture history project, the Linares-Ranere project 'mapped its observations of the archaeological record onto a set of assumptions about how human beings operated in the past' (per Binford 1977: 6, Thomas 2004e: 69). The Linares-Ranere project represented in some terms what Binford (1985) distrusted, which was interpretive argument that sought to 'link pieces of observable evidence with events or processes in the past' (Thomas 2004: 72). Rather than subsume human behavior under a processual covering law, the interpretations incorporated a highly contingent event (volcanic eruption). This contingency and chance is somewhat culture history tinged. Additionally, the Linares-Ranere publications held that eruption did not impact all people even within a very small area due to social factors that lay outside of the data. Unlike New Archaeology, which promoted objective research method utilizing cross-correlating numerical information over human observation (Binford 2001: 674), the Linares-Ranere project members tried a computerized ceramic analysis but discarded it in preference of more intuitive sorting by hand (Borgogno and Linares 1980). In sum, the project was unique and was tailored to the very specific context of western Panamá.

Tantalizing social elements were interwoven into the research interpretations. Per my own research interests, the most interesting of these concerns why some groups left the Barú area while others, only 10 km away, did not. Despite the clear statements of the direct link between volcanic eruption and population movements cited as part of the concept of adaptive radiation, the researchers also stated that the carrying capacity of the natural landscape to support human populations was not met and describe catastrophic explanations for migration as generally 'unpalatable' (1977a: 312-13, see also Linares and Ranere 1980c: 245, Linares, Sheets, and Rosenthal 1975: 143). This leaves the door open to as yet unidentified social reasons for population movements, though these were not approached in their research.

Discussion: The conjunction of social and earth sciences

Barú's designation as volcanic or non-volcanic, the definition of its eruption history, its archaeological role, and even its long-term material form itself have undergone radical transformations over time. I have traced some of these changes in physicality, perception and understanding in this chapter in order to compile a comprehensive study of our current view of the volcano.

As I discussed in the beginning of this chapter, the earliest geological work in Central America was conducted by Alexander von Humboldt (1997 [1851]). In his understanding of the natural world and how it intersected with culture, Humboldt was very heavily influenced by Kant (Harvey 2000, Sachs 2006). In doing so, Humboldt accepted a heavily divided Enlightenment conception of nature and culture.[73] My research approach diverges from that of Humboldt in regards to the conceptualization of nature. French sociologist Bruno Latour is one of the most prolific critics of the division of what he casts as an artificial and unhelpful division between nature and culture (Latour 1991, 2004, 2005, 2007a). This thesis is more closely aligned with this

[73] Kant also troublingly used nature to justify racial differences and stereotypes in *Geography* (see Harvey 2000).

vantage of hybridity and messiness between the permeable boundaries of nature and culture and subject and object.

While I do not accept his characterization of nature and culture, Humboldt's conception of synthesis and the broadness possible in academic questions is worth reconsidering in the contemporary era and highly applicable to the research that volcanic contexts require. While the Enlightenment and its embedded conceptions have largely pejorative associations in postmodern literature, the lack of disciplinary narrowness allowed to Enlightenment thinkers like Humboldt is worth reconsideration today (Harvey 1996). In the introduction to this thesis I used the analogy of the vibrating string to indicate the long-term effects (or precursors) of volcanic eruptions. This string highlights the long periods between eruptions, but also the number of academic disciplines invoked in the study of the volcanic past. A larger gathering of disciplinary specialists combined with a permeability of academic divisions of data and theory are required for a fuller understanding of the complexly cultured natures of the volcano.

An impressively multi-disciplinary approach is already firmly established in the isthmian area via integrated analysis of archaeological, ethnographic, genetic, palaeoecological, and linguistic data. I have cited a number of these studies throughout this chapter, and hold that Panamá offers a unique laboratory for archaeological investigation. As I will discuss in the coming two chapters, this uniqueness stems in part from the removal of many forms of material culture from archaeological accessibility and prompts the elucidation of new forms of thinking and new questions. I view my research as parallel to the Linares-Ranere project on which it builds in the sense that, like the prior researchers, I seek to utilize environmental data within the framework of very recent social science theoretical frameworks. This work can be more tightly bound with social theory to permit fresh questions of the data and identification of new sources of data.

In the next chapter, Chapter two, I discuss petrography analysis I completed using tephra samples from two lake-sediment cores and the archaeological site of Barriles. I discuss the results of the analyses in context of tephrochronology studies and explore some of the possible experiential implications of the newly refined eruption history of Barú that I discussed in Chapter one. Many gaps exist in our understanding of Barú's eruption history. As I mentioned early in this chapter, these gaps in understanding were physically represented by sixteenth through nineteenth-century maps that failed to recognize Barú as a volcano. In Chapter two, I discuss parallel gaps in the stratigraphic record of Barú eruptions.

Chapter 2 • CULTURAL NATURE: TEPHRA AS ECOFACT

> We long for place; but place itself longs. Human memory is encoded in air currents and river sediments. Eskers of ash wait to be scooped up, lives reconstituted.
>
> Anne Michaels, *Fugitive Pieces* (1996), p. 53

Erupted volcanic materials, which are subsumed by the general term of *tephra*, represent an ambiguous delineation of *natural* and *cultural* elements when examined in terms of continuous human occupation of the volcanic landscape.[74] Each eruption of Barú for at least the past 2,000 years was witnessed and experienced by numerous people. The tephra is the representative of that experience, yet is not the product of human manipulation. It is instead an *ecofact,* 'a relic of other-than-human engagements with matter, climate, weather, and biology' (Jones 2005: 85). Archaeology as a field is in a unique position to study the interactions between eruption and human experience in the past through its material remains. As such, archaeology is privileged with the ability to examine the lacuna left by geophysical, seismological, and sociological examinations of volcanism.

[74] Tephra is a collective term for unconsolidated pyroclastic deposits. For a guide to the nomenclature and description of volcanic materials, see Schmid (1981). Opening photo shows tephra recovered in the 2004 fieldwork.

In this chapter I discuss the interpretation of tephra in the stratigraphic record of Barú. Anthropologist Michel-Rolph Trouillot (1997) influentially wrote about the 'silences' in historical narrative, referring to the gaps inherent in both the creation and interpretation of historical archives that create the final product of history. Similarly, stratigraphy can be seen as an archive of prehistoric past natural events that is filled with sometimes frustrating silences.[75] In the prior chapter I discussed the importance of integrating archaeological and palaeoecological studies. Palaeoecology, especially when based upon pollen records, however, can also leave 'silences' that are not indicative of past life (Ford 2008). Trouillot (1997) correctly admonishes that a broader and more accurate view of history is obtained by permitting a broader range of voices and perspectives to create it. The investigation of a volcano's eruption history can be paralleled to this, as no one vantage provides the entire amount of data available. In the highlands of western Panamá archaeological excavation, lake cores, geological survey, and radiocarbon dating each provide a slightly different record of past life in the study area. Each is incomplete in regards to the full range of interactions and factors involved.

The precise relationship between key volcanic eruptions and the archaeological and environmental record can be highly problematic even for heavily studied volcanic events such as the Bronze Age eruption of Santorini that covered the site of Thera (e.g., Friedrich et al. 2006, Manning 1999, Manning et al. 2006, Pearson et al. 2005). A clearer understanding of the timing and nature of volcanic eruption is critical, however, when it is interpretively linked to important cultural changes. Dating past volcanic eruptions can be a difficult endeavor. Archaeological, historical, environmental, and climate data sets frequently do not fit comfortably with one another. While tephra can be an excellent geochronological marker in undisturbed contexts representing large-scale volcanic events (e.g., Braitseva et al. 1997: 125), there is a tremendous complexity to tephra distribution and dating. Even within very small areas, volcanic materials from a single eruption can how a high variability (Sheets 1979).

[75] This, however, is *not* to equate artifacts with texts (cf. Hodder 1986).

Tephrochronology

Explosive volcanism can generate buoyant eruption columns of ash that extend as high as 40 km into the stratosphere and then spread laterally and settle upon the ground surface (Kutterolf et al. 2007: 395). Tephrochronology, or the dating of volcanic ash layers to create a chronological framework to which archaeological and palaeoecological records can be correlated, relies upon the identification and characterization of these volcanic sediments. The texture and composition of tephra components provides a promising way of identifying eruptions (Cioni, D'Oriano, and Bertagnini 2008, McHenry, Mollel, and Swisher 2008).

Tephra layers can at times provide strikingly graphic and useful visual stratigraphic markers. The layer cake of sediments on Garua Island in Papua New Guinea where Robin Torrence has led a multi-year archaeology project is an example of this (Torrence 2008). Volcanic materials, however, are not always so visually apparent. The recent discovery of *cryptotephra* has stimulated new applications of tephrochronology and opened new possibilities of data recovery (Lowe and Hunt 2001, Payne, Blackford, and Van der Plicht 2008, Turney et al. 2004).[76] A recent study used tephra-grain counting, morphology, and geochemistry from the north Iceland shelf to define 22 individual tephra horizons in a context where only a single visible layer existed (Kristjánsdóttir et al. 2007). These invisible layers, which are also sometimes called microtephras, can be highly complex. Subtle variations in cryptotephras may represent different eruptions or may perhaps only represent selective redistribution and post-depositional modification (Newton, Dugmore, and Gittings 2007: 737).

Tephrachronologies are well developed in locations such as Iceland and New Zealand where clear stratigraphic horizons and contexts with spatial continuity allow

[76] *Cryptotephra*, also called microtephra, are tephra horizons that are invisible to the naked eye yet can be helpful temporal markers.

rapid identification and mapping[77] Additional factors, including the number of researchers currently addressing tephrochronology also play a factor. Iceland's record was initially developed over decades of research by Sigurdur Thórarinsson who matched historical descriptions of eruptions to stratigraphic layers to date stratigraphy to a particular year, month, week, day, or even time of day (Anthony Newton, written communication, 2007; Thórarinsson 1944, 1958, 1980, 1981a, 1981b).

The distinctive geochemical signatures of Icelandic tephras, which can be identified visually by layer thickness, color and particle size without expensive analysis is also a factor in the Icelandic context (Newton, Dugmore, and Gittings 2007). Tephra from Icelandic volcanoes, such as Hekla, were often highly dispersed and can be successfully identified in central Sweden, the Faroe Islands, and Shetland (Wastegård et al. 2008). Well developed tephrochronology studies in Iceland and western Europe provide an excellent framework for examining archaeological and environmental changes.[78] Tephrochronology studies in New Zealand are also highly developed.[79] Recent work is greatly increasing the known tephra sequences in Africa, Alaska, Asia, eastern Europe/Eurasia, Antarctica, the northwestern United States, and eastern and southern Europe.[80]

Tephrochronology and archaeology in Latin America

In comparison with the well-developed tephrochronologies of Iceland, New Zealand, and elsewhere Latin American tephra have received scant attention. This is

[77] www.tephrabase.org, hosted by the University of Edinburgh, provides a database of tephra layers found in Iceland, north-west and northern Europe, Russia and central México as well as a reference database. The site is funded by the UK's Natural Environment Research Council (NERC) and the Leverhulme Trust. See Newton, Dugmore, and Gittings (2007).

[78] See Appendix A (2) for citations.

[79] See Appendix A (3) for citations.

[80] See Appendices A (4-10) for citations.

disadvantageous, as tephra can provide important marker horizons for the post late-glacial history of the area. Volcanism has been studied extensively in central México, though as Newton et al. (2005: 91) point out this research primarily has focused upon volcanic hazards (e.g., Martin del Pozzo et al. 1995). In comparison to the remainder of Latin America, however, a large percentage of recent Latin American tephrochronology studies are in México.[81] The Andes and Patagonia have also garnered a fair amount of recent tephrochronology studies.[82]

Central America has a paucity of recent tephrochronology studies despite its highly volcanic context. The majority of new Central American tephra studies are of Arenal volcano in Costa Rica (e.g., Alvarado et al. 2006, Bolge et al. 2006, Cole et al. 2005, Soto and Alvarado 2006) or other volcanoes and offshore deposits (e.g.; Clift et al. 2005, Shaw et al. 2006). Tephrochronology studies of Ilopongo volcano in El Salvador, which draw from the archaeological work of Payson Sheets, provide an important example of recent Central American tephrochronology (Dull, Southon, and Sheets 2001, Mehringer et al. 2005).

Cultural material from natural objects

A number of studies examine sediments as ecofacts that elucidate the human past in the isthmus; I touched upon a number of these in the prior chapter. These studies include Costa Rican lake sediments from Laguna Zoncho (Clement and Horn 2001, Lane, Horn, and Mora 2004), Laguna Santa Elena and the Las Cruces Biological Station of La Amistad International Park and Biosphere Reserve (Anchukaitis and Horn 2005, Horn and Kennedy 2001, Kennedy and Horn 1997), Laguna Bonilla and Laguna Bonallita on the lower eastern slope the Volcán Turrialba (Lane et al. in press , Northrop

[81] See Appendix A (11) for citations. México is the only Latin American country with data in the Tephrabase (www.tephrabase.org) database.

[82] See Appendix A (12) for citations.

and Horn 1996) and La Selva Biological Station (Horn and Kennedy 2001, Horn and Sanford Jr. 1992).

Several studies of lake and swamp sediments and of data relative to climate change and vegetation history have been undertaken in Panamá. These include Laguna Volcán west of Barú (Behling 2000), the Laguna of La Yeguada in central Pacific Panamá (Bush et al. 1992, Piperno, Bush, and Colinvaux 1990, 1991a, b), the El Valle volcano crater in Panamá (Bush and Colinvaux 1990), the Gatun basin of the canal zone [which is more specifically really river sediment now submerged under an artificial lake] (Bartlett and Barghoom 1973, Bartlett, Barghoorn, and Berger 1969), Monte Oscuro on the Pacific coastal plain (Piperno and Jones 2003), the Changuinola swamp (Phillips, Rouse, and Bustin), and the Cana Swamp and Lake Wodehouse in the far eastern Darien (Bush and Colinvaux 1994, Piperno 1994). These studies and a number of discussions of palaeoecological data point out that often ecofacts give more information than artifacts regarding the temporal depth of human life in the isthmus (see Arford and Horn 2004, Cooke 1992, Cooke, Norr, and Piperno 1996, Dickau, Ranere, and Cooke 2007, Horn 2007, in press, López and Cano 2008, Piperno and Pearsall 1998, Piperno et al. 2000, Ranere and Cooke 2003, Smalley and Blake 2003).

Petrographic analysis

In designing and completing the fieldwork and analysis for this portion of my project I made several primary assumptions:

(1) The geochemical differences between Central American Quaternary volcanoes vary widely (de Boer et al. 1988: 279, Johnston and Thorkelson 1997: 469, though see Newton, Dugmore, and Gittings 2007: 738). Building upon this, my first assumption was that separate eruptions of particular

volcanoes, such as Barú, would also be distinctive and could provide a chronostratigraphic marker.

(2) My second assumption, which was confirmed by satellite imagery and field examination, was that the east and west sides of Barú were differentially impacted by eruption.[83] While the pyroclastic flows, lahars, and other eruptive events deposited heavier materials primarily on the west side of the crater due to the breach in the crater wall, light-weight and pumice-rich lapilli and ash are found on both sides of the crater. For this reason I focused upon *juvenile material,* or fresh volcanic material. The presence of this juvenile material on both sides of the Barú crater, I hoped, could help link the archaeological sites in my own fieldwork to those of the Linares-Ranere project and the known eruption history of Barú.

(3) My third assumption was that all tephra in the Barú vicinity came from eruptions of Barú rather than from some other volcano. In this I join a number of other researchers (Anchukaitis and Horn 2005, Behling 2000, Cooke et al. 2003b: 25, Linares and Ranere 1980a). It is, of course, possible that large-scale eruptions such as the 1835 eruption of Cosigüina in Nicaragua, which deposited ash throughout most of Central America, could complicate the tephra record.

As Sherrod et al. (2007: 5 and Figure 4) note, repeated blankets of tephra spread more than 100 km downwind from Barú, though most deposits are found with a 10-20 cm thickness at a distance of 10-15 km downwind.[84] Due to the nature of an eruption

[83] As M. Wagner is quoted as saying, the two sides of Barú are 'entirely distinct'. see p 10 of (Sapper 1925) The exact quote is: *Visto desde el lado SE, el 'Boquete', donde no se distinguen los conos menores, presenta el volcán de Chiriquí un aspecto enteramente distinto.*

[84] As noted in Chapter one of this thesis, tephra from the eruption is also found in cores from Laguna Zoncho, roughly 45 km west of Barú (Clement and Horn 2001) and Laguna Santa Elena, roughly 45

plume, which widens and spreads, minor eruptions will generally fall in the proximal range of 3 to 8 km, and will not be included in samples from the medial range. All of the samples in my study come from the medial distance range that Wallace (2003: 108) suggests is preferable when examining significant coarse tephra falls from stratovolcano eruptions. According to Wallace (ibid.), the 10-50 km distance is significant as it will only contain material from major eruptions. Additionally, tephra beds from this distance can frequently be identified and correlated by their lithology, stratigraphic position, and mineralogy without resorting to geochemical 'fingerprinting' to differentiate tephras (Shane 2000).

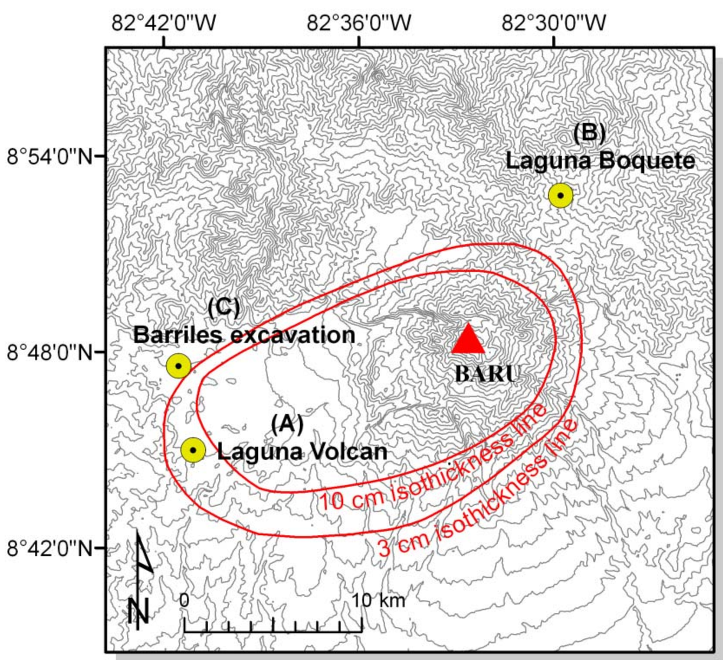


FIGURE 2-1: THE SOURCE LOCATIONS OF THE THREE TEPHRA SAMPLE LOCATIONS FOR MY PETROGRAPHIC ANALYSES

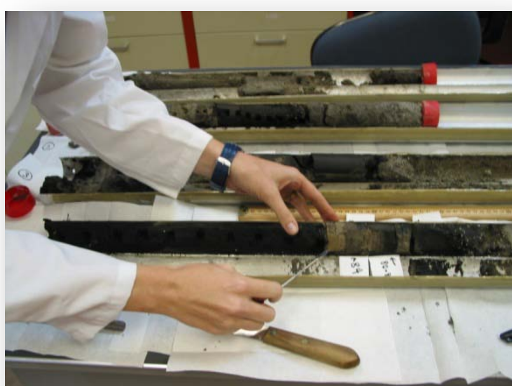
The isothickness lines are the USGS estimation of major tephra falls from the most recent eruption of Barú (Sherrod et al. 2007: Figure 4).

---

northwest of Barú (Anchukaitis and Horn 2005) and can be found as far as 100 km downwind (Sherrod et al. 2007).

SAMPLE A: Laguna Volcán (Behling 2000)

With the assistance of Enrique Moreno at the Smithsonian Tropical Research Institute (STRI) in Panamá City, I collected tephra samples from the Laguna Volcán lake-sediment core that was collected by Hermann Behling while he was a STRI post-doctoral student and is currently held in cold storage (4°C) at the STRI facilities.[85] Laguna Volcán is roughly 16 km southwest of the Barú crater. The core was taken in April 1995 with a modified Livingston piston sampler from a central part of the lake and the AMS dates Behling (2000) cited were run in 1996 by Beta Analytic. The core is 128 cm long and 5 cm wide and its dated record begins at 2860 ^{14}C yr BP. While Behling (2000) believed the lake to be a volcanic crater, Sherrod et al. (2007) instead interpret it as a pond formed within a closed depression on the surface of the avalanche deposit created when the crater wall collapsed. For continuity I used the depth measurements listed in Behling (2000: Table 1), though the cleanliness of the depths and descriptions did not concur precisely with the reality of the actual cores. This could indicate that some core sample material was lost or that the core has shrunk.



[85] My thanks to Hermann Behling, then at the Center of Tropical Marine Ecology in Bremen, Germany and now at Georg-August University in Göttingen, Germany for the permission to do so.

SAMPLE B: Laguna 'Boquete'

Enrique Moreno also helped me to open and sample an unpublished lake-sediment core from lake roughly 10 km northeast of Barú. The core was taken on March, 30 1996 by a STRI team under the direction of Paul Colinvaux and three AMS samples obtained from this core by Colinvaux were dated in 1996 by Beta Analytic.[86] AMS samples were taken from the 17 cm mark of the first core (IM1), 140 cm mark of the second core (IM2), and 250 cm mark of the third core (IM3), which is the lowest core hence this depth marks roughly the bottom of the core record. Like the Behling (2000) lake-sediment core it was also held in cold storage (4°C) at STRI. If the lake is named, neither the STRI researchers who took the core nor I know what it is and following their lab name have simply called it Laguna Boquete. The lake is roughly a seven hour hike from Alto Quiel and is at the boundary of the Chiriquí and Bocas del Toro provinces. I hiked to this lake in 2000 for photos and GPS points.

SAMPLE C: The Barriles site

Sample set C is from the exposed stratigraphy of the Barriles archaeological site, which is roughly 16 km west of the Barú crater. The Barriles site has been heavily looted and minimally excavated (Beilke-Voigt, Joly, and Kunne 2004, Ichon 1968b, Künne and Beilke-Voigt nd, Rosenthal 1980, Stirling 1950), but is interpreted as the most important known regional center in prehistoric highland Chiriquí due to the presence of large statues depicting human figures and elaborate shaft-like tombs. Recently completed fieldwork by Scott Palumbo from University of Pittsburgh in the area surrounding the Künne excavation trench where I obtained my tephra sample offers to provide new data from Barriles. For a map of the Palumbo (2008: 57) shovel test pits in relation to my tephra samples please see Appendix C .

[86] The samples from Beta Analytic are β-95701, β-95702, β-95703 and the data are held by Paul Colinvaux.

Tephra from the Barriles site in Adaptive Radiations

As I pointed out in Chapter two, the *Adaptive Radiations* volume edited by Linares and Ranere (1980a) provides very little data regarding tephra. Dahlin (1980: 276-7) describes the overall Volcán region of the Barriles site by stating that,

> Throughout the survey area the culture-bearing strata are capped by a more or less thick layer of pumice with a contemporary humic layer on top…. Using the sondage technique enabled us to tentatively assess the variable effects of the pumice fall. In recording the amount, size, and angularity of the pumice particles and the nature of their deposition at any and all locations within the survey area, we were able to identify the source of the pumice as Volcán Barú and conclude that it affected the entire survey area.

Dahlin (ibid.), however, does not provide details regarding how they sourced the tephra to Barú or the morphological descriptions of the tephra and these data are not included in any of the other Linares-Ranere project publications. Linares et al. (1975) do describe the uppermost tephra layer as 'part pumice, part soil; medium yellow pumice', which (Sherrod et al. 2007: 29) interpret as 'slightly weathered pumice lapilli admixed with soil….' (Rosenthal 1980: 290-1) provides stratigraphic descriptions and profile drawings for Barriles (BU-24) that place a *talpetate*, or 'yellow brown, hard-packed volcanic ash' roughly 90 cm below the surface. In Cut 1 this volcanic layer had 'pockets of black clay and yellow weathered pumice pieces'. Rather than attribute these to volcanic eruption, these volcanic materials were interpreted as fluvial deposits by the publications, though no explanation is offered for this interpretation. In Cut 2 the material described by Rosenthal as *talpetate* is topped with a 'yellow weathered pumice and heavy deposit of sherds', marking an admixture of volcanic and human materials. Above this layer 'an intervening stratum of black sediment which is mottled with white' is noted, though whether this represents a white pumice or some other material is impossible to determine as no further description is provided. In sum, the distribution and discussion of tephra from the Barú area provides more questions than answers.

Description of the samples

I chose ten discrete tephra samples, four from each of the lake-sediment cores and two from the archaeological site of Barriles, and exposed them to a series of ten minute sonic baths in de-ionized water until the dirt loosened. I then dried samples under a heat lamp and washed them with acetone to separate the particles. I used a Nikon SMZ-2T binocular microscope at 1.5x magnification with a fiber optic light to record the compositions and characteristics of each sample and at 6x magnification to define the vesicularity of clasts. The USGS allowed me to use their lab in Flagstaff to take photos of the samples using an Olympus DP11 microscope camera attachment and fiber optic light.

I originally planned to use an ICP-MS (inductively coupled plasma mass spectrometer) to obtain geochemical data from the samples. In consultation with Michael Ort at Northern Arizona University, where I completed the lab work, I instead chose visual microscopic examination as the samples seemed sufficiently different from visual inspection and I was trying to develop a method that could be completed in the field repeatedly and inexpensively by other researchers. A small tephrochronological geochemical study of ten samples can cost roughly $9,000 US and a larger study of 100 samples as much as $90,000 US (USGS 2008). One goal of my project was to try and develop techniques and results that were reproducible by future researchers in the area on the low budgets typical of archaeological projects.

The samples varied most significantly in percentages and colors of juvenile clasts, hornblende (a black, crystalline formation with a 60-120 cleavage which is common in intermediate magmas), biotite (black crystal sheets), and feldspar (white crystalline formations, likely either sanidine or plagioclase). I provide a brief description of each sample in the text below; for more data please see Appendix D.

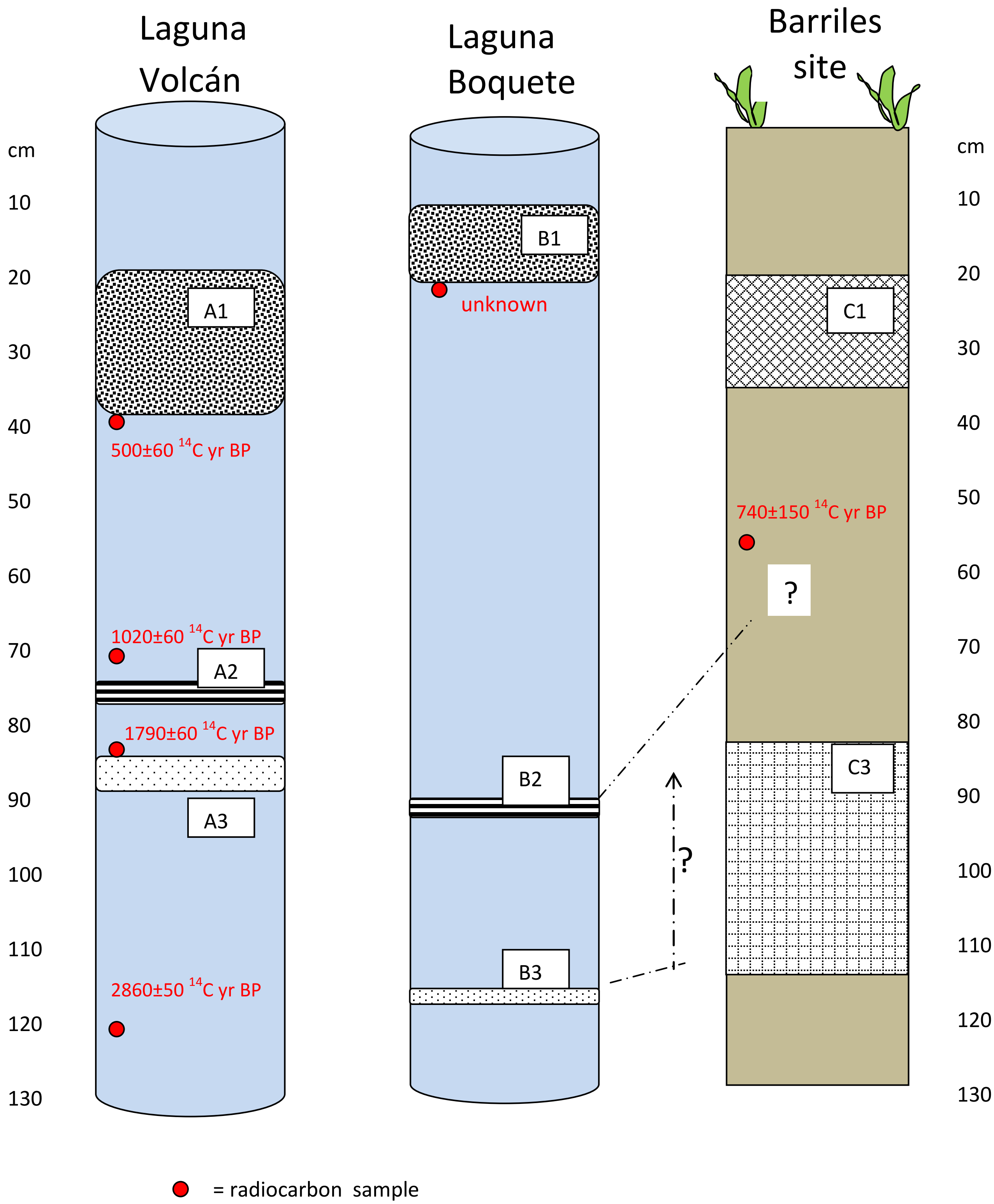
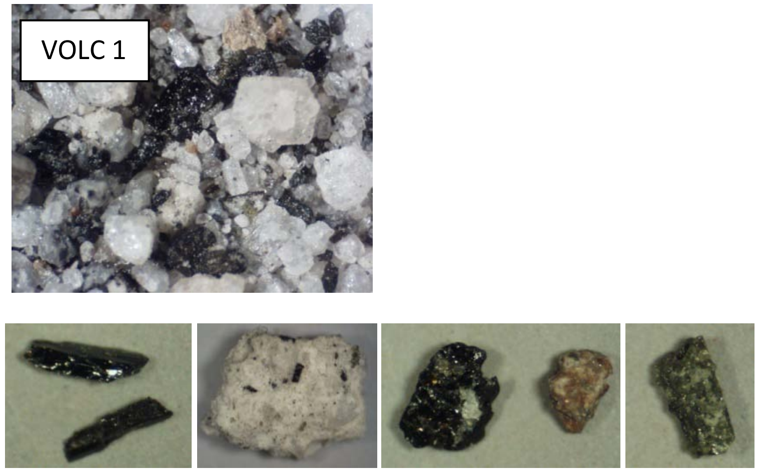
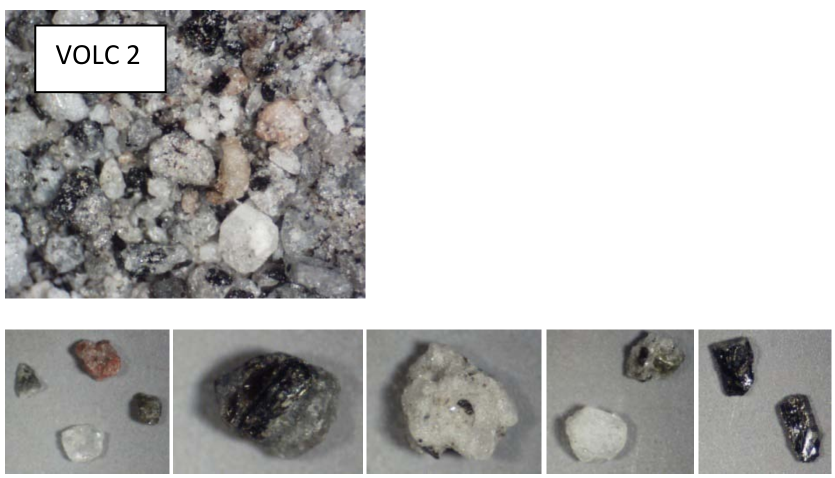


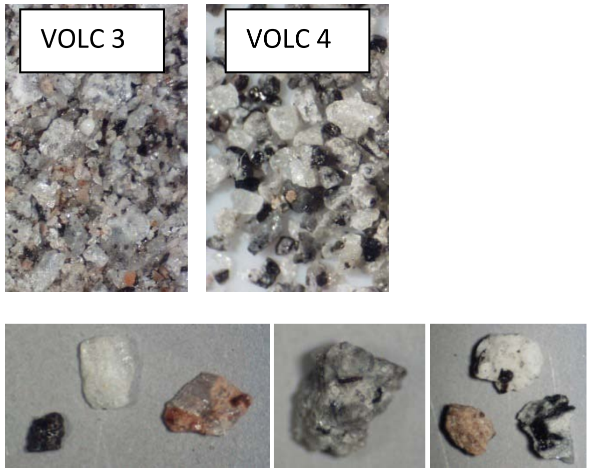
FIGURE 2-2: SCHEMATIC DRAWING OF THE TEPHRA STRATIGRAPHY FROM THE TWO LAKE-SEDIMENT CORES AND THE ARCHAEOLOGICAL STRATIGRAPHY



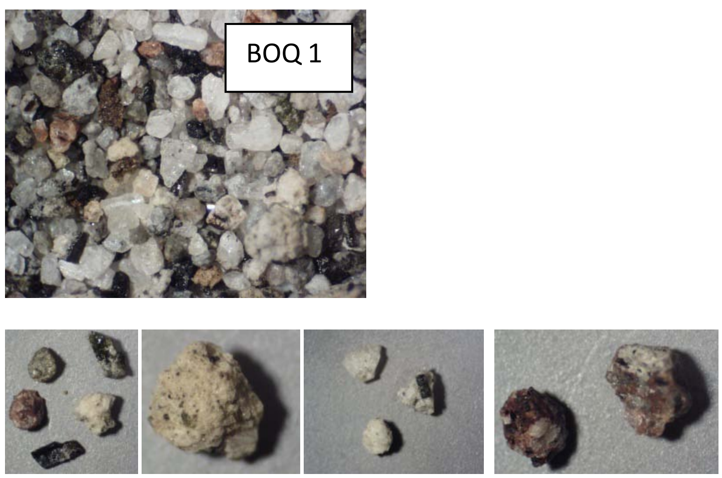
(A1) VOLC 1 (Laguna Volcán) Coarse and light gray to the naked eye, but the juvenile matrix became pure white and glassy when washed and viewed under microscope. Predominantly feldspar (0.5-1.5 mm) and loose black hornblende chunks (0.5-2 mm) with some very white juvenile clasts (1.5-6 mm), some gray juveniles and hornblende inclusions. Deposit is very 'clean' and shows a mafic crystal size. Lots of amphibole and green crystal (olivine or pyroxene?) are present in the juvenile material. Some unusual rose crystal and biotite particles are present. Sample is finer grained than BOQ2. Clasts at 6x magnification show some irregular pitting and tunnels.



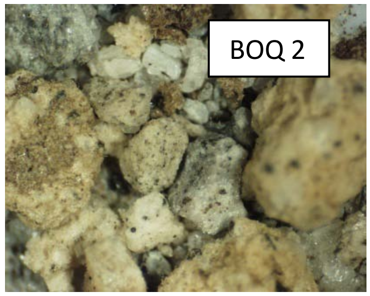
(A2) VOLC 2 (Laguna Volcán) Light yellow-white and gray juvenile clasts (1-4 mm) with small hornblende inclusions (0.25 mm). Some loose hornblende chunks (~1 mm). Higher percentage of ash than VOLC1 and only a minimal percentage of the feldspar in VOLC1. Feldspar is also significantly smaller (~0.5 mm) and overall particle sizes are smaller. High percentage of amber and green (olivine or pyroxene?) colored crystal in fine-grained fraction. Very crystalline due to high % of hornblende. Clasts at 6x magnification appear glassy with lots of very small vesicles but no tunnels.



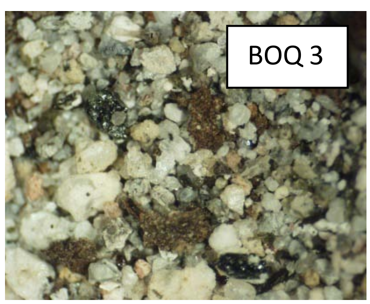
(A3): VOLC 3/VOLC 4 (Laguna Volcán) Pure white juvenile matrix with some gray and amber juveniles. Conglomerations of small feldspar chunks with hornblende are common and high % of feldspar and hornblende overall. Very different in color and feldspar/hornblende % from VOLC2. Crystals include amber color and very few green (olivine or pyroxene?). primary difference between VOLC3 and VOLC4 is in the vesicularity, though both have distinctly visible vesicles even at 1x magnification. Clasts at 6x magnification show very round holes, some of which are deep, very round, and tunnel-like in VOLC3; in VOLC4 clasts show some deep pitting but are irregularly shaped. Both samples are from the same stratigraphic layer, but VOLC3 is from a portion of the tephra with a higher amount of sandy ash.



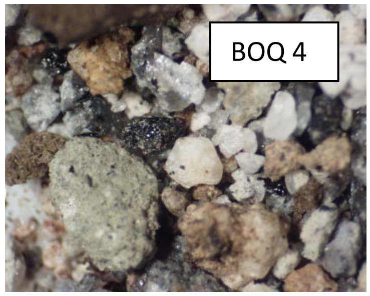
(B1-a) BOQ 1 (Laguna Boquete) Light yellow-white matrix with pure white, and gray juvenile clasts (~2 mm) and hornblende inclusions. Some sandy, ashy material at roughly the 12 cm depth. lots of loose white feldspar (~1 mm) and similarly sized pieces of hornblende. Green (olivine or pyroxene?) and amber crystals. Amber-colored crystal could be a stained plagioclase? Some biotite. Clasts at 6x magnification show moderately shallow round and irregular holes with some tunnels.



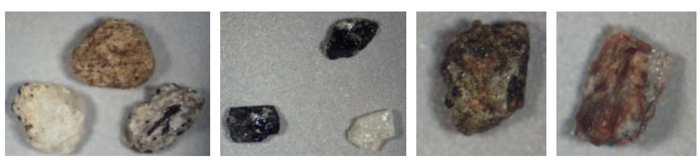
(B1-b) BOQ 2 (Laguna Boquete) Is from the 14 cm depth of the same layer as BOQ 1. Glassy white matrix with yellow-white, pure white, and orange-brown juvenile fragments (2-5 mm) welded with white feldspar chunks (~0.75 mm) and hornblende (~0.5 mm). Like BOQ1, hornblende is in big, crude chunks but also see angular shards like those found in pre-Columbian ceramic temper in the Boquete area. Once washed can see vesicular juvenile fragments. Dacite composition indicated by light color, contains sanidine (potassium feldspar). Contains biotite (sheet-like black crystal). could be primary fall-out - not overly rounded/re-worked looking. Lots of microlites in fine-grained portion. Does have pumice (floated to top in sonication). contains amber colored (1mm), green (1mm). Biotite inclusions. Clasts at 6x magnification show shallow, irregular holes.



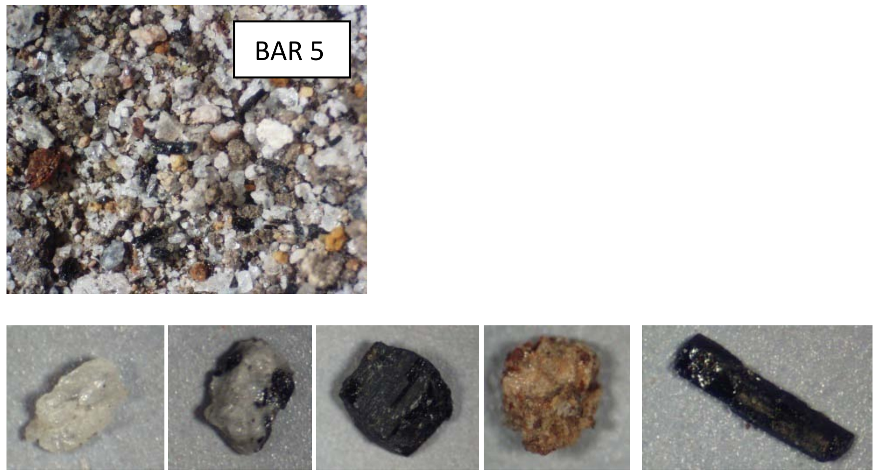
(B2) BOQ 3 (Laguna Boquete) Pure white and light orange-gray juvenile matrix with small, fine ash and yellow pumice. loose white feldspar (~1 mm) and hornblende (~0.5 mm). Angular sherds of hornblende (~1 mm). Glassy, darker juveniles are more vesicular and angular than white juveniles. Contains a seed, carbon sample, green crystal (olivine or pyroxene?). Clasts at 6x magnification show shallow, rounded holes and deeper tunnels. Stretched vesicles indicate that they started forming holes while still in magma chamber?



(B3) BOQ 4 (Laguna Boquete) Mixture of ash and orange, white, and gray juveniles. Glassy with some biotite inclusions. Appeared the same as BOQ 3, but with smaller chunks, to the naked eye. Under microscope, however, appears very distinct from BOQ 3. Lots of white feldspar (~1 mm) and hornblende chunks (0.25-1 mm), juvenile fragments (~2 mm) are very white. Amber colored and green (olivine or pyroxene?) crystal and rose colored mineral. Very close in appearance to VOLC 1. Clasts at 6x magnification show shallow round holes, no tunnels.



(C1) BAR 2 (Barriles excavation) White, orange, and gray juvenile clasts with hornblende inclusions. Some light yellow-white juveniles (1-4 mm) and hornblende (~1 mm).Lots of clear, white feldspar (~0.5-1 mm). glassy. Some rose colored and green (olivine or pyroxene?) crystal. Some biotite. Some additional black bits may be intermediate to mafic composition. Has much salicic material that could be blown in by wind. Clasts at 6x magnification show irregular holes and pitting with no tunnels; fragments are rounded with few vesicules hence appears to either be re-worked by a stream or wind or to be perhaps from a phreatomagmatic eruption. Contains much salicic material that could be blown in by wind.



(C3) BAR 5 (Barriles excavation) Grayish-white and bright orange juvenile matrix. Juvenile fragments are lighter in color than BAR 2. Glassy, lots of small hornblende inclusions. Sample is very ‘dirty’ and took 4x as long as the others to remove soil in the sonic bath. Smaller overall particle size than BAR 2 (0.25-0.75 mm), though there is one 5 mm particle. Some amber colored and green (olivine or pyroxene?) crystal. Clasts at 6x magnification show deep, irregular pits and tunnels.

Results and discussion

I assigned the numbers one to three to the tephra layers due to the presence of three obvious layers in the published lake-sediment cores by Behling (2000) and Anchukaitis and Horn (2005). The recent USGS report by Sherrod et al. (2007) interprets a fourth eruption, though it was not easily evident via radiocarbon samples or visual inspection and is based on a paleosol that the palaeoecological and archaeological studies did not detect. My intention is to provide a guide that is helpful for archaeologists in the field and I have also already published a brief discussion of the tephra layers in Holmberg (2007a) with letters and numbers assigned in my discussion of Barú tephras so for uniformity I will continue with the discussion of three tephra layers. The possibility of a fourth eruption is interesting, however, and I look forward to further elucidation of it. It is important to note that the USGS determination of the fourth, undated eruption (sometime between the end of their episode 3 and before the beginning of their episode 1, which is the most recent eruption) was made from a stratigraphic section 4.6 km west of the Barú summit. This proximal - or very close -

location is on the western, breached side of the caldera and is comprised solely by pyroclastic surge and surge fallout and has no associated tephra fall. No tephra record from this eruption should therefore be expected on either the east or west sides of Barú.

Using feldspar to hornblende ratios present in juvenile clasts in the samples, the uppermost tephra layer (C1) at the Barriles site and the uppermost tephra layer in the Laguna Volcán coring (A1) appear quite similar (see Figure 2-3 and Appendix D). Although the uppermost tephra layer in the Boquete lake core (B1) does not appear strongly correlated to the A1 and C1 samples through the crystal ratios of the clasts, the Boquete (B1) sample does correlate with the higher vesicularity percentages in the Volcán (A1) and Barriles (C1) samples, which differentiate them from tephra layers lower in the stratigraphic record. This is likely a result of weathering and re-working over time. The second tephra layer in each lake-sediment core (A2 and B2) was dissimilar to the tephra taken from the Barriles archaeological site, and samples from this layer appear to indicate an eruption is not present or clear in the Barriles stratigraphy.

	Depth of tephra deposits (cm)	*Feldspar to hornblende ratio in juvenile clasts*	*Vesicularity of juvenile clasts*
Volcán lake core			
A1	21	2.14	25%
A2	1.5	1.6	15%
A3	4	0.7	15%
Boquete lake core			
B1	10	0.20	20%
B2	1	0.40	15%
B3	1	0.29	10%
Barriles site			
C1	15	2.00	20%
C2	absent	--	--
C3	30*	0.20	10%

*tephra is not found in a concise layer, but is mixed heavily interspersed with soil

FIGURE 2-3: TEPHRA SAMPLE CHARACTERISTICS (FOR FULL DATA SEE APENDIX O) [87]

The presence of only two tephra layers in the Barriles archaeological stratigraphy and three in the lake cores indicates an interesting dilemma for archaeologists accustomed to viewing volcanic strata as secure chronometric markers. Lacustrine environments protect the tephra falls from the wind and heavy rainfall that erode tephra evidence in archaeological contexts, particularly in this region of steep topography. Rather than a concise layer of angular tephra, as found in the lake core samples, the tephra at archaeological sites can be moderately to heavily re-worked from erosion and cultural activities. Both chemical and morphological composition can change when tephra is reworked (Kutterolf et al. 2007: 408). This could explain the lack of resemblance in the lower Barriles tephra layer (C3) to either of the lower layers of the lake-sediment cores. Alternately, the lowest layer of volcanic material in the Barriles stratigraphy could represent tephra that is a secondary deposit rather than the result of a primary air-fall deposit. This is in line with the interpretations of the Linares-Ranere project researchers, who interpreted the lower tephra layer as a fluvial deposit (e.g., Rosenthal 1980).

[87] In future research, trace elements will provide a useful means of correlating tephra as the distance from origin andreworking by rain and wind proved problematic.

Another possibility is that the absent C2 tephra at the Barriles site is simply merged into the very 'dirty' lens in which the C3 layer is found. As juvenile clasts of coarse tephra were heavily interspersed within a 30-cm layer, it is possible that the moderately small (as inferred by the depths of the A2 and C2 deposits) amount of tephra distributed by the eruption leached and sifted down and became incorporated within that of the C3 tephra. It appears, in any case, that an entire layer of eruptive material is simply 'missing' in the archaeological context

The samples from the Boquete lake core (sample set B) are more problematic, in terms of correlation, as they seem compositionally different from the uppermost tephra layer from the Laguna Volcán (sample set A) and at the Barriles site (sample set C). As I noted earlier in this chapter, it is entirely possible that tephra from a single eruption can vary in composition. If the composition of Boquete area tephra varies widely, it weakens or at least complicates the validity of my underlying assumption that tephra could provide a useful marker for the overall Barú area.

I intend to pursue further analysis of my tephra samples. A firmer stratigraphic correlation would require considerations of the modal composition of the crystal fraction, the stratigraphic order of ash layers, crystal-glass ratios, and the chemical composition of glass shards (Kutterolf et al. 2007: 408). In this project I have only examined the composition of the tephra in conjunction with their stratigraphic locations and have not performed geochemical analyses. At the inception of this research I hoped that this alone could provide statistically significant differences between the tephra samples that could possibly allow them to be helpful archaeological markers without expensive lab testing. In the absence of statistically robust differences however, the tephra samples should be further examined with either thin section petrography, which allows microscopic identification of tephra mineralogy and texture using an electron microprobe, or an ICP-MS (inductively coupled plasma mass spectrometer) to differentiate samples and determine isotope ratios of glass shards. In particular, I will pay more attention to the glassy fraction, as in some contexts glass or phenocrysts provide more information.

'Silences' and the event of eruption

My project represents a preliminary examination of Barú tephra. The small number of samples I utilized in this project clearly makes my results suggestive rather than conclusive. One primary conclusion of this portion of my project is that archaeological stratigraphy can be deficient when compared to the tephra record in lake-sediment cores or offshore marine stratigraphy (Kutterolf et al. 2007). Tephra layers can be best preserved in marine or lacustrine environments (Horn 2007: 439, Kutterolf et al. 2007, Newton et al. 2005, Schiff et al. 2008, Zolitschka et al. 2006) and archaeological stratigraphy may not necessarily show the complete record of volcanic eruptions. Lake-sediment cores, in turn, do not provide a full record of eruptive events shown in the eruption record.

In the Barú context, the interpretation of eruptive events has changed significantly in less than a decade. The *Adaptive Radiations* volume – which provided the most direct archaeological discussion of Barú's intersection in pre-Columbian life until this thesis - discussed only one eruption during human occupation of the Barú area. My archaeological excavations in the Barú area, which I will discuss in the next chapter, generally contained tephra evidence for two eruptions. Palaeoecological studies of lake-sediment cores show evidence interpreted to represent three Barú eruptions (Anchukaitis and Horn 2005, Behling 2000). The USGS survey, using a paleosol to detect an event not visible in the palaeoecological cores or radiocarbon record, interpret four eruptions (Sherrod et al. 2007). While tephra in archaeological contexts may have an ambiguous placement between nature and culture or ecofact and artifact (in the case of crude tephra sculptures I will discuss in chapter three), the identification and physical placement of tephra is also problematic.

Archaeologists excavate objects that are considered residues of past events. In the case of the tephra in my samples, however, the past events are obscured or hidden as the material is eroded, missing, or inscrutable. The tephra layers that do exist can be completely reversed: the USGS researchers found that 'stratigraphic inversion' occurred in Barú summit road cut samples where 'the relative stratigraphic position of ages and samples is inverted' (David Sherrod, personal communication 2008). While the Revolt of Objects myth discussed in the introduction to the thesis is intended to provide a means of considering past perceptions of volcanic eruption, the concept of objects in revolt and reversal of order is pertinent in the contemporary analysis of the past material as well.

This chapter detailed the analyses I completed on ten discrete samples from two lake-sediment cores held in cold storage at STRI and from the stratigraphy of an excavation pit at the archaeological site of Barriles. My first assumption was that geochemical signatures between eruptions would vary enough to delineate different eruption events. This is possibly an inaccurate assumption, or at least is not fully accessible from visual microscopic examination. While differences existed in sample vesicularity by depth of the layers, this could simply be a matter of erosion and weathering. My second assumption was that the east and west sides of Barú received very different physical impacts from eruption. This does seem accurate, though gauging impact only by material evidence can be misleading as indirect physical impacts like water table changes could certainly have occurred; I will discuss this possibility further in the next chapter. My third assumption, that all of the tephra samples are from Barú, seems accurate though cannot be fully assessed with certainty until further tephrochronology work is completed in the area. Further analysis on the tephra samples should include analysis of trace elements and closer attention to glass shards in the tephra.

At the beginning of this chapter I noted the silences discussed by Trouillot was one way of thinking of the tephra record of Barú. This is not a perfect analogy as Trouillot describes archives; this invokes history, which is the agent of another human's agency. In the case of tephra, the volcano (or 'nature') is the agent and the tephra is not text or history. It is most certainly silent however, as multiple volcanic events are not represented by the material and tephra layers are merged with others, eroded, or simply missing.

Instead of providing reliable stratochronological controls (*cf.* Stewart 1978: 17), the Barú tephra layers – at least the ones included in my sample - instead are a source of questions. Some eruptive events suffer from archaeological invisibility in the stratigraphic record or are stratigraphically re-worked and diffused. As mentioned at the beginning of this chapter, *cryptotephra* is a word that is used to define tephra that is not visible to the naked eye. In an inadvertently poetic phrase in a discussion of tephra geochemistry, Kristjándóttir et al. (2007: 156) state that the term *cryptotephra* is meant to convey 'the concealed nature of the tephra'. To turn this phrase slightly, there is also a 'concealed culture of tephra' when it is examined as an ecofact that provides one of the few records of human experience with volcanic eruptions in the Barú area.

While no written record exists of Barú's past eruptions, archaeological investigation of the timing and settlement patterning of human life around the volcano in conjunction with palaeoecological and geological assessments of the eruption history of the volcano can potentially provide a more integrated interpretation of how eruptions impacted people's lives and why some eruptions led to abandonments while others did not. The best way to interpret the tephra, however, is yet to be determined.

Chapter 3 • MATERIAL, CULTURE, AND THE VOLCANO: CIRCULATING THINGS

> Orchestrated moments of destruction, cycles of appearance and vanishing, and other material losses recur across time and societies and scales of human action in ways that are pervasive, deeply social, and not anti-materialistic .
>
> Rudi Colloredo-Mansfeld, 'Matter unbound' (2003), p. 245

The circulation of objects between people and places is examined in the social sciences as a series of physical movements and transfers, though circulation also shapes social practices and individual consciousness (Gaonkar and Povinelli 2003: 388). In this chapter I discuss the portable material culture from my survey. I analyzed the traditional archaeological materials of ceramics and stone tools, but also examine more ambiguously 'artifactual' objects such as the distinctive volcanic stones carried over long distances to construct graves and crude figurines and miniature items made out of tephra.

In Chapter one I pointed out that Linares and Ranere (1980a) used data from the western slopes of Barú to formulate the hypothesis that a catastrophic volcanic eruption in AD 600 prompted settlement changes in those areas that were most heavily impacted by this event. My interpretation of remote sensing data regarding the extent of the tephra coverage to the east of the volcanic crater (see Figure 1-5) suggested that these slopes received less physical impact from Barú's eruptions. I reasoned, therefore, that if this observation was corroborated in the field and substantiated by archaeological survey data, a reevaluation of the extent and scope of the volcano's impact would become necessary. Indirect physical impacts of eruptions may have prompted settlement changes linked by the Linares-Ranere project interpretations to an eruption in roughly AD 600 or social factors completely unrelated to the volcano may be involved, but the role of Barú as a catastrophic prime mover for settlement changes requires reassessment.

In this chapter, I argue that volcanic eruptions were a deeply embedded social element of past life in the Barú region. While the most recent eruption (estimated to have occurred at some point in the fourteenth through sixteenth centuries AD by the research included in this thesis) seems to have had a strong impact on the surrounding landscape, the eruptions which preceded it seemed to have had little physical impact on pre-Columbian occupation. Eruption was, however, a relatively frequent event with a strong experiential impact. I suggest that one result of this could have been the utilization of volcanic materials for important objects in a purposeful appropriation of the telluric power of the volcanic landscape.

Since the middle of the nineteenth century, pre-Columbian burial grounds (mortuary precincts) in Chiriquí have been heavily looted. Orderly excavations of mortuary precincts, which led to the description of grave features and artifacts, have been limited to very few areas.[88] Many thousands of pre-Columbian graves have been looted in Chiriquí, though intact mortuary contexts can be found (Haberland 1957, 1961a). It is a sad commentary that my fieldwork provides the first AMS-dated

[88] These mortuary precincts were excavated by researchers such as Roberto de la Guardia and Wolfgang Haberland and tended to be located in the Costa Rica-Panamá frontier zone.

mortuary context for the highlands of Chiriquí, Panamá. The grave site I excavated could be considered the antithesis of a 'pristine' context as it was from an area that has been heavily looted and was in the midst of a construction site. Work of heavily looted contexts is ongoing in Panamá at sites such as Cerro Juan Diaz (e.g., Cooke 1997a, Cooke and Sanchez 1998, Cooke, Sánchez, and Udagawa 2000) and in Costa Rican portions of Greater Chiriquí (e.g., Frost 2009, Quilter 2004), and my field survey and this prior work highlight the fact that valuable and new information do exist even in very non-ideal archaeological contexts.

Material loss and collection

> Of the enormous archaeological material only a quite insignificant proportion has been won by systematic excavations, because here, if ever, one may speak of archaeological rapacious exploitation. Downright pillage was the rule.
>
> Sigvald Linné (1936), 'Archaeological fieldwork in Chiriquí', p. 96

The impact of looting is a prevalent consideration in Latin American archaeology (e.g., Bruhns 2000, Coggins 1972, 1995, Cooke 1997a, Donnan 1991, Lothrop 1934, Matsuda 1994, Quilter 2000, Sheets 1973, Snarskis 1981b). The first documented looting of Panamanian graves began in 1519, when the conquistador Gaspar de Espinosa stripped the gold from three chiefly bodies prepared for burial (Espinosa 1873).

The most documented example of highland Chiriquí grave looting occurred in 1859 after gold was discovered in graves at the site of Bugaba (Figure 3-1). News of the find spread rapidly and within a month more than one thousand people, including many Europeans and North Americans, descended upon the graves (Anon. 1859b, Bateman 1860, Blake 1863, Bollaert 1860a, 1860b, 1863, De Zeltner 1860, Lothrop 1919, Meagher 1861, Merritt 1860, Otis 1859, Pinart 1885, Taylor 1867). Hundreds of pounds of gold artifacts were removed; many were melted for the value of the gold, despite the fact that much of it was alloyed with copper.[89] A reported £ 10,000 of Chiriquí gold artifacts were melted annually by the Bank of England during the 1860's (Lothrop 1948: 162).

The cemeteries in the Boquete area where I conducted my fieldwork, east of the Volcán Barú, were heavily looted in the same late nineteenth-century time period as the site of Bugaba (De Zeltner 1866: 4, Lothrop 1919: 28, Wassén 1949: 145). As Thomas Meagher (1861: 205) related in one of the gentleman's magazine articles that detailed the aggressive search for gold,

> A mile outside Dolega the party stopped at the house of Don Roberto Soes, the discoverer of the golden relics in the Indian graves of Chiriquí. All the way from David we had ridden through thousands of these disemboweled and ransacked graves, and in every direction, for leagues and leagues, from Terraba and Boruca to Santiago de Veraguas, we might have seen tens of thousands more. [90]

Detection of Chiriquí grave locations is fairly easy, despite the frequent lack of above ground markers, as the capping stones of the graves allow a *huaquero* (looter) to simply push a metal rod or blade into the earth until it hits a telltale stone (Holmes 1888: 16).[91] Transportation and accommodation for looters were quickly developed by entrepreneurs who catered to the needs of the thousands of people who flocked to Chiriquí to seek gold (see Meagher 1861).[92] The rampant looting led to a nineteenth-

[89] Gold alloyed with copper is known as *tumbaga.*

[90] Though such articles certainly encouraged further looting and frequently glorified adventurous treasure hunters, Meagher (1861: 200-1) described the *huaquero* in his travel party as 'squint-eyed, knocker-kneed…morose, dogged, beetle-browed'.

[91] This technique is still commonly used by *huaqueros* today. It was also standard Boy Scout procedure, at least through the 1950's, for boys from the American-controlled Canal Zone who would visit the highlands on field trips and stay in a camp near Barriles (Robert Boyd, personal communication). Matthew Stirling used this Boy Scout camp as the base for the fieldwork he described in Stirling (1950) at the site of Barriles.

[92] The streets of Panamá in 1859 were reported to have been filled with signs similar to this example: 'For the Chiriquí gold diggings – the fast-sailing clipper-schooner *Carolina*, Captain Manuel Delgado, having a large part of her freight engaged, will have immediate dispatch for David, Chiriquí. Only a limited number of passengers and small quantity of freight will be taken, for which early application must be made at the office of the undersigned. Over $200,000 worth of gold images have been taken from one *huaca*, many of

century proposal of government licenses for short-term rights to open graves (Merritt 1860: 11), though governmental intervention did little to prevent looting throughout the isthmus.[93]

The discovery and looting of Chiriquí cemeteries continued throughout the twentieth century. In a 1949 letter to American archaeologist Samuel Lothrop at Harvard, American archaeologist Matthew Stirling wrote that a large cemetery was discovered in late December near El Hato de Volcán and was decimated within a month (Wood and Shelton 1996: 8, from Stirling's field notes, Accession File No. 364365). Two decades later, German archaeologist Wolfgang Haberland (1963) noted the complete destruction of the site of Puerto Gonzales Viquez on the Panamá-Costa Rica border. These looters almost invariably sought gold, which was more highly commodified in the contemporary context. Doris Stone (1943: 76) describes the Térraba region of southeast Costa Rica in ways that are pertinent to much of the Chiriquí area:

> Nearly every mound in the west coast region has been disturbed by *huaqueros* or pothunters looking for gold. Very often the contents of the mound are smashed, or carelessly flung aside by the plunderers who were presumably annoyed by ceramics and stone work.

---

which images can be seen at Don Maximo Perez, who has received a king weighing 50 pounds, and a hat weighing 25 pounds, and as there are thousands of *huacas* in Chiriquí, many millions of dollars will be dug out of these Indian burial places. Over three thousand persons are now digging there with great success. For full particulars, inquire at the undersigned, at their office near the Taller. (Anon. 1859a).

[93] The most significant law protecting cultural heritage and archaeological sites in Panama is *Ley* 14, enacted May 5, 1982.

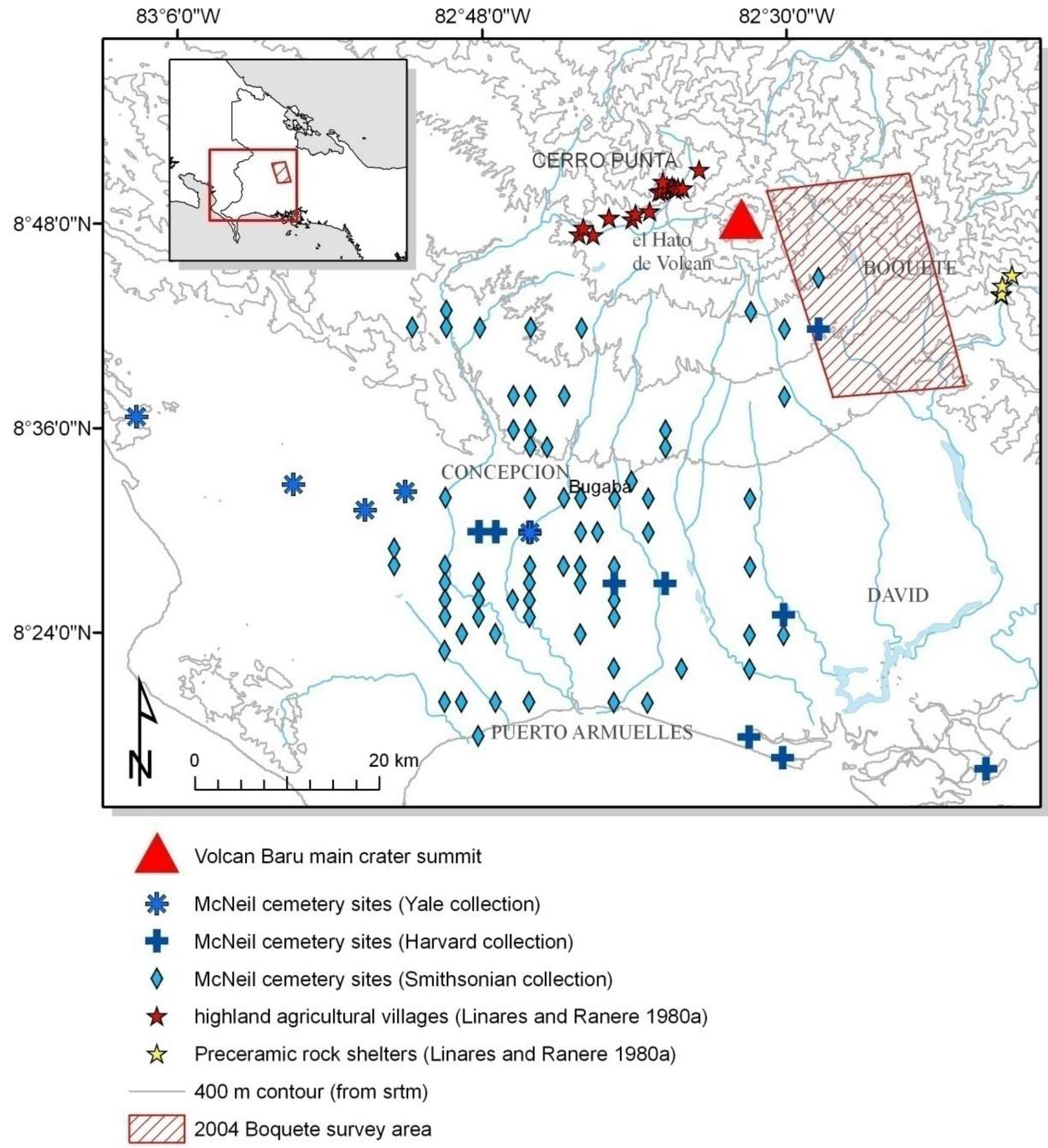


FIGURE 3-1: MAP OF THE GRAVE SITES WHERE J.A. MCNEIL OBTAINED ARTIFACTS NOW IN THE MAJOR US COLLECTIONS (AS RECORDED IN COLLECTION RECORDS)

Looting is an object-centered notion that places the past in terms of property and ownership (Meskell 2002, Pollock 2003, Pollock and Bernbeck 2005). Looting and collecting are intimately paired practices. The concept of collecting that began in the Enlightenment culminated in the establishment of the great western museums (including the Louvre, Hermitage, Smithsonian, and the British Museum) and became inextricably linked to an emergent consumerism (Belk 2001, Buchli 2007: 179). The artifacts taken from Chiriquí graves became incorporated within this burgeoning interest in artifact collections. While gold prompted the original interest in Chiriquí graves, the concomitant ceramic grave goods were also highly valued by collectors. Chiriquí ceramics were stated to be 'the finest ware produced in aboriginal America' in terms of 'form and technique' (Joyce 1916b: 136). These ceramics were assessed to represent 'a very high stage of development' and the highest level of aesthetic development in the Americas (Holmes 1888: 54).

The major Chiriquí collections in the United States are held by Yale, Harvard, and the Smithsonian Institute's National Museum of the American Indian (see Shelton 1984, 1994).[94] A large percentage of each of the artifacts in the collections were gathered by a single, highly proficient grave opener named J.A. McNeil and purchased by US collector John Lamson.[95] McNeil opened graves predominantly to the south of the Linares-Ranere project highland sites and to the southwest of my 2004 Boquete survey area. Two of McNeil's cited source locations for artifacts, however, fall within the larger survey area of my fieldwork (Figure 3-1).

Though decontextualized, the looted Chiriquí artifacts in the Yale collection importantly formed the basis for foundational studies of Chiriquí ceramics by William Henry Holmes (1888), George Grant MacCurdy (1911, 1913), and Cornelius Osgood (1935). Holmes (1888) additionally utilized the Smithsonian collection, while Osgood added a private collection from David, Panamá. The use of looted materials by archaeologists raises provocative ethical concerns. In a well-known and contentious example, Christopher Donnan examined both excavated and looted Moche pieces to

[94] My thanks to Susan Haskell at the Harvard Peabody Museum, David Rosenthal at the National Museum of the American Indian Cultural Resource Center, and Roger Colten at the Yale Peabody Museum for their help with the Chiriquí collections and records.

[95] I examined cataloged and uncatalogued items in the Smithsonian Chiriquí collection in April 2007. The most anomalous object (or subject?) that merits future attention is: "*Catalog number: 74,501. Archeology. Mummy of child - boy. Cards 1. Specimens 1; Accession # 014796, gift from J.A. Mcneil, accessioned aug 29 1884*".

allow comparative analysis of ceramics and metalwork and develop ideas of technology, social and political organization, systems of belief, and ritual practice (Donnan 1988: 235, 1990, 1991, Wylie 2002a). In the Chiriquí context, Catherine Shelton (1984) examined artifacts from her archaeological survey in the Barú area in tandem with looted materials in the major US collections. The museum collections do not offer the ideal of carefully excavated and contextualized artifacts, yet Shelton's study proved the capability of museum collections to answer questions beyond those of simple typology and social organization.

Buying, selling, giving, and stealing: the present value of the past

The Smithsonian collection received a steady stream of donated Chiriquí artifacts throughout the early decades of the twentieth century, particularly from US military personnel. One accession record notes the loan of a plaster cast of a stone image excavated at Bugaba in 1918 by Captain Theodore Thompson, a surveyor and engineer, when he was 'digging for graves of ancient origin in expectation of finding gold ornaments and pottery'.[96] This use of archaeological sites as resources for possible enrichment by military personnel, expatriates, and Canal Zone residents was fairly common and abetted the large-scale destruction of sites.[97] The conception of the indigenous past as the subject of avocational interest can be seen in the work of some of an expatriate group in the Canal Zone who formed the Archaeological Society of Panamá in 1949. The group published six volumes of a journal, *Panamá Archaeologist*, between 1958 and 1965 (see Cooke and Sánchez Herrera 2004b: 18). Some submissions provide useful archaeological information (e.g., Haberland 1959, 1960, Lothrop 1960); other submissions detail the looting of Boquete graves as entertainment and have a

---

[96] 1930. Accession #064459; Catalog #311399.

[97] Mention of grave opening as an entertainment for guests to Boquete, reminiscent of the mummy unwrapping that was a popular entertainment at Victorian London dinner parties, is made in Anon. (1930).

dated and racist tone (e.g., Curtis 1958) or simply describe artifacts purchased from looters (e.g., Sander 1960). Others fall within those extremes.

The valuation of artifacts was not limited to private sales between looters and collectors. Official Panamanian use of artifacts as a medium of exchange as indicated by the accession note attached to two *metates* and a *mano* from Veraguas that were given in reciprocation for ornithological services provided to the national museum in Panamá.[98] This is a particularly interesting case, in that artifacts were removed from the museum collection, hence detracting from its holdings, in exchange for what museum officials felt was information that would strengthen or improve other collections.[99] While most archaeological attention is directed at the use of objects as commodified gifts in past contexts, their use in contemporary contexts is also an indication of the symbolic load we place upon associations with the past and their connections to object worlds.

In addition to the large museum collections, numerous smaller collections of Chiriquí artifacts exist. The ubiquity of these objects in the global market was noted by Swedish archaeologist Sigvald Linné (1936: 95) who stated,

> It may well be supposed that there does not exist any important museum for general ethnography whose American section lacks a more or less extensive collection of archaeological clay vessels from the Province of Chiriquí, Panamá.

Collections can be found in Hamburg at the Hamburgisches Museum für Völkerkunde (Haberland 1984a: 238-9) and in Sweden at the Gothenburg Ethnographical Museum (Wassén 1949). The Boston Museum of Fine Arts holds a significant number of gold pieces from Chiriquí that were collected by J. A. McNeil; a number of these were gifted

---

[98] 1984. Accession # 343155; Catalog # 507, 892-507,894. gifted by Mrs. Alexander Wetmore on behalf of her husband, who in turn was gifted the objects by the director of the national museum, Ms. A.M. Peneina.

[99] This attitude is still common amongst many biologists who work in Panamá. A well-known case entailed the illegal export of Panamanian artifacts by Alan Grinnell, an expert in tropical bats who works at the University of California, Los Angeles.

by Thomas Appleton (in 1884) and Joseph Stearns (in 1883) and several dozen gold artifacts, likely from the Barú area, were purchased in 1922 from a private collection. Smaller and less formal institutional collections clearly exist, as is evident from a bulletin of the American Ethnological Society from April 17, 1860 that notes,

> a letter was received from Mr. Totten, chief engineer of the Panamá Railroad Company at Aspinwall, April 2d [sic], accepting his appointment as a corresponding member, and promising to send more curiosities from the Chiriquí graveyards (Merritt 1860: 9).

In this example, the artifact signified a link between the railroad engineer in Panamá and a metropolitan gentleman's organization, the members of which conjecturally held a far higher socioeconomic status than the engineer. This use of artifacts as a source of social status, I assume, plays upon an exoticism of the past and of far-away places held by the urban, professional men who comprised the nineteenth-century membership of the American Ethnological Society.[100]

Numerous Chiriquí artifacts also remained in private Panamanian collections. A high school organization led by Roberto de la Guardia collected artifacts for the Museo Chiricano in David. Though the group is no longer active, interviews I conducted in 2004-5 with local Boquete residents who participated in the organization as students or teachers attest to its importance in building a local appreciation for the Chiriquí past. The avocational archaeologists published their findings between 1965 and 1968 as the *Boletín del Museo Chiricano* (see Cooke and Sanchez 2004: 19, Corrales 2000: 31, Griggs 2005: 31).

Artifacts are also held by other schools and households in the area but are not as obvious due to the lack of publication or study of the collections. I photographed a

[100] Though it is now a special interest group under the American Anthropological Association, the American Ethnological Society was founded in 1842 in New York City as a social networking organization for professional men with an avocational interest in ethnology. Shortly after this 1860 report, the society partially dissolved and lost much of the prestige it originally held; in the 1910's an affiliation with Columbia University and the American Museum of Natural History lent it a professionalized, academic focus to a greatly expanded membership.

collection of artifacts from the Benigno T. Argote school in Boquete, which holds a wide range of unprovenienced pieces collected by students. As was the case with a museum established for a short time in Boquete, the school collection has waxed and waned over time due to the ongoing process of artifact donations to the collection and burglaries from it.[101]

FIGURE 3-2: A SAMPLE OF SOME OF THE ARTIFACTS HELD AT THE BENIGNO T. ARGOTE SCHOOL IN BOQUETE

The photo at the top left shows the school entrance (top left). Note in particular the stone balls (top right) and miniature ceramic vessels (bottom left), which are artifact classes I discuss later in this chapter.

[101] At the time that I visited the school in April, 2004, the collection consisted of roughly 50 complete ceramic vessels, 6 *metates*, 10 *manos*, 4 stone balls, 122 chipped stone tools, and 1 flat, rectangular ground stone piece I could not identify. It will have lost some of these artifacts and gained others since my visit.

Material, culture, and the Volcán Barú

The widespread collection of Chiriquí artifacts and the ongoing looting of sites attest to the material richness of the pre-Columbian remains, yet prior to the Linares-Ranere project a disproportionately low amount of academic archaeological attention was paid to the area (Haberland 1957, Linné 1936, Verrill 1928b). The Linares-Ranere project represented the first multi-year, systematic archaeological project conducted in highland Chiriquí. Figure 3-3 shows how the sites I excavated and surveyed relate to those of the Linares-Ranere project, while Figure 3-4 provides a map of published archaeological work conducted to date on the western flanks of Barú.

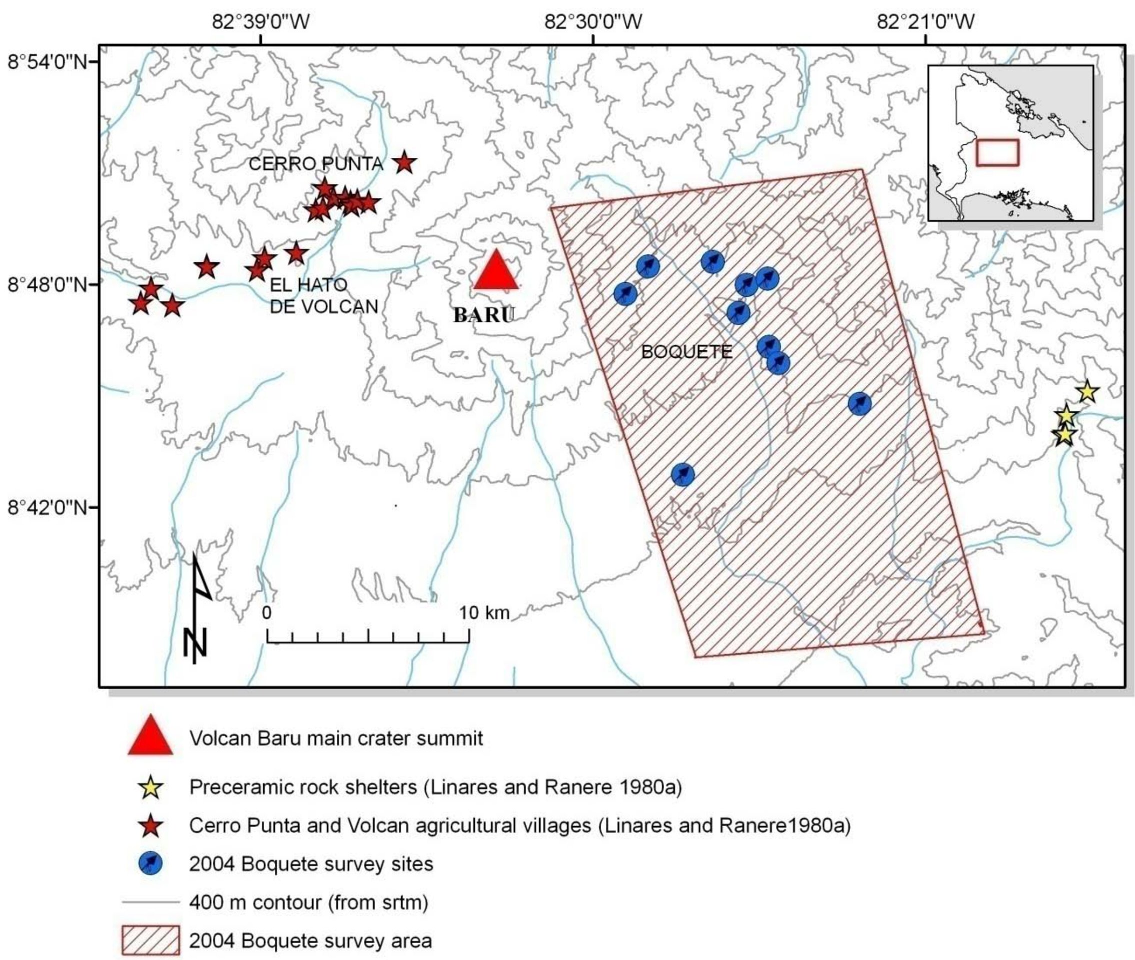


FIGURE 3-3: THE 2004 BOQUETE SURVEY SITES IN RELATION TO THE LINARES-RANERE PROJECT SITES (LINARES AND RANERE 1980A)

Archaeological studies in the Barú area

Swedish archaeologist Sigvald Linné (1936) provided the first published descriptions and drawings from a grave site in an area of roughly 50 graves in the Cerro Punta area.[102] A small number of published, systematic archaeological excavations were subsequently conducted in highland Chiriquí at cemetery sites (Haberland 1957, 1958, 1961a, b) and the regional center of Barriles (Ichon 1968a, Stirling 1950). The Linares-Ranere project team also completed work at Barriles in the early 1970's.

Studies completed since the Linares-Ranere project on the western flanks of Barú include survey and ceramic analysis by Catherine Shelton (1984), a number of impact analysis surveys for construction of dams, pipelines, and roads (e.g., Barillas 1982), and a field school completed at the site of Barriles overseen by Panamanian Professor Luz Graciela Joly Adams (Universidad Autónoma de Chiriquí) and German archaeologists Martin Künne, Ines Beilke-Voigt, and Kay-Uwe Voigt (Beilke-Voigt 2002, Beilke-Voigt, Joly, and Kunne 2004, Künne and Beilke-Voigt in prep.) Fieldwork was most recently conducted by Scott Palumbo (University of Pittsburgh) at seven areas in the Cerro Punta/Volcán area, including work at the sites of Barriles and Sitio Pitti-González (Palumbo 2008).

[102]The descriptions were provided to Linné by a Swedish Forestry Serviceman, Gösta von Friesendorff, who accompanied a 'professional-grave exploiter', Louis Hartman, in opening the graves. Hartman, a Czech, claimed at the time to have opened over 1,000 graves in the area. German archaeologist Wolfgang Haberland seems to have travelled and collaborated with Hartman, and mentions that any archaeologist in the Chiriquí area also knew him; see Haberland (1960: 7).

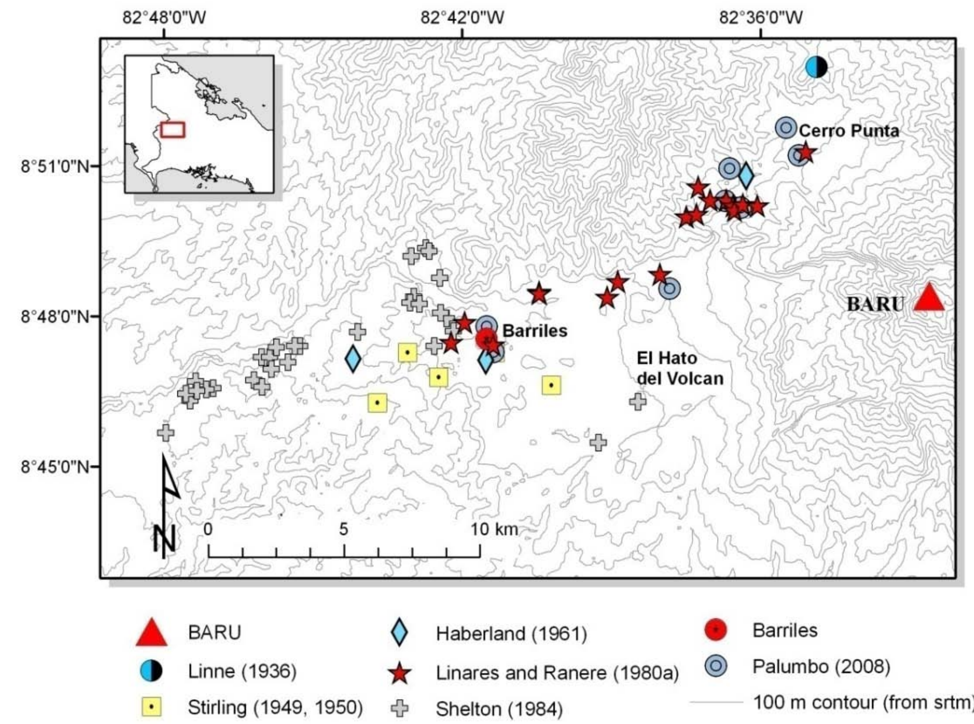


FIGURE 3-4: SITES EXAMINED BY RESEARCHERS ON THE WESTERN FLANKS OF BARÚ

The site of Barriles was also examined by Beilke-Voigt et al. (2004) and Ichon (1968).

A smaller number of published archaeological studies have been completed on the high-elevation eastern slopes of Barú.[103] Figure 3-5 provides my estimated locations for the sites described in published accounts of pre-Columbian sites in the Boquete area (Bateman 1860, Osgood 1935, Wassén 1949).[104] Coordinates for these locations and descriptions of the sites, all of which were cemeteries, are provided in Appendix E.

[103] Though note that the mid-elevation rock shelters excavated by Anthony Ranere were roughly 28 km east of the Barú summit.

[104] I do not include the account of French Consul A. de Zeltner, who classified grave construction in the area into six types. Though de Zeltner clearly states that he owns a sizable collection of Chiriquí artifacts, he does not give any indication that his descriptions are based upon personal observation, nor does he mention the locations of the graves he describes (see De Zeltner 1866).

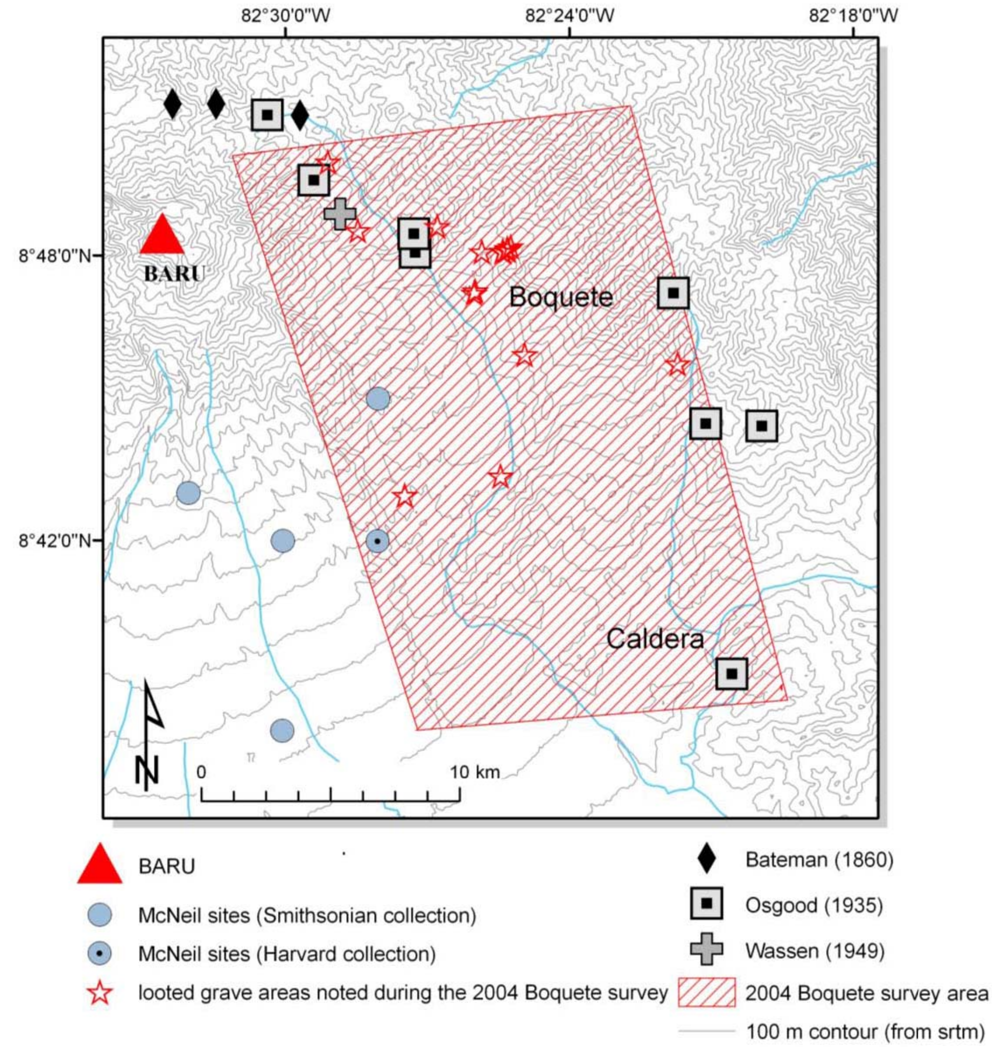


FIGURE 3-5: LOCATIONS OF PRE-COLUMBIAN GRAVE SITES DISCUSSED IN EARLY ARCHAEOLOGICAL PUBLICATIONS AND LOOTED GRAVE CONTEXTS EXAMINED DURING THE 2004 BOQUETE SURVEY

The first description of archaeological sites in Boquete that can be linked to a specific location was provided by J. Bateman (1860) in a report to the American Ethnological Society in New York. Bateman described three graveyards in Boquete and one that I estimate was located in the Bugaba district, west of Barú. The earliest published account of systematic archaeological work on the Boquete side of the Volcán Barú was completed by US ethnologist Cornelius Osgood (1935). Osgood visited Boquete for two weeks during which he examined locally held collections and examined the excavation records for 117 graves from eight sites. Osgood provides no indication of when the graves were opened and his vague descriptions of site locations indicate that he did not see all eight sites, particularly as his trip was during the rainy season and travel would have been difficult.[105] A representative of the Gothenburg Ethnographical Museum, Henry Wassén, excavated three graves from a looted context in the area of Finca Lerida, Boquete in 1947.[106] Wassén used Gothenburg Museum collections from three additional graves excavated from the same location in January 1937 and the private collection of the land owners to provide descriptions of the tomb constructions and grave offerings. A member of the Archaeological Society of Panamá, Dan Sander, excavated a cemetery near Boquete and recovered one tubular bead and 20 round jade beads (Haberland 1965).[107] I can find no reference to any publication of this excavation, however, nor any further mention of its location.

My survey methods

I conducted preliminary surface surveys and stratigraphy observations in 1999, 2000, and 2001, though the primary source of data for this thesis was fieldwork and laboratory analysis conducted between January 2004 and March 2005 in Boquete, Panamá. This work was approved and supervised by the *Departamento de Patrimonio Histórico (Instituto Nacional de Cultura)* and funded by the Fulbright Program and the Wenner-Gren Foundation.

My fieldwork research universe was a 240 km^2 area on the east slopes of the Volcán Barú (see Figure 3-6). I examined volcanic landscape features and looted graves

[105] Osgood seems to have been the guest of Jack Browne so ostensibly would have seen at least the location of the three graves he cites on the Browne *finca* in Bajo Mono.

[106] Wassén was the guest of the Swedish Consul General, Hans Elliot. I am grateful to Hans Elliot's daughter and son-in-law, Ann and Gunnar Lindahl, who provided invaluable support and friendship during my own fieldwork.

[107] This reference to jade could be suspect. This material is potentially held by the American Museum of Natural History, which purchased many artifacts from Canal Zone looters and collectors (Richard Cooke, personal communication).

and conducted interviews throughout this area. My primary area of artifact collection can be contained in a polygon of roughly 40 km^2 along the Rio Caldera. Through surface survey, shovel test pits, and excavated test units I collected artifacts from an estimated 4.08 km^2, or roughly a 10% sample of the area. Survey areas ranged from 920-1680 m elevation.

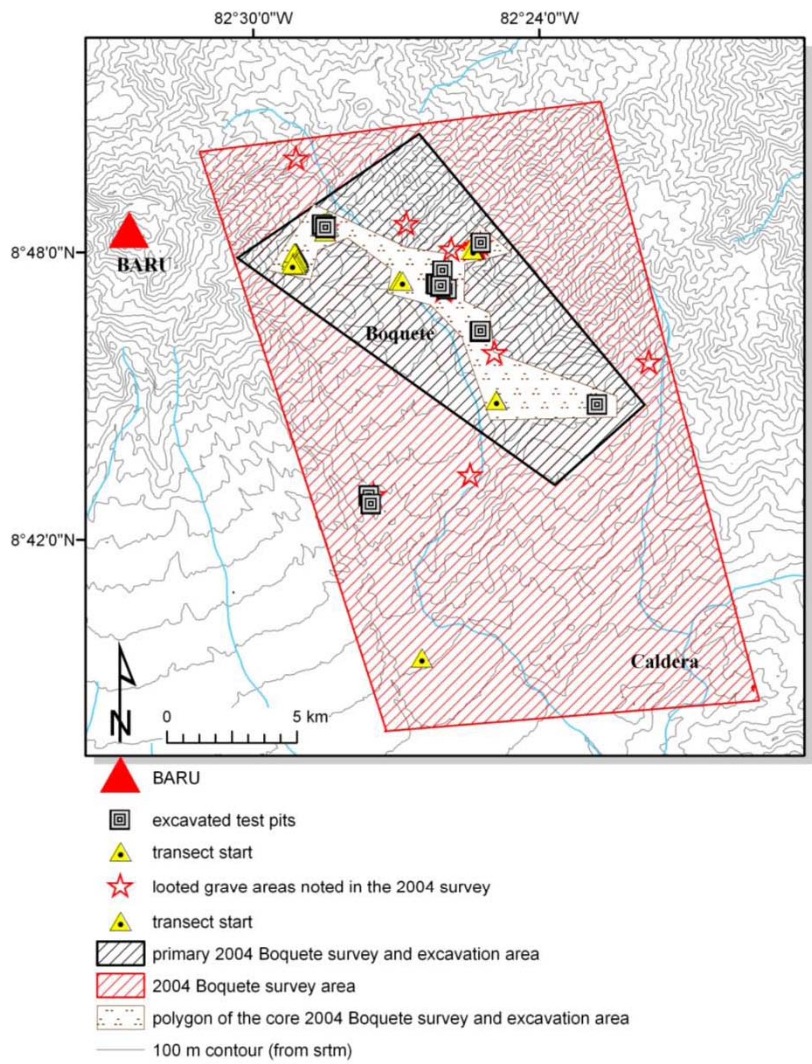


FIGURE 3-6: THE 2004 BOQUETE SURVEY AREA

The designation of a place as a *site* is necessarily problematic and the term is applied with little consistency by different researchers in the Barú area. In 1965 the Archaeological Society of Panamá published a compilation entitled *Site Report List* –

Republic of Panamá (Bull 1965). This publication did not list a single site in Boquete despite a century of heavy looting and multiple publications describing Boquete archaeological sites (Bateman 1860, Lutz 1924, Osgood 1935, Wassén 1949). While the Archaeological Society was a predominantly amateur organization and hence beholden to no set standards, the omission is part of an overall trend of inconsistency in the recording standards in western Panamá, particularly in comparison to the well-defined recording systems of central Panamá.[108]

My survey was purposive rather than systematic (aleatoric). In general, I found it more pertinent for my research questions to examine the overall volcanic landscape yet found that the word and concept of 'site' is difficult to avoid; it is shorter and easier than 'location' or other alternatives, so for clarity I am using *site* to define areas the areas where I placed shovel test pit transects or excavated test units. I use the word broadly and interchangeably with *place* in this thesis and my survey could be largely be considered a 'non-site' survey in the sense first discussed by Kenneth Kvamme (Banning 2002: 7). I examined a number of areas using transects and shovel test pits but did not give site numbers to them if they did not provide diagnostic artifacts. I also examined areas with looted graves, evidence of the manufacturing of stone tools, or petroglyphs but did not provide them with site numbers if I did not collect any artifacts from them.

I numbered the excavated locations with an abbreviation for the Boquete district (BE) followed by a unique number, per prior standards (Biese 1962, Bull 1965). On the suggestion of representatives from *Patrimonio Histórico* I began these site numbers with the number eleven in order to leave space for any sites that may have already been registered and followed the site number with my initials (KH) to clearly signify the

---

[108] It should be noted that, though published by avocational archaeologists, the *Panamá Archaeologist* journal boasted a fairly large and prestigious subscription list, including the Smithsonian Institution, American Museum of Natural History, Harvard University, Museum of the American Indian, National Museums of Panamá and Costa Rica, Society of American Archaeology, Archaeological Institute of America, New York Public Library, University of Cambridge, University of Michigan, and numerous others, hence their publications were accessible to the professional archaeological community. For a full list of the membership at the time of the final publication see The Archaeological Society of Panamá (1965).

excavator. I numbered sites according to their distance from the Barú summit; site numbers increase with increased distance from the summit relative to the other sites (Figure 3-7).

To investigate any physical impact of volcanism upon archaeological sites on the eastern flanks of Barú, I divided sites into three categories by their distance from the Barú crater using concentric circles that provide heuristic estimates of tephra fall distributions (see Figure 3-7). These tephra fall ranges extend those already defined by the USGS for the primary tephra falls (Sherrod et al. 2007). On the eastern flanks of Barú the USGS isothickness lines for an expected 10 cm and 3 cm tephra fall radii were roughly 5 km and 6.5 km from the main crater. As was evident from the presence of tephra in the Boquete lake core I examined in 2005 and the Laguna Zoncho lake core in Costa Rica (Clement and Horn 2001), detectable tephra fallout occurred in larger radii than the primary fallout that formed the focus of the USGS study. I placed additional circles of hypothetical fallout lines at 9 km, 13 km, and 20 km radii from the main crater. While I was aware that the complexity of tephra preservation in the Barú area would not necessarily correspond to differences in tephra thickness or stratigraphic locations in the three zones, I anticipated that increased distance from the volcano summit would correspond to decreased likelihood of tephra presence in archaeological stratigraphy.

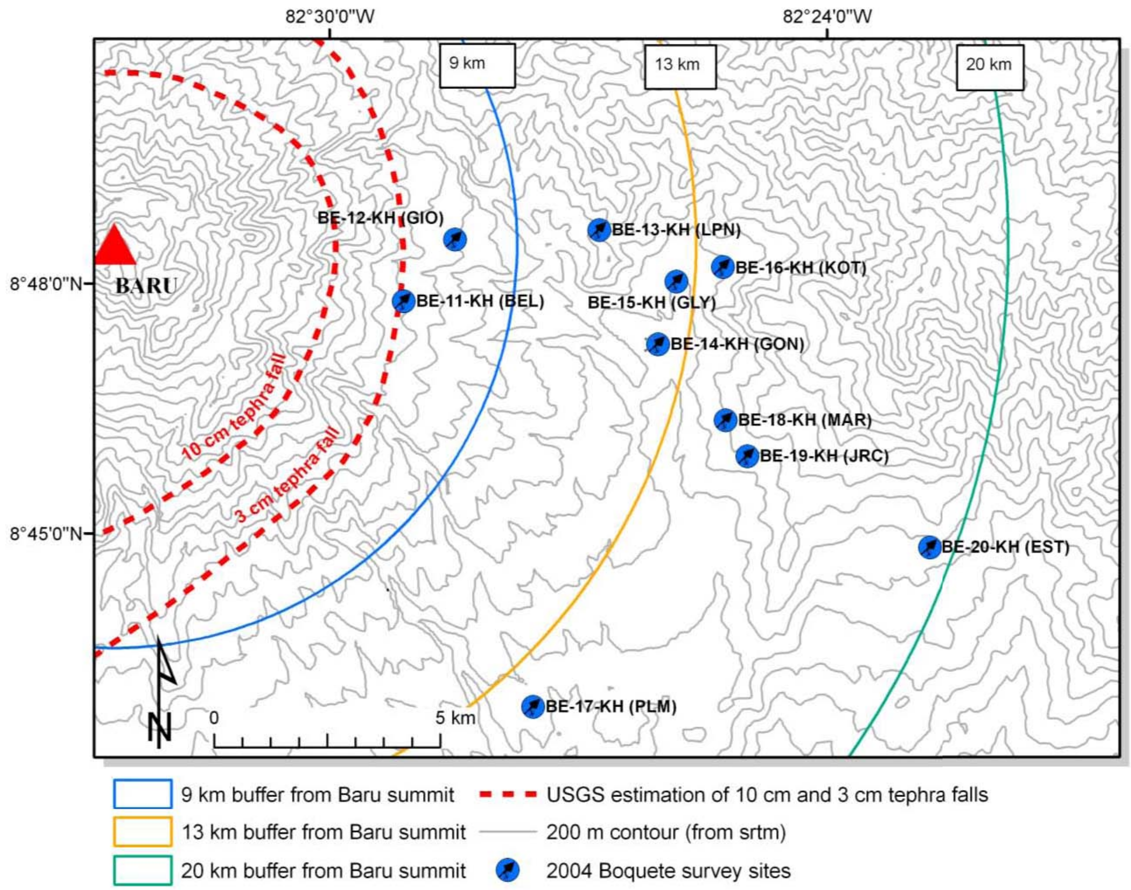


FIGURE 3-7: SITES IN THE 2004 BOQUETE SURVEY AREA IN RELATION TO HEURISTIC TEPHRA FALL RADII

My archaeological fieldwork methods included surface survey, shovel test pits, and trowel-excavated test units. Appendix F provides the coordinates for site locations, elevations, quantity of shovel test pits (stp), excavated units, estimated survey area, and a summary of the artifacts retrieved from each site. Shovel test pits averaged 40 cm in diameter and 70 cm depth and were spaced every 10 m upon north-bearing transect. I used a Global Positioning System (GPS) to provide a coordinate for each transect start and excavated test unit to keep an accurate record of fieldwork in a Geographical Information System (GIS) while in the field. Artifacts were bagged separately from each shovel test pit and the stratigraphy and soil composition of each shovel test pit was recorded on field forms, particularly noting the presence and depth of tephra inclusions.

We frequently used m*achetes* to clear site areas in overgrown areas. Coffee fields and cattle fields required far less clearing, but obviously demanded consideration of the property owners' crop or livestock in the decision of where to place units. Tools and team members were transported in a 4-wheel drive vehicle that I purchased with Wenner-Gren funding and then donated to the Smithsonian Tropical Research Institute at the end of my fieldwork. A number of the sites examined were inaccessible even with 4-wheel drive and required hiking from the last accessible road point.

I recruited paid field assistants from the local area; the size and composition of the team varied depending on the time period of the fieldwork between one and five people. We dry screened soils from both shovel test pits and excavated units through 1/4" mesh rocking sifter screens that I designed and had built by a local carpenter. The same carpenter made drying trays and artifact washing and sorting tables for my field laboratory. I rinsed and brushed artifacts with water and air dried them but did not use detergent in order to preserve microbotanical remains for future analysis.

Team members used a standard United States Department of Agriculture soil texturing field flowchart to describe soil compositions and a Munsell soil chart to describe soil color. Excavated test units were aligned to cardinal directions using a compass and stratigraphy was measured using line levels and plumb bobs. We excavated test units in arbitrary 10 cm strata when no clear stratigraphy was present and excavated features separately and bagged and recorded artifacts from each strata. Most units were excavated to roughly a 1 m depth.

Artifacts were inventoried, photographed, and are stored in accordance with Panamanian government standards. Ceramics (*8257 items*) and lithics (*599 items*) comprised the majority of the material culture recovered, though bone, casts, and historical glass and metal items were also recovered. All artifacts recovered are the property of the Republic of Panamá and are under the jurisdiction of *Patrimonio*

Histórico.[109] A total of 74 carbon samples were recovered for possible future testing, though only four samples were chosen for immediate AMS testing (see Appendices K and L).

Artifacts and eruptions in the Boquete survey area

Preservation in Panamá can prove to be highly differential even within the stratigraphy of a single site (Carvajal-Contreras, Cooke, and Jiménez 2008: 101), though it tends to preference stone, ceramic, and metal objects (Cooke and Sánchez Herrera 2004a: 61, Lothrop 1948: 162-3). The bulk of the material recovered during my survey fell within these categories.[110] Both ceramic and lithic assemblages in Greater Chiriquí indicate a widely shared tradition that became progressively more specialized and divergent to particular areas over time (see Cooke 2005: 133). This is seen as evidence for autochthonous development of stylistic traditions and technologies and amends earlier the reliance in prior interpretations upon external forces, influences, or objects for culture change.

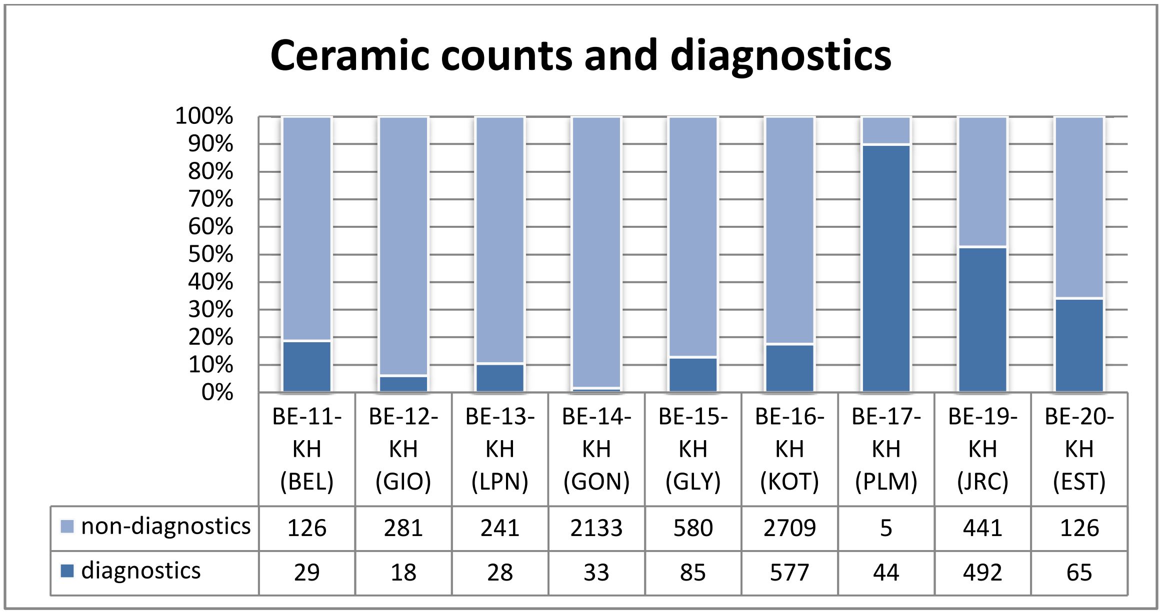
The ability of lithic materials to elucidate details of pre-Columbian life in the isthmus is increasingly evident as recent residue and starch grain analyses from stone tools are providing important new data (Dickau, Ranere, and Cooke 2007, Pearsall, Chandler-Ezell, and Zeidler 2004, Piperno 2006a, Piperno and Pearsall 1998, Piperno et al. 2000). Recent analysis in Costa Rica is also offering promising stylistic examinations of Greater Chiriquí lithics (Quintanilla 2007, 2008). Most studies rely more heavily upon ceramics, however, to determine site chronologies and cultural affiliations.

[109] As no space was available in official storage facilities, the artifacts are currently stored at the Café Kotowa coffee estate in Boquete under the custodianship of owner Ricardo MacIntyre Koyner and with the approval of the *Instituo Nacional de Cultura de Panamá* (INAC).

[110] Though the only metal objects I recovered were historic or contemporary.

Highland Chiriquí ceramics are viewed as more sensitive and trustworthy chronological markers of human presence than lithics (Ranere 1980b: 118). The classification of Greater Chiriquí ceramic materials, however, has suffered a lack of consistency throughout the twentieth century due to overlapping and competing terminologies (Haberland 1984b, Hoopes 1996b: 15). It is certainly true that regional ceramic chronologies require periodic revision as new data are obtained (Wood and Shelton 1996: 13). As Costa Rican archaeologist Francisco Corrales (2000: 27) accurately points out, however, despite the relatively modest archaeological attention afforded to Greater Chiriquí to date, an unwieldy number of classification systems exist due to the application of unique nomenclature by each researcher who examined the material (e.g., Baldi 2001, Haberland 1961b, Holmes 1888, Linares de Sapir 1968, Linares 1980a, MacCurdy 1911, Minelli and Minelli 1966, Osgood 1935, Shelton 1984).

Though I cross-referenced other citations in trying to identify pieces (in particular Linares 1980a and Shelton 1984), I drew primarily upon the classification established by Corrales (2000) as I found it clearly defined and capable of bridging the artificial boundary between Panamanian and Costa Rican portions of the Greater Chiriquí culture area. The abbreviated ceramics guide that I developed for my field lab is provided in Appendix G. Figure 3-8 provides the overall ceramic counts from the sites in my survey and divides them by diagnostic and non-diagnostic counts. For descriptions of the diagnostic types found at each site see Appendix H (a-d).

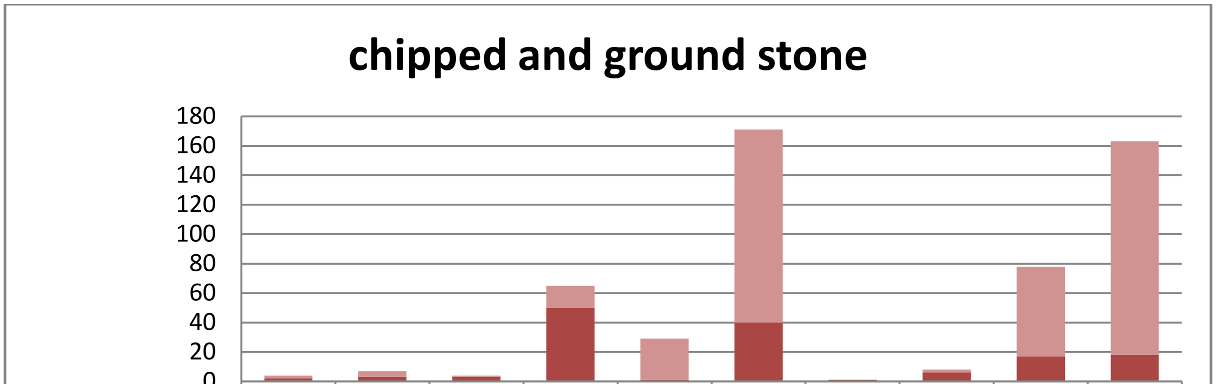


	BE-11-KH (BEL)	BE-12-KH (GIO)	BE-13-KH (LPN)	BE-14-KH (GON)	BE-15-KH (GLY)	BE-16-KH (KOT)	BE-17-KH (PLM)	BE-19-KH (JRC)	BE-20-KH (EST)
non-diagnostics	126	281	241	2133	580	2709	5	441	126
diagnostics	29	18	28	33	85	577	44	492	65

FIGURE 3-8: CERAMIC COUNTS AND DIAGNOSTICS FROM THE BOQUETE SITES [111]

Figure 3-9 provides a count for the ground and chipped stone artifacts recovered during my survey. Descriptions of the lithics can be found in Appendix I. I interpret two of the sites with heavy lithic counts (BE-14-KH GON and BE-16-KOT) as mortuary contexts and two (BE-19-KH/JRC and BE-20-KH/EST) as manufacturing contexts.

[111] Note: this chart excludes BE-18-KH (MAR; 1 sherd).



	BE-11-KH (BEL)	BE-12-KH (GIO)	BE-13-KH (LPN)	BE-14-KH (GON)	BE-15-KH (GLY)	BE-16-KH (KOT)	BE-17-KH (PLM)	BE-18-KH (MAR)	BE-19-KH (JRC)	BE-20-KH (EST)
chipped stone	2	4	1	15	28	131		2	61	145
ground stone	2	3	3	50	1	40	1	6	17	18

FIGURE 3-9: GROUND STONE VS CHIPPED STONE ARTIFACTS FROM THE BOQUETE SITES

Tephra layers create remarkably clear stratigraphic boundaries in other pre-Columbian archaeological contexts (e.g., Miller 2002: 17, Figure 2.8). As I discussed in Chapter two, one of my primary field interests was gauging the usefulness of tephra as a stratigraphic marker for archaeological sites in the Barú area. Appendix J provides a representative sample of the location and depth of tephra in the stratigraphy of the Boquete sites in my survey. Distance from the volcano summit, wind currents, slope, flooding, and topography all play a role in airborne tephra fall preservation. The stratigraphy of even a small area can vary widely in the Barú area due to slope and heavy rainfall. Overall, however, two distinct tephra layers were present in the Boquete survey sites.[112] As noted in Chapter two: four eruptions are proposed by geological studies (Sherrod et al. 2007), three eruptions are indicated by tephra in palaeoecological studies of lake core samples (Anchukaitis and Horn 2005, Behling 2000, Clement and Horn 2001), and one eruption was cited in the archaeological sites west of the volcano (Linares and Ranere 1980a, Sheets 2008). Archaeological contexts, hence, do not provide clear records of the full tephra record of Barú eruptions in the Boquete area.

[112] Though note that two sites (BE-16-KH KOT and BE-18-KH MAR) only contained one detectable tephra layer.

Highly studied and stratigraphically clear tephra layers can provide tight *terminus post quem* and *terminus ante quem* (e.g., Dugmore, Keller, and McGovern 2007). When it is found in the Barú area, however, tephra provides a relatively broad temporal range due to our poor understanding of the eruption history. The tephra is, in this sense, parallel to chronological data provided by ceramics and radiocarbon dates as they also provide relatively broad windows of time rather than specific dates. Four carbon samples from my fieldwork were AMS dated and accurately bracketed what I interpreted, from ceramics, to be the earliest and latest dates in my survey sample. This provided me with a degree of confidence regarding my identification of ceramics and established ceramic chronologies (Corrales 2000, Linares and Ranere 1980a, Shelton 1984). Data for the four AMS dated samples are provided in Appendix K and the complete list of carbon samples collected during my survey are provided in Appendix L.

My assumption in the field was that the relatively small amount of physical eruption impact on the eastern flanks of the volcano should result in a lack of abandonment or settlement changes that can be linked to the timing of volcanic eruptions. If any settlement changes were correlated to phases of volcanic activity, however, they should more strongly impact sites that are closest to the summit and least impact sites farthest from the summit. Figure 3-10 shows the interrelationship between the AMS dates, ceramics recovered from each site, and the eruption history of the Volcán Barú as interpreted from palaeoecological data and the USGS survey.[113]

[113] The undated 'Episode 2' suggested by Sherrod et al 2007 coincides in the chart with the most recent eruption suggested by Anchukaitis and Horn (2005). If four rather than three eruptions occurred, however, the Anchukaitis and Horn lake core likely reflects only the most recent, larger eruption of Barú (Kevin Anchukaitis, personal communication).

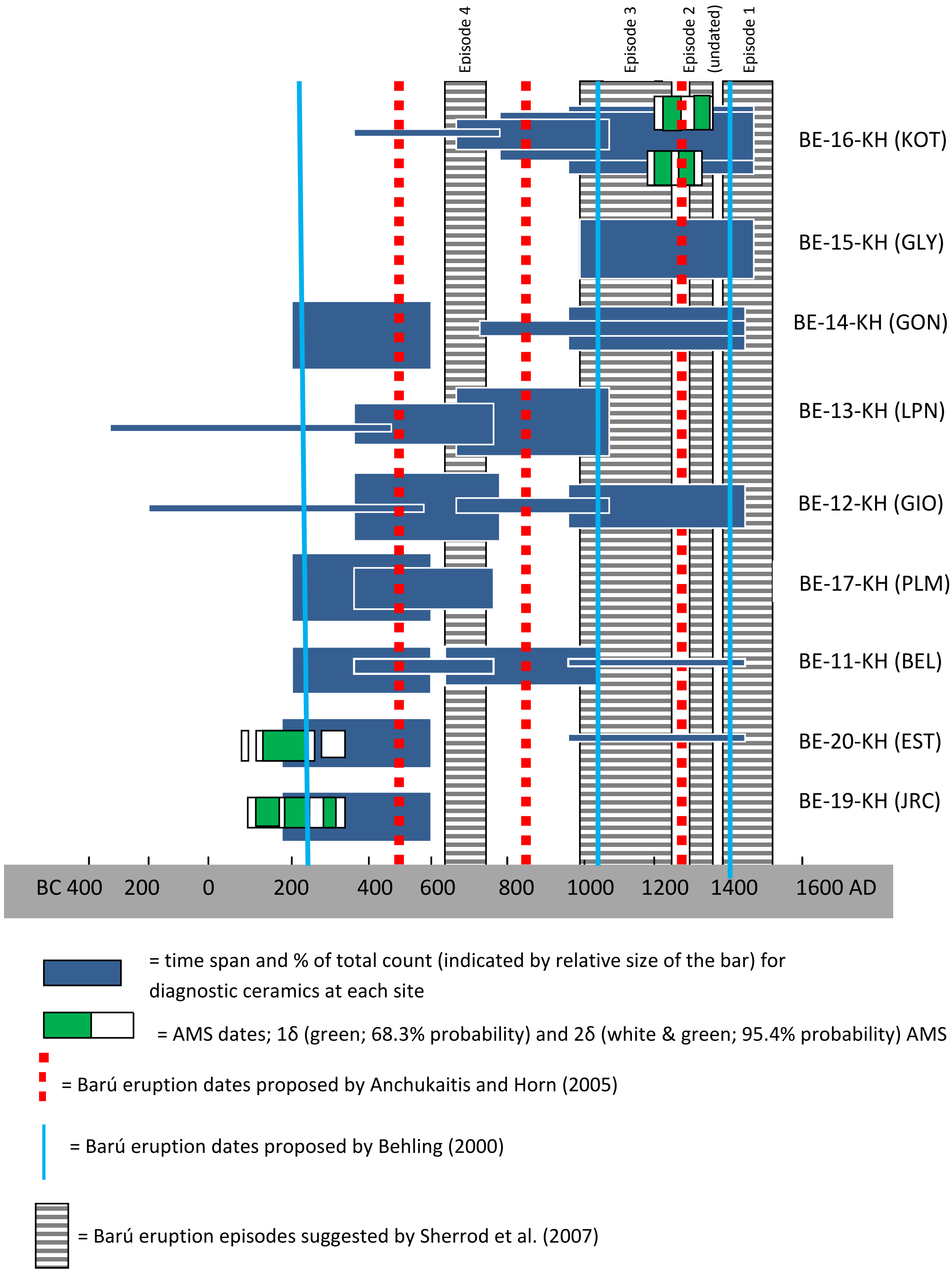


FIGURE 3-10: CHRONOLOGICAL SCHEMATIC OF THE INTERSECTION OF SITE USE AND VOLCANIC ERUPTIONS

Blue bars indicate dates for archaeological sites in the 2004 Boquete survey (from ceramic chronologies); vertical lines show volcanic eruption dates suggested by palaeoecological and volcanological studies; green and white bars indicate AMS dates obtained from the site bars over which they are located.

The Linares-Ranere project researchers proposed that Cerro Punta sites on the western flanks of Barú were abandoned following a catastrophic AD 600 eruption, while occupation continued at sites several kilometers southwest as they were less impacted by tephra.[114] It is worth examining this interpretation closely in conjunction with the data from the eastern flanks of Barú. Simplistically, if tephra fall impacted settlement on the eastern flanks of Barú the sites nearest the volcano should not evidence the same time depth and should indicate occupation gaps or abandonments linked to volcanic events; sites farthest from the Barú summit should have uninterrupted sequences.

The opposite trend occurred in the 2004 Boquete survey sites, as sites nearest to the Barú summit (BE-11-KH BEL and BE-12-KH GIO) evidenced some of the longest continual occupation spans. The two farthest sites (BE-19-KH JRC and BE-20-KH EST) actually have the shortest and least continuous occupation record. Both of these sites were obvious lithic manufacturing locations, and it is possible that changes in stone tool use, consumption, or manufacture could have changed or simply that my survey sample did not provide evidence for the full span of site use.

Interestingly, the ceramic record indicates that a break in occupation or site abandonment occurred at several of the Boquete sites at roughly the same AD 600 time period that the Linares-Ranere project researchers suggested for the Cerro Punta sites. Two sites (BE-19-KH JRC and BE-17-KH PLM) show a possible absence of occupation at roughly that period. Two other sites (BE-14-KH GON and BE-20-KH EST) show a gap in occupation beginning at AD 600 that resumes by roughly AD 1000. Tephra fall or other hazards are an insufficient explanation for these settlement and occupation changes due to the very light impact of eruptions in the Boquete area.

[114] In the 1975 Linares et al. *Science* article, the authors suggest that the site of Barriles (southwest of the abandoned Cerro Punta sites) was not abandoned at AD 600 as it was less impacted by volcanism. They interpret that the Barriles site use continued until AD 800, but then lapsed until AD 1200. No explanation was provided for the 400 year gap.

If related to volcanic eruption, the occupation changes would have to be the result of an indirect volcanic impact. One such repercussion of volcanic eruptions in Iceland, for example, is the shifting of water tables from earthquakes associated with eruptions (Andrew Dugmore, personal communication, October 2008). Should earthquakes have disrupted the *ojos de agua* - or sources of streams still considered valuable assets in contemporary Boquete - occupation, agriculture, and manufacturing could have been impinged. If groups living near one another were as garrulous with one another as the chroniclers' accounts describe, the possibility of straying out of one's territory to get water from a further source could possibly not be an option.

The release of volcanic gases, too, could be a possible indirect result of eruption that is archaeologically difficult to detect. Indigenous residents of Boquete whom I interviewed told me a story of an earthquake in the 1970's that caused a stream flowing down from the Barú summit to smell like sulphur for days. Volcanic gas release could cause irritation to eyes and respiratory systems of people and animals and the poisoning of crops. These hazards generally only affect areas within 5-7 km from the vent, however, hence would not explain the cessation or gap of occupation at the farther Boquete survey sites of BE-19-KH (JRC) and BE-20-KH (EST). It is possible, however, for volcanic gases to develop into *vog* (volcanic fog) or acid rain, which can be absorbed into aerosol droplets and dispersed downwind. The Barú area is well known for its characteristic *bajareque*, or sideways blowing rain and mists, and if volcanic gases were somehow incorporated into these misty currents it is possible that eruption impacts occurred that are archaeologically difficult to detect.

Alternately, the apparent interruption of occupation in the Boquete survey sites could simply be a product of a misinterpretation of the period of time which certain ceramic styles were used. The entire group of Bugaba ceramics, in particular the very diagnostic Cerro Punta Orange ceramics, are truncated by the Linares-Ranere project ceramic chronologies at AD 600 (Linares 1980a). If future revision of the ceramic chronology extends the period for which Cerro Punta Orange ceramics were produced and used, the gap in occupation at the BE-14-KH (GON) and BE-20-KH (EST) sites would disappear.

An obvious caveat is clearly required for the use of ceramic chronologies as the indicator of presence or absence of people as I have displayed in Figure 3-10. While the presence of a ceramic type that was common from AD 700-1100 gives a possible chronological span, there is no indication that the site was occupied during that entire time span. Instead, the occupation could clump to earlier or later extremes of the span or fall outside of it if the current chronologies are incorrect. While the three sites (BE-16-KH KOT, BE-19-KH JRC, and BE-20-KH EST) with AMS dates provide an indication of an anchor at that date, the low number of dated samples obviously gives a small window of the possible occupation span.

The first AMS-dated grave site in western Panamá

The area of Palo Alto, Boquete is well-known to recreational *huaqueros* in Boquete as a rich location for graves. The Kotowa coffee farm in Palo Alto was founded in the 1920's by a Canadian, Alexander MacIntyre, who is the grandfather of the current owner. The 31 hectare farm boasts several *ojos de agua*, rich soils, and a commanding view of the Volcán Barú and hence is desirable land for contemporary and pre-Columbian use. Construction workers excavating a new house foundation in 2004 recovered artifacts and the owner, Ricardo MacIntyre Koyner, slowed construction in order to allow me to excavate the area (Figure 3-11 and 3-12). The construction area was originally a cattle pasture and *huaqueros* removed a large number of artifacts from the general area over a span of many decades (Ricardo Koyner, personal communication). I designated the graves as BE-16-KH (KOT) and completed a series of excavated test pits, shovel test pit transects and surface survey on the property. AMS dates of 680 ±40 ^{14}C yr BP (β204731) and 600 ±40 ^{14}C yr BP (β204732) temporally situate the graves at roughly AD 1300 (see Appendix K for full AMS data).

FIGURE 3-11: CONSTRUCTION AND GRAVE SITE AT BE-16-KH (KOT); LOOKING WEST TOWARD BARÚ (13 KM DISTANCE TO THE SUMMIT)

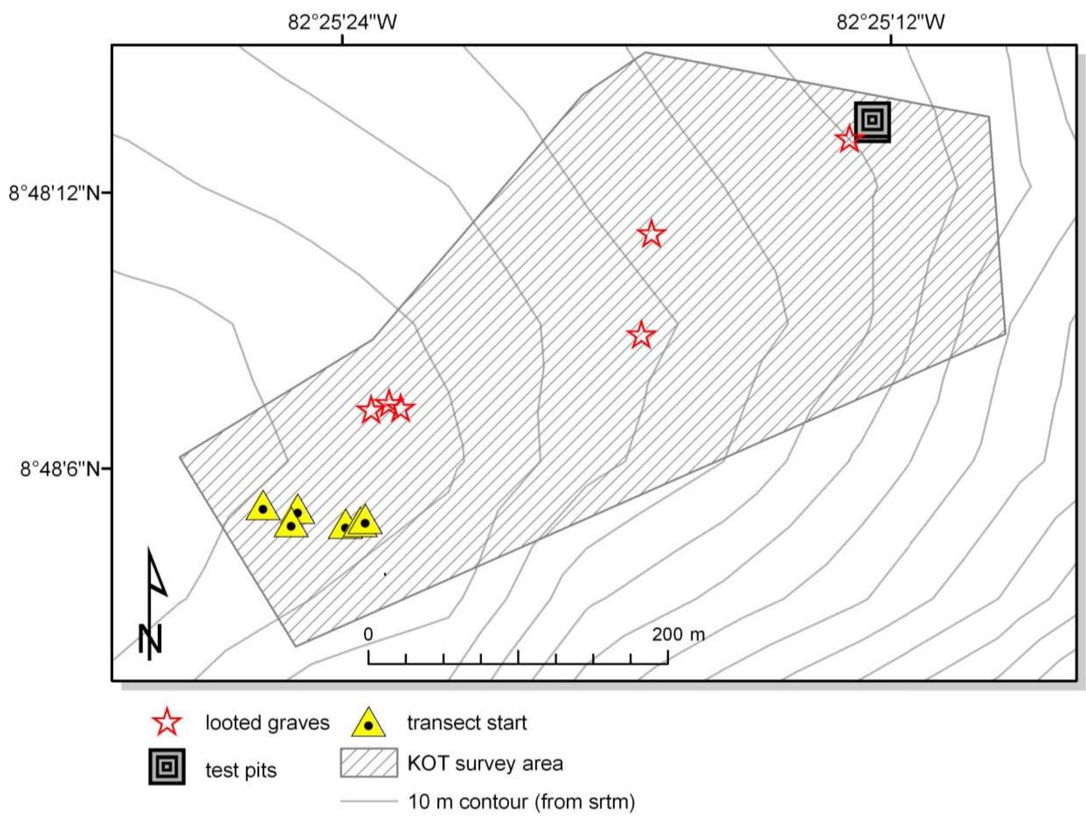


FIGURE 3-12: BE-15-KH (KOT) SURVEY AND EXCAVATION AREA

The dacite slabs used as capping stones for four graves I excavated in the BE-16-KH (KOT) construction site were spaced 3 m apart from one another and located in a linear pattern along cardinal directions (see Figure 3-13). From his examination of the records from 117 graves in Boquete, Osgood (1935: 243) concluded that graves generally are found 'in series forming a single line due north and south', which conforms to the pattern at BE-16-KH (KOT) when examining only the location of the capping stones. The actual burial cavities, however, were oriented northeast-southwest rather than to the cardinal directions Osgood noted. Osgood provided no information regarding who made the records he used in his study or when or how they were made; if the grave descriptions were made without the use of a compass the assumption of a cardinal orientation could have been approximate.

Accounts of graves in the Boquete area note the high concentration of burials within extremely close proximity to one another (Bateman 1860, Wassén 1936). It is entirely likely, therefore, that the spacing of the intact graves I excavated at BE-16-KH has less to do with the original layout of the cemetery so much as in the techniques utilized by recreational *huaqueros*. I excavated, in essence, the graves they failed to open. As was the case at other sites in my survey where heavy grave looting and agricultural activity were both present, mounds of dacite slabs (flat volcanic stones used in grave construction) were present at the Kotowa *finca* and indicate the excavation and relocation of grave construction materials.

The BE-16-KH (KOT) graves clearly are from a highly disturbed context. For this reason I constrain my interpretation and description of the material to the most reliable data I encountered, which were grave construction and an intact cache of grave offerings with associated AMS dates. I then examine some of the other artifacts found in the construction area, but not as clearly associated with a particular grave.

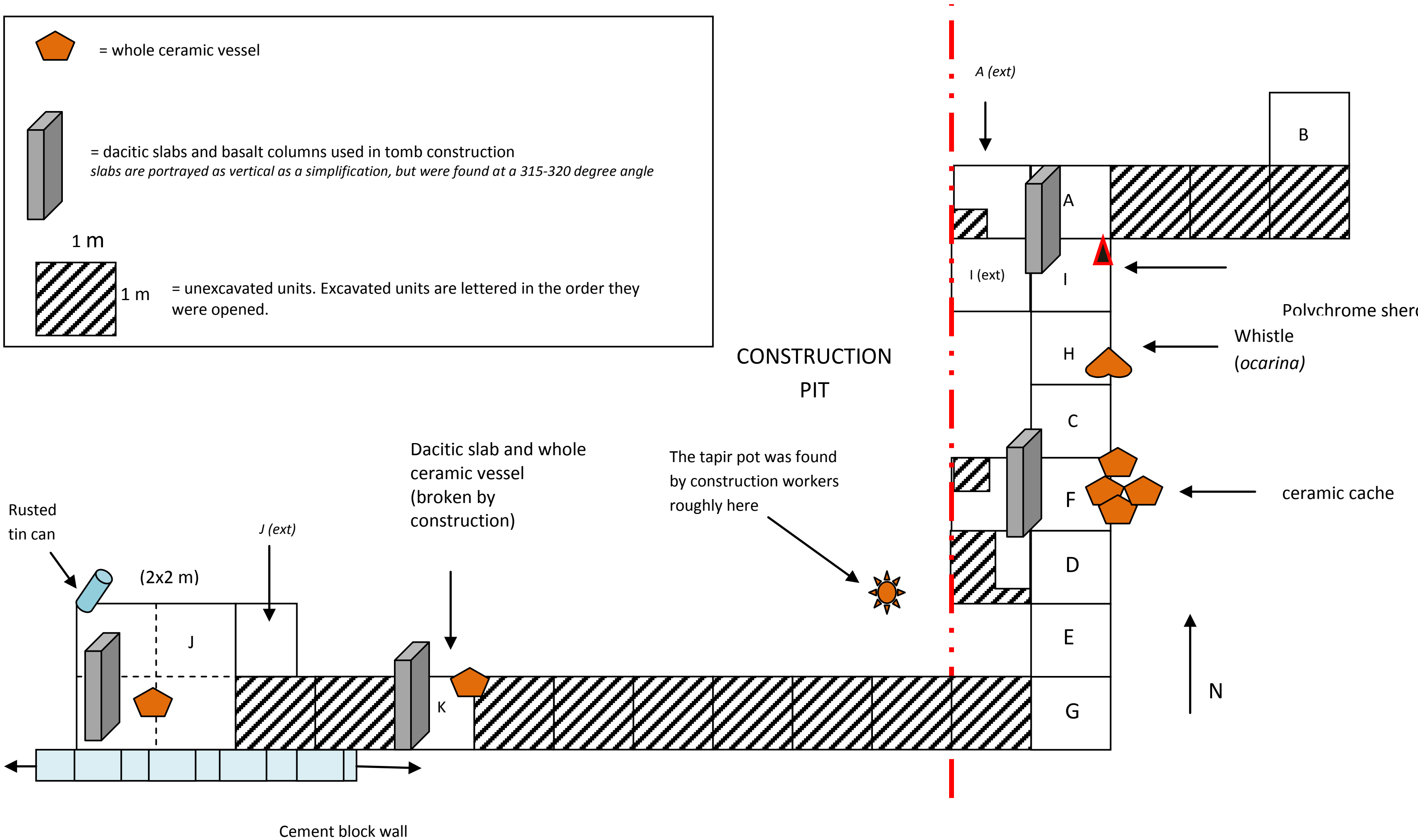


FIGURE 3-13: EXCAVATED TEST PITS AT BE-16-KH (KOT)

Grave construction

The grave construction of the KOT-J grave was intact while the other three graves were slightly disturbed due to natural settling of the grave, the frequent seismic events in Boquete, and the heavy equipment used in the house construction. A trench in the northwestern wall of the KOT-J unit revealed a heavily rusted tin can, indicating the probably activity of *huaqueros*, though they appear to have been distracted by the excavation of an adjacent grave and did not detect the presence of the KOT-J grave.

FIGURE 3-14: REMNANTS OF A TIN CAN FOUND IN KOT-J (68 CM DEPTH WITHIN THE CONSTRUCTION PIT)

The graves from BE-16-KH (KOT) do not match any of the construction styles described in prior discussions of Chiriquí burials (de Zeltner 1967 [1865]: 17-20, Holmes 1888, Joyce 1916b: 107-9, Merritt 1860) and seem to represent a yet undocumented style of grave construction.[115] The four graves were constructed using a carefully stacked wall of basalt columns created when lava flows cool and form crystalline structures.[116] Dacite slabs, or flat capping stones, overlapped one another at an angle

[115] Note that Holmes (1888: 18-20) casts aspersion on some of de Zeltner's grave descriptions as there is no indication of whether de Zeltner viewed any sites; additionally, Holmes (ibid.) notes that J.A. McNeil, who opened vast numbers of Chiriquí graves, had never seen some of the more complex chamber graves in de Zeltner's classification, though Stirling (1950: 243) describes an elaborate shaft grave with three *laja*-lined chambers at the site of Barriles.

[116] A natural outcrop of basalt columns occurs roughly 6 km from the BE-16-KH (KOT) graves and will be discussed further in the next chapter.

to create a roof (see Figure 3-15). The dacite slabs are a yellowish gray (Munsell 5Y 7/2) when dry and a light olive gray (Munsell 5Y 5/2) when wet. Dacite slabs, which are naturally flat-fracturing andesite, are also found in Costa Rica in the Arenal volcano area and their use represented a significant change in Arenal-area tomb construction during the AD 600-1300 period (Sheets 2004: 9). Greater Chiriquí graves were often constructed with stone walls, floors, and lids (Cooke 2005: 159, Snarskis 1981b: Figure 13, 1992: Figure 9, 10). The graves at BE-16-KH (KOT), however, lacked a stone floor and the burial cavity was lined with stone only on the two longest walls. Grave goods were found roughly one meter below the surface level, though exact depths were obfuscated as heavy machinery had stripped the surface of the entire construction area.

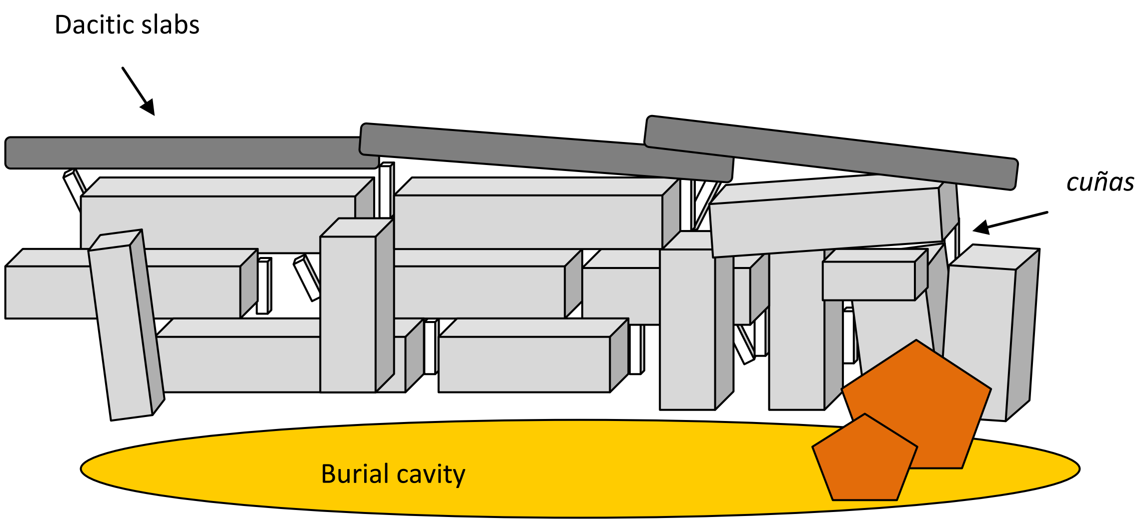


FIGURE 3-15: WALL OF BASALT COLUMNS FROM KOTJ AS SEEN FROM THE BURIAL CAVITY AND LOOKING EAST

The dacite slabs in KOT-A/I, KOT-F, and KOT-J were each angled with a 315°-320° azimuth (Figure 3-18). As I had seen illustrations of Chiriquí graves lined with flat capping stones (Barillas 1982, Linné 1936, Wassén 1949) I assumed upon excavation of the first grave that this angle was the result of settling or disruption. The uniformity of the angle and the integrity of the KOT-J construction, however, lend credence to the angle as an intentional design. Though no illustration was provided, this slanted roof does match an ethnographic description of Bribrí graves offered by Joyce (1916b: 105), who describes their construction as being 'in the form of a penthouse' in opposition to the flat grave caps favored by Cabeçar groups.[117]

Rather than a matching parallel wall of basalt columns, the uppermost end of the angled dacite slab was supported instead with large, unworked stones similar to those available in any Boquete stream bed. Many small stone chips were used as chinking stones (or *cuñas)* in between the larger stones. Burial cavities of roughly 0.5 x 2 m were excavated into the hard yellow clay and ash substrate. Grave goods were found throughout the burial cavity, but tended to be closer to the lower edge of the angled dacite slab.

	Direction of the upper edge of the dacite slab	Angle of the dacite slab	Length (cm)	thickness (cm)	width (end A)(cm)	Width (middle)(cm)	Width (end B)(cm)
KOT A/I	N (slightly W)	315°	69	4	26	-	26
KOT F	S (slight east)	320°	97	4.5	26	-	21
			82	4	48	-	49
			96	3	22	36	38
KOT J	N (slightly W)	315°	83	4	35	47	43
			96	4	50	-	23
			84	4.5		47	
						-	

FIGURE 3-16: WHOLE DACITE SLABS RETRIEVED FROM THE KOT GRAVES. THE KOT-K CONTEXT WAS TOO HEAVILY DISTURBED BY CONSTRUCTION TO OBTAIN AN ACCURATE IDEA OF THE PLACEMENT OF THE DASITIC SLABS AND IS NOT INCLUDED

[117] The diagonal placement of the *lajas* could possibly be what German archaeologist Otto Lutz (1922: 364-5) described when he stated that the Boquete graves he examined, which I anticipate were likely those in the area of my BE-14-KH (GON) site, were diagonally angled 'up the valley'. Lutz likely describes walls made of basalt columns, though his description is unique in that he describes finding bones in the burials. Lutz reports finding skeletal remains with knees bound to the chin and some gold.

FIGURE 3-17: PHOTOGRAPHS OF KOT-J DURING EXCAVATION SHOWING THE USE OF DACITE SLABS AND BASALT COLUMNS IN GRAVE CONSTRUCTION

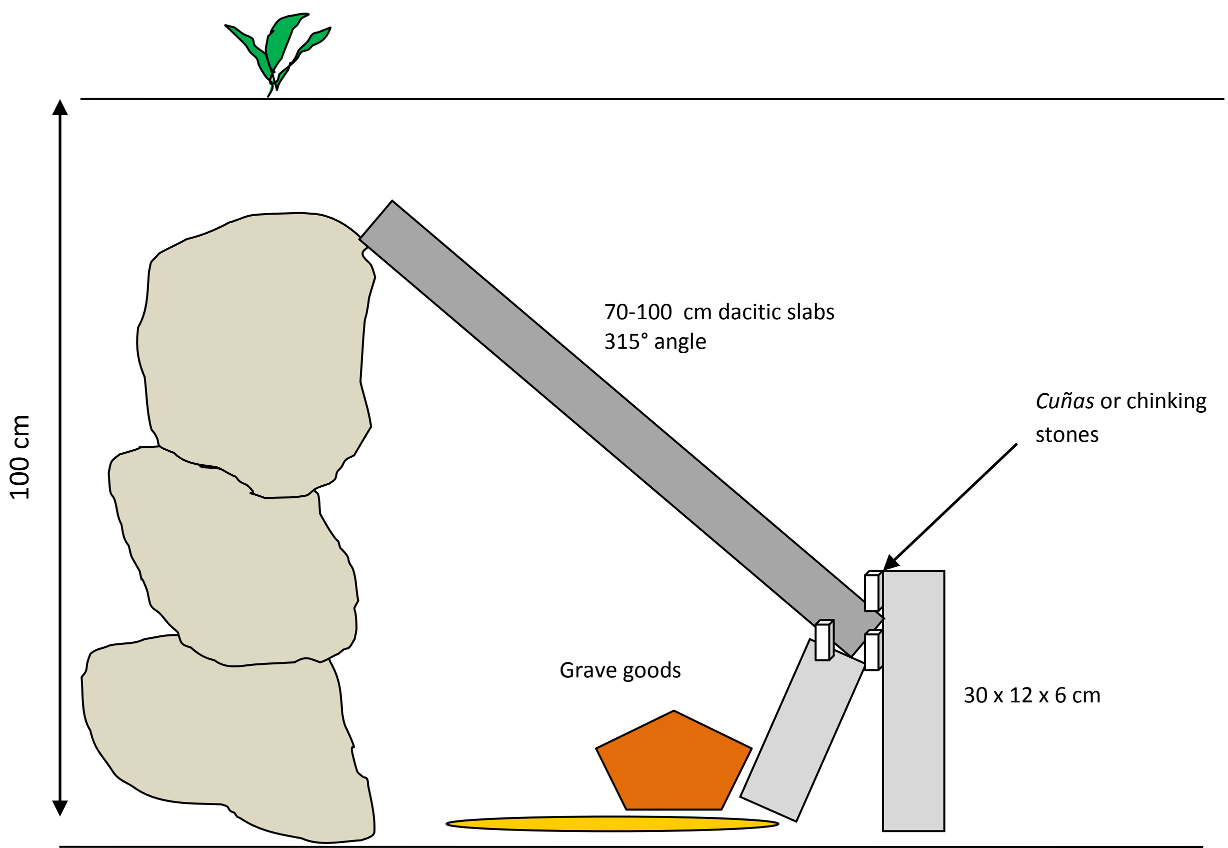


FIGURE 3-18: STYLIZED PROFILE OF THE KOT-J GRAVE CONSTRUCTION

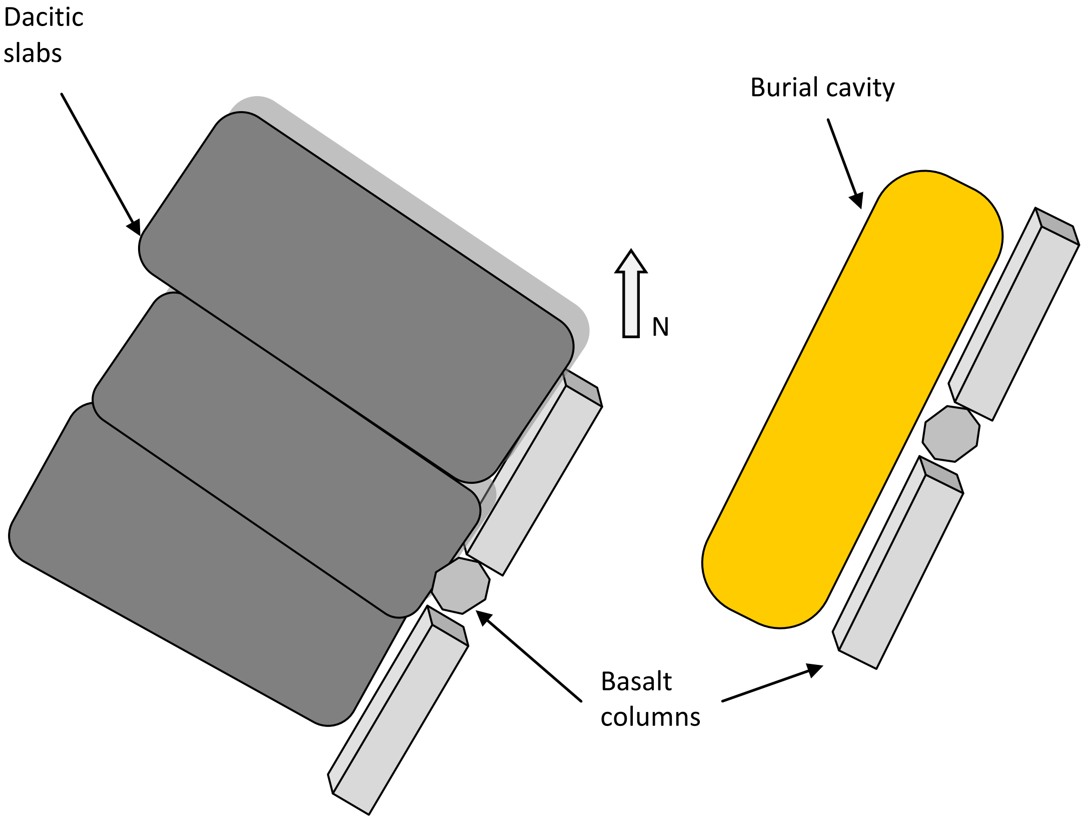


FIGURE 3-19: STYLIZED BE-16-KH (KOT) GRAVE CONSTRUCTION AS VIEWED FROM ABOVE, WITH DACITE SLABS (LEFT) AND WITHOUT (RIGHT)

FIGURE 3-20: A DACITE SLAB FROM KOT-F (SCALE IS 1 METER WITH 10 CM DIVISIONS)

FIGURE 3-21: BASALT COLUMNS FROM KOT-J

I excavated two other mortuary contexts in the Boquete survey area. The first of these, BE-18-KH (PLM), is dated by ceramics to roughly AD 200-600 and was constructed with rounded river stones rather than dacite slabs and basalt columns. These graves are two kilometers northeast of the coordinates provided for a grave site where J.A. McNeil took artifacts now held in the Harvard collection. Whole ceramic vessels were retrieved by local residents when heavy machinery widened a road, though the graves were completely dismantled by the time I arrived a week later. At BE-12-KH (GIO) I found finely fractured dacite slabs at precise right angles to one another along with chips of basalt columns (Figure 3-22 and 3-23). Cerro Punta Orange ceramics found in association with the dacite slabs are dated to AD 200-600 (Linares 1980a), though the overall ceramic record at BE-12-KH (GIO) stretches from 200 BC – AD 1500. The stones were just below the surface (40 cm depth) and did not seem deep enough for a grave, nor were there other graves in the area to indicate a cemetery. The area was, however, was commandingly placed upon a high, flat ridge with a very direct view of the Volcán Barú. As Haberland (1984a: 251) notes, such locations are characteristic for Chiriquí period cemeteries, though these were often also the preferred settlement locations for the earlier groups hence the later period graves sometimes cut into the older sites.

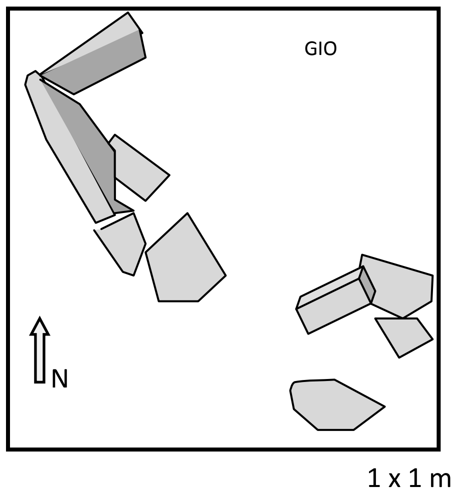


FIGURE 3-22: VERTICAL DACITE SLABS AT A RIGHT ANGLE AT BE-12-KH (GIO), GTESTC [118]

Stone foundations or walls in Greater Chiriquí domestic contexts are found in Costa Rica after roughly 2500 BP (Cooke 2005: 158-9, Corrales and Quintanilla 1996: Figures 5-10, Drolet 1992, Fonseca Zamora 1981, Quilter 2004, Snarskis 1981b: Figures 16, 20, 32). The documented stone foundations, however, are constructed with round cobbles rather than with dacite slabs. Until further data are available, I will interpret the BE-12-KH (GIO) dacite slabs and columnar joints as a heavily looted and nearly disassembled grave context. Further work to verify or dispute this interpretation, however, would be useful due to its lack of cohesion with general patterns of Chiriquí period burials, which tend to be concentrated in large cemeteries and more deeply buried.

[118] This 1x1 meter test pit, 'GTESTC', was located 2 meters from the following map location: 8.80889N, -82.47432W.

FIGURE 3-23: BASALT COLUMN IN THE SURFACE SCATTER OF BE-12-KH (GIO)

The BE-16-KH (KOT) grave construction is unique in published descriptions of Boquete area tombs in the use of stones, likely from a stream bed, to support one side of the dacite slab while basalt columns support the other. The use of dacite slabs and basalt columns, however, is otherwise very similar to the Boquete graves described by Henry Wassén (1949). Wassén (ibid: 152) notes that there seemed to be significant shifting of the grave materials from earthquake activity, looting, and tree roots and assumes that the original form of the graves he examined was heavily altered (see Figure 3-24). In viewing a schematic drawing of one of the graves Wassén examined, however, it seems plausible that the construction form was less disturbed than he imagined if the dacite slabs were similarly angled to those at BE-16-KH (KOT). Though Wassén conflated dacite slabs and basalt columns under the term *tapas* and describes them as either flat (i.e., dacite slabs) or rod-shaped (i.e., basalt columns*).* He similarly conflated them in the schematic drawing he provided, and it is possible that the construction could have mirrored that of the BE-16-KH (KOT) site rather closely if the shorter stones in his schematic are basalt columns.

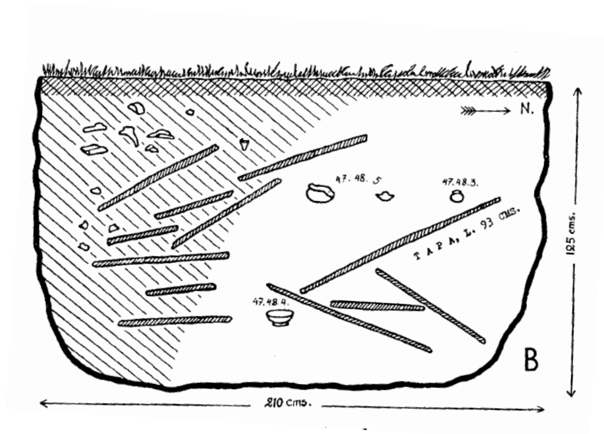


FIGURE 3-24: GRAVE CONSTRUCTION SCHEMATIC PROVIDED BY WASSÉN (1949: FIGURE 6, GRAVE I)

Wassén (ibid: 164-5) described the dacite slab in another grave as 'leaning at a sharp angle toward the south', yet interpreted the original construction without the angle and created a table-shaped reconstruction with vertical and horizontal dacite slabs (Figure 3-25).

FIGURE 3-25: GRAVE RE-CONSTRUCTION AS INTERPRETED BY WASSÉN (1969: FIGURE 18B, GRAVE II)

Bateman (1860) clearly describes dacite slabs, or 'large, flat stones, many of which would measure a yard square' and basalt columns, or 'quadrates, of four inches by twenty inches in length' in his description of graves on the northern flanks of Barú, though he provides little indication of tomb construction other than defining it as 'quadrangular' and constructed with vertical basalt columns in one section of the cemetery and with dacite slabs lining the sides and top of the grave in another.

Linné (1936: 97) provides a sketch from the western flanks of Barú of a single grave (Figure 3-26). His report is based upon notes and sketches and it is impossible to know if the schematic he provides is an interpretative reconstruction or an accurate portrayal of the excavated grave. A strikingly similar illustration was provided in the oil pipeline report by Barillas (1982) for a partially looted grave in the proximity of the Casita de Piedra site examined by Ranere (1980a). No mention is made of how accurate the interpretation of the tomb construction could be as it was at least partially disassembled when the archaeologists examined it.

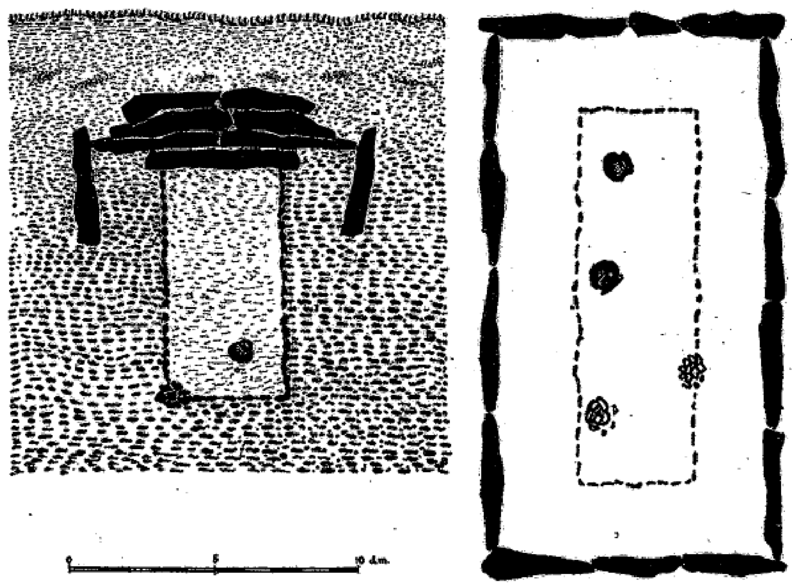


FIGURE 3-26: GRAVE CONSTRUCTION AS INTERPRETED BY LINNÉ (1936: FIGURE 1)

The KOT-F grave cache: ritual killing and inverted orders

The grave goods from KOT-F were the most intact and can be most confidently associated with an individual grave. As Quilter and Frost (2008: 36) found at the site of Rivas in Costa Rica, grave goods in KOT-F were concentrated at the ends of the grave cavity, possibly correlating to where the head and the feet would have been in the case of a primary burial. A softer earth, commonly called *tierra del muerto* and interpreted to indicate the possible location of a body or remains, did not provide a clear enough soil stain to confidently determine whether the grave represented a primary or secondary burial.

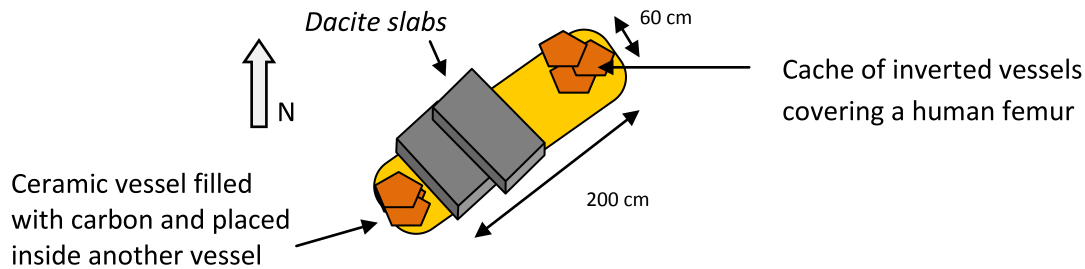


FIGURE 3-27: THE KOT-F BURIAL CAVITY

A total of ten complete or nearly complete ceramic vessels were associated with the KOT-F grave. This seems to be a fairly well-provisioned grave relative to Barú area standards. While Linné (1936: 97) states that the Czech-born looter, Louis Hartman, found as many as 30 vessels in a single grave in exceptional cases, Wassén (1949: 241) notes an average of only two ceramic vessels per grave and a significant percentage (38%) of graves with no ceramic vessels at all in his sample of 117 graves.[119] At the Costa Rican site of Rivas, up to 24 grave goods were recovered (Quilter and Frost 2008: 37).

The pre-excavation depth from the original soil surface is unknown due to the use of heavy machinery to level the surface of the grave area prior to my arrival, though I estimate that complete and nearly complete grave goods were recovered from the 100-170 cm depth below the pre-construction surface. Grave goods were clearly not all at the same original depth even when clearly associated with a single grave cavity. The ceramic vessels at the southwestern end of the KOT-F grave cavity were 30-40 cm higher relative to the cache of ceramics in the northeastern end. It appears that goods were not placed in the grave in a single stage. Linné (1936: 99) notes a similar trend for the grave he examined in Cerro Punta, as do Quilter and Frost (2008) for graves in Costa Rica.

[119] Additionally, stone tools were found in 12 of the graves that lacked ceramic goods and in 28% (n=56) of the overall sample of graves that Wassén (1949) examined.

At the southwest perimeter of the grave cavity, we removed the remnants of a globular Bisquit ceramic vessel with a smaller, plain vessel within it. Both vessels were broken by construction workers as they were embedded in the inner wall of the construction pit and appeared to have been interred while whole (see Appendix M: 9, 10]. The vessels were not reconstructed for photographs, though the carbon that heavily crusted the inner ceramic was AMS dated to a calibrated date of 680 ± 40 ^{14}C yr BP (β-204731).[120]

A nearly complete but broken vessel was recovered in the southwestern end of the burial cavity. The rimmed vessel had an *adorno* handle formed by an anthropomorphic figure resting its chin in its hands (see Figure 3-28 and the opening photo of this chapter as well as Appendix M: vessel 8), appears to have been purposefully broken (or 'ritually killed') at the time of interment as interpreted by the way the sherds were stacked within one another. Bollaert (1863: 150) also interpreted, based on the account of the Boquete graves described by Bateman (1860), that the ceramics were purposefully broken before burial.

FIGURE 3-28: RIM SHERD FROM A WHOLE CERAMIC (VESSEL 8) THAT APPEARED INTENTIONALLY BROKEN IN THE KOT-F GRAVE

[120] Radiocarbon dates from my project are listed in Appendix K.

The intentional destruction of grave goods was a common practice in pre-Columbian contexts. In *Seeing with New Eyes*, Rebecca Stone-Miller (2002: 169-70) discusses some of the possible motivations for the ritual killing of objects in pre-Columbian life. These could include a political statement showing domination over rivals and predecessors or the removal of the item from circulation so that it is not available to rivals. Though these could certainly be pertinent in some cases, Stone-Miller prefers a shamanistic interpretation of the act as a way of modifying the life force of the object in order to allow it to cross the liminal boundary between the world of the living and the realm of the spirits (ibid.). Ethnographic accounts describe a long and dangerous trip by the soul in the underworld to reach paradise, called Sibú, which abounded in fish and fruit (Joyce 1916).

This purposeful smashing of special vessels in special places seems particularly linked to unique anthropic or anthropomorphic forms (Quilter and Frost 2007b: 34). Two nasal snuffers from Costa Rica, likely used for psychotropic effects by shamans, were shaped like vultures and were ceremonially punctured though their middles (Snarskis 1981b: 200). A ceramic painted on the interior with crocodilian and turtle designs was intentionally killed and the pieces scattered in the grave of a young woman at the site of Cerro Juan Díaz in central Panamá (Cooke and Sánchez 2003: 19, Cooke, Sánchez, and Udagawa 2000: Figures 8.3a, b, 8.6, Feature 94). Peter Stahl (1986) associates the breakage and destruction of anthropomorphic imagery in South America with shamanism and hallucination and suggests that figurines and otherworldly spirits share an intimate relationship (see also Staller 2001). The process of destroying the objects maintains social codes, allowing for the continued animation or processes and circulation of materials (DeSilvey 2006: 324).

At the northeastern end of the KOT-F burial cavity we excavated a cache of six complete vessels (Figure 3-29). Individual photos and measurements for each vessel in the grave assemblage is provided in Appendix M.

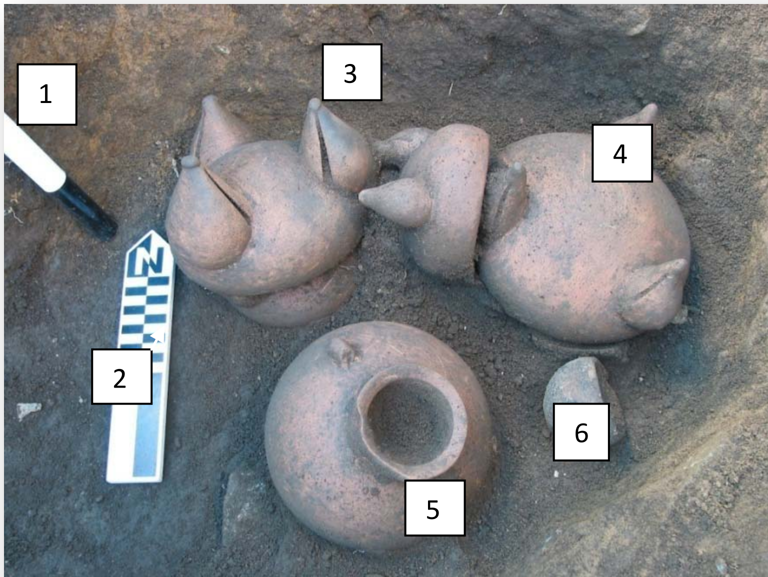


FIGURE 3-29: CACHE OF KOT-F POTS *IN SITU*

Three of the tripod ceramics in the cache were purposefully inverted (vessels 1, 2, and 4), which matches a description of an inverted tripod grave vessel in the Boquete graves observed by Wassén (1949: 170). Inverted ceramic vessels are common throughout Panamanian grave contexts.[121] While killing vessels though defacement or mutilation of them is one way to convert objects into forms that are compatible with other co-existing realms, inverting them also accomplishes a similar task (Stone-Miller 2002: 91, 169-70). This positioning orients the top of the vessel to the underworld while replicating the mirror image of the above ground world that the inhabited by the living (ibid.). This reversal of the normal order of things provides a physical representation of the pre-Columbian conception of co-existing realms of existence (ibid.). In the context of the discussion I provided of the Revolt of Objects myth in the introduction to this thesis, this possibly provides another example of the reversal inherent to the story.

[121] An inverted tripod bowl is also described from the Rivas site in Costa Rica, p 47 of Quilter (2004). As Richard Cooke (personal communication) points out, one explanation for inverted vessels found in Panamanian grave contexts is that they originally were placed on wooden stands.

The KOT-F ceramics that were inverted are frequently linked to breasts and feet through their definition as ‘mammiform tripods’. The clay pellets in the hollow appendages are defined as rattles and the ceramics themselves as vessels. Personally, I feel that the ceramics that were inverted in the KOT-F grave are highly evocative not of feet, however, but of stylized animistic heads with movable clay eyes. This gives the ceramic an association with sight and guardianship and flips it from that of a vessel, or something meant to hold something, to a cover or something meant to protect something. The concept of sight is already considered in discussions of painted ceramics from central Panamá, which evidence shamanistic images of crocodiles and hybrid animal-human subjects that prominently display eyes. The unpainted Chiriquí ceramics merit further consideration in their associations to sightedness. Important objects, such as gold figurines were very deliberately placed under unpainted Chiriquí ceramics. Conjecturally, this could have been intended as a means of warding off intruders from either the living or the spirit world from disturbing the grave context through the watchfulness of the guardian object.

Local Boquete legends narrate that when highly valued grave goods such as gold are included in pre-Columbian graves, they are found beneath an inverted ceramic vessel. Vessels 1 and 2 in the KOT-F cache did not have objects placed under them. The largest tripod, vessel 4, covered the shaft of a bone (Figure 3-30). This is a highly unusual find. The complete lack of human remains in highland Chiriquí graves is a well-known phenomenon due to the acidity of the volcanic soil (Cooke 1997b: 167, Holmes 1888: 20). Bollaert (1863: 154) provides one of the very few descriptions of finding bone in Chiriquí graves, though states that it crumbled immediately upon excavation.

The size of the KOT-F burial cavity supports the interpretation that a complete body or skeletal remains could potentially have been interred. No other remains were found in the grave, however, and the location of the grave goods at the far extremity of the grave cavity (i.e., at either the head of the foot of the grave) as well as the location of the bone directly under the inverted ceramic seem to indicate something other than a coincidental preservation.

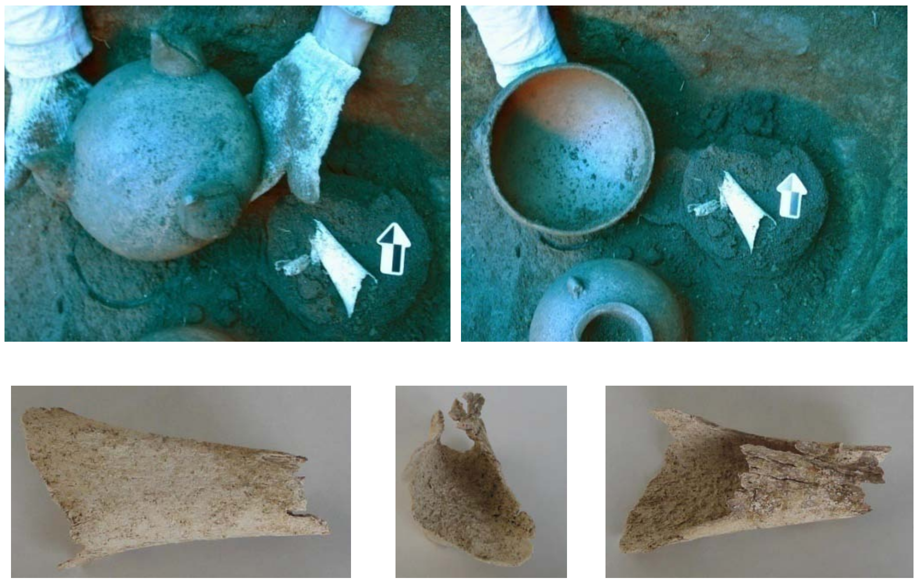


FIGURE 3-30: THE BONE GOUND UNDER VESSEL 4 OF THE KOT-F GRAVE CACHE (PRE-CONSERVATION MEASUREMENTS: 4.10 CM AND 2.14 CM DIAMETERS; 6.73 AND 8.18 CM LENGTHS; 0.92 CM BONE THICKNESS) [122]

Aureliano Valencia identified the bone as a portion of a human tibia and soaked it for two hours with a 3% solution of acryloid B72, acetone, and 30% solution of ethyl acetate to consolidate it at STRI. Crumbled samples of the bone that could not be consolidated were reserved prior to the chemical processes for possible stable isotope testing, or any other future research use. Both the upper and lower extremities of the bone were missing; in a tibia these possibly could have provided information regarding the age of the individual from whom it came as changes in bone connection occur in early adulthood.

[122] The quality of the *in situ* photos was negatively impacted by the lack of light caused by a tarp that had to be pulled over the grave due to rain.

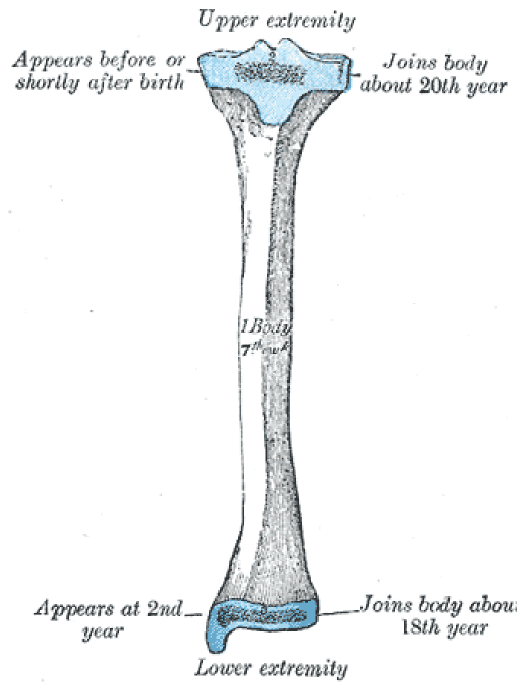


FIGURE 3-31: HUMAN TIBIA AS SHOWN IN GRAY'S ANATOMY (GRAY 1918)

Human bones can be found buried inside large ceramic vessels in Panamá, as was the case at sites such as Cerro Juan Diaz. The careful curation and use of human and non-human bone was also important throughout the isthmian area. Carved animal bone objects found in Costa Rica are viewed as important cult objects (Stone 1963). A deer metatarsal bone recovered from the La Pitahaya site on the Caribbean coast of Panamá also lacked both proximal and distal ends and was perforated with holes that likely were used to suspend it from a cord (Linares 1980f: 143). The presence of a human bone with no obvious signs of carving or work in the place usually reserved for valued objects, however, adds further dimension to its role. Ethnohistoric and archaeological data point to a concern for ancestors that entailed multi-stage burial rites, mortuary houses where embalmed remains were displayed, and multi-generational use of tombs (Briggs 1989, Cooke 2001, 2005: 160, Cooke and Jiménez in press, Díaz 1999). Human bone in the pre-Columbian world was often removed from burials for secondary treatment and could circulate for centuries until redeposited as heirloom items (Joyce 2000). Heirlooms, or 'history objects' can be used to provide physical evidence of alliances and affiliations and link the living to the dead (Hoskins 1993: 118-41, 1998: 11, Joyce 2003: 16, Meskell and Joyce 2003: 77).

The purposeful positioning of the inverted ceramic over the bone raises the possibility that the bone was a grave offering for the person interred in the grave rather than a remnant of that person. In this sense, the bone could represent an object as well as a subject. The divide between nature and culture and subject and object which we impose on Amerindian contexts does not necessarily bear any context to their past perception, particularly in relation to the human body (Fausto 2007). In the Rio Negro region of Colombia, a flute made from the femur of an enemy was believed to contain the victim's breath and, as it became inalienable from its owner, was buried with the killer (Fausto 2007: 509, Journet 1995: 191-7). In this context bone becomes a receptacle and synecdoche for other, less tangible elements of life. Breath and blood are inherently transformable and fleeting, but bone retains a comparatively stable physical essence (Meskell 2003: 77).

Other BE-16-KH (KOT) mortuary artifacts

Ethnographic accounts attest to the importance of many perishable items such as feathers, blow-guns, tattoos, body paints, animal skins, textiles, and musical instruments in indigenous isthmian lives (Bray 1984: 327, Joyce 1916b: 98-9, Lathrap 1973, Linares and Ranere 1980b: 80). Carbonized plant remains offer important indicators of pre-Columbian foodstuffs in western Panamá that were usefully incorporated into the Linares-Ranere project (Galinat 1980, Ranere 1980a, Smith 1980). These objects, in general, fall within the 90-95% of organic material culture important in the lived experience of past people but not accessible to archaeologists (Drooker 2001). Pre-Columbian grave contexts likely held a great number of organic offerings and items that are not easily accessible archaeologically.

The ceramic vessel filled with carbon in the BE-16-KH (KOT) grave clearly attests to some unidentified organic material, likely a foodstuff, that was placed within the vessel. Less identifiable were a significant number of unusual spherical casts that were found in the BE-16-KH (KOT) graves. The presence of these casts, like that of the bone, is puzzling as they are not carbonized (Figure 3-32). The casts in the BE-16-KH (KOT) graves were associated with nearly complete ceramic vessels and were found in each of the graves, including the intact burial cavity of KOT-F in association with grave goods (Appendix M). I initially identified these objects as palm casts based on their similarity to modern palm fruit and similar interpretations by the Linares-Ranere project (Smith 1980).

The casts I recovered appeared very similar to *Acrocomia Mexicana* casts identified at the site of Barriles by the Linares-Ranere project as (Smith 1980: Figure 10.0-6: e,f), though the Linares-Ranere project casts were more frequently only fragmentary.[123] The 65 casts that I recovered throughout the course of fieldwork were often whole, but extremely fragile and crumbled easily once recovered. The lack of whole palm remains in the Linares-Ranere project sites is logical, as they excavated domestic contexts and the palms would have been shattered for food. If the whole spherical objects I excavated were correctly identified as palm fruit casts, one possible interpretation is that they were deliberately interred with the BE-16-KH (KOT) grave goods as sustenance for the dead individual in the afterworld.

[123] The local name for the palms described by Smith (1980) is *corozo pacora.*

FIGURE 3-32: SPHERICAL ORGANIC CASTS INTERPRETED AS EVIDENCE OF PALM NUTS USED AS GRAVE OFFERINGS

As my own uncertainty about the process by which these casts were made and preserved mirror those of C.E. Smith (1980: 163) of the Linares-Ranere project, I will quote the earlier description:

> The evidence for plant material from the Barriles site is very unusual. While some small fragments of carbonized plant material were recovered (largely flecks of wood charcoal), all of the large, recognizable plant parts are casts of the original organic material. The material which forms the casts is not a uniform plastic, which is the normal cast-forming substance when a plant part rots away and the mold is filled, nor is it a crystalline material, which is often the result of replacement of plant material by water-borne minerals. The material which forms the casts at Barriles is a plastic material probably little different from the surrounding fill. It includes crystals, rounded bits of rock, and soil particles. The mechanism by which the cast is formed and subsequently holds its shape is unknown.

Ranere (1980a: 38-9) points out that the palms are not native to the higher elevations of the Volcán Barú slopes. If the casts are of palms, their presence at the BE-16-KH (KOT) site and at the high elevation sites examined by the Linares-Ranere project possibly indicate that the palm fruits were imported to the highlands from lower elevations. Alternately, cultivation of palms at the higher elevation is a possibility (ibid.).

Ethnographic accounts of Bribrí burial rites in Chiriquí describe a fire that is burned for nine days and then extinguished with a calabash of chocolate before seeds and shavings are dropped into the burial one at a time by friends and relatives of the dead person (Gabb 1875: 104, Joyce 1916b). Each seed represented one story told by one person and carried a tremendous social and emotional valence. Should these prove to indeed be casts of fruits that were deliberately placed into graves, this would provide a facet of information that has been overlooked to date. While material wealth is possibly evidenced by the permanent grave goods, these more ephemeral offerings possibly indicate 'emotional wealth' as evidenced by the friends and relatives willing to contribute a story.

I personally prefer the interpretation of the spherical objects as palm casts due to the social richness it adds to the grave remains and for the correlation the casts would then have to other interesting work in Panamá. For example, thousands of carbonized fragments of *Acrocomia Mexicana* and other palms were recovered in the Preceramic and Early Ceramic Aguadulce shelter (Dickau 2005). Additionally, recent research in Bocas del Toro is directing renewed attention to the role of wild or semi-domesticated palms in pre-Columbian western Panamá (Wake 2006). It must be noted, however, that Richard Cooke strongly questions the interpretation of the spherical objects as palm casts and has noted, upon consultation with entomologists at STRI, that similar objects can be made by stag beetle (*Lucanidae)* larvae. These beetles feed anywhere that rotting wood is found. Should the spherical objects excavated in my project be insect rather than plant related, perhaps some association to human occupation sites can be researched in the future as none were found in any archaeologically sterile contexts in my survey and were found in close association with archaeological contexts.

A great number of the artifacts from the BE-16-KH (KOT) grave site could not be easily associated with a particular grave cavity. This may stem equally from burial practices as from degradation of the original cemetery context. Grave goods and stones used to construct graves in Costa Rica were not necessarily clearly aligned, possibly because the paving stones were put in place significantly later than the burial (Quilter and Frost 2008: 36). It is also highly possible that grave offerings found close to the surface of graves could represent offerings made long after the burial. Secondary and multi-stage burials, such as are found in central Panamá, could also explain this pattern (see Cooke and Jiménez in press).

Construction workers recovered an anthropomorphic vessel prior to my excavations at the BE-16-KH (KOT) site from an area closest to the KOT-J grave (Figure 3-33).[124] The vessel was nearly whole but damaged in the construction process. The anthropomorphic pot was reconstructed by Aureliano Valencia at STRI, who used acryloid B72, *polyfilla remplissage cellulosique*, and a mixture of pigments to match the adhesive color to the original. The vessel is unpainted and unslipped, though the neck of the pot is decorated with incised pellets of clay.

FIGURE 3-33: THE RITUALLY KILLED ANTHROPOMORPHIC POT FROM BE-16-KH (KOT)

[124] Rim diameter: 10 cm. Rim thickness: 7.6 mm. Height: 16 cm.

Though armadillos are frequently represented in Chiriquí ceramics, the lack of any markings or indication for a carapace suggests that the pot represents a tapir or possum (Richard Cooke, personal communication). Ethnographically, tapirs were thought to have been owned by supernatural beings that lived inside the rocks of particular mountain peaks (Joyce 1916: 102). Tapirs are frequently portrayed in Chiriquí ceramics from the Barú area (e.g., Joyce 1916: 143, MacCurdy 1911: 145).[125]

Like the anthropomorphic handled vessel in the KOT-J grave, the vessel was ritually killed. Rather than smashing the pot, however, the pot killer punctured or drilled small holes in the bottom of the vessel. This form of ritual killing is found in other Boquete contexts (Wassén 1949: 161, Osgood 1935: 243) and is long noted in Coclé contexts from central Panamá (e.g., Mason 1941). The presence of ceramics within a single grave that were killed by two different means poses an interesting question of what the different techniques – smashing versus drilling – indicated or meant to those burying the dead individual. This question is unanswerable from the data.


FIG. 39.—Talamancan vase representing a tapir. *Yale University. After MacCurdy. Scale ⅓.*

FIGURE 3-34: A TAPIR POT ILLUSTRATED BY JOYCE 1916: 143 (SEE ALSO MACCURDY 1911: 145, FIGURE 245)

A ceramic whistle was recovered from very near the surface (~10 cm below the post-construction leveling) in the KOT-H unit (Figure 35). This places it slightly closer to the grave construction materials of KOT-A/I than that of KOT-F, though it could originally

[125] For a discussion of some possible tapir associations please see Appendix Q.

been associated with a different but missing looted tomb. Similar whistles are also found in the McNeil artifacts in the Harvard, Yale, and Smithsonian collections. The whistle is slipped with red on a buff body painted with bisecting parallel black lines.

Whistles were multivalent objects as they were both musical instruments and personal adornment when suspended from a cord and worn as a necklace (Stone-Miller 2002: 114). Holmes (1888: 161) provides an illustration of a similarly shaped double whistle, which he likens to a primitive Roman *tibiae pares* and describes as either being pear or gourd shaped (see also MacCurdy 1911: 170, Figure 274). An alternate interpretation of their shape is testicular (Luz Graciela Joly, personal communication). The interpretation of the whistle as a reference to genitalia is interesting when the object is considered as a personal adornment rather than a musical instrument. Pronounced genitalia are common in isthmian artifacts and are thought to have conveyed fertility and power (Stone-Miller 2002: 120). Wearing the whistle as a male could have intended to provide or connote an visual redundancy in similar ways that an Olmec jade axe holding a version of itself (Miller 1996: 18, Figure 3), a Moche Warrior Priest depicted wearing earrings that connote itself, or a jaguar effigy represented with smaller jaguars hidden in his spots (Stone-Miller 2002: 108, no. 222). These examples of reiteration and restatement reinforce status or power by concentrating the message. Alternately, if worn by a female some other message or invocation of fertility could be implied. Joyce (1916: 147) notes that whistles often portray pregnant women, which potentially supports a fertility aspect to the objects, though Joyce believes that they objects were potentially toys.

FIGURE 3-35: CERAMIC DOUBLE WHISTLE FROM KOT H.1 (3.63 CM X 4.5 CM). UPPER PHOTO SHOWS THE WHISTLE IN SITU WITH ASSOCIATED CARBON (AT THE UPPER POINT OF THE TOOTHPICK)

A polychrome rim sherd from the KOT-I unit is likely associated with the grave construction represented by the dacite slabs and basalt columns scattered in the KOT-A/I units, though was not clearly contained within a burial cavity and was only 40 cm below the construction surface (Figure 3-36). The recovery of a polychrome piece is quite rare in the Boquete area. Osgood (1935: 235) notes that of the 4,000 pieces in the Yale collection, only seven are polychrome. Twenty polychrome sherds in total were recovered from BE-16-KH (KOT), which provides a slightly higher percentage (0.034) of diagnostic ceramic sherds than that of the whole pieces in the Yale sample (0.001). Polychrome ceramics are most often associated with sites in central Panamá (Cooke 1985, 1995, Ladd 1964, Lothrop 1942, Mayo 2003). One of the salient characteristics of the Greater Coclé culture area is its polychrome tradition, which is very distinct from the ceramics of Greater Chiriquí.

FIGURE 3-36: POLYCHROME SHERD FROM KOT I(EXT).4 [126]

The polychrome rim from KOT-I appears to be a central Panamanian piece (Francisco Corrales, personal communication; Richard Cooke, personal communication). Polychrome ceramics at the site of La Pitahaya (IS-3) are interpreted as indications of contact between coastal sites along the Gulf of Chiriquí and central Panamanian sites (Cooke 1980). A very similar vessel excavated from a grave context in the Azuero Peninsula (He-4; see Figure 37) was identified as a Conte pasta beige vessel produced in the northern Coclé region from approximately AD 750-50 (William Locascio, personal communication). This pottery style is found in earlier Sitio Conté sites (Lothrop 1942).

FIGURE 3-37: CONTE, PASTA BEIGE VESSEL RECOVERED FROM A GRAVE IN THE AZUERO PENINSULA OF PANAMÁ (EXCAVATION AND PHOTOS BY WILLIAM LOCASCIO; PARP 2007, HE-4-D-4, STRAT 1, EXCAVATED 10/24/07)

[126] My thanks to Francisco Corrales, William Locascio, and Scott Palumbo for helpful discussions of these sherds.

Miniaturization, 'miscellanea', and impermanence

Stone sculpture is a hallmark of head villages in Central American chiefdoms (Cooke 1997b: 167, Haberland 1973). Recent work is addressing the symbolic and social significance of stone sculptures in the Chiriquí region and attempting to provide temporal proveniences to different styles and forms of stone artifacts and address the social, economic, political, and ideological statements the objects were meant to embody (Quintanilla 2007, 2008). The phenomenon of stone sculptures in the Chiriquí region was related to a period of social change in which populations increased and institutionalized social inequality grew as hierarchical societies replaced egalitarian villages (Quintanilla 2008).

The best known and most frequently cited lithic figurines from the Barú area are the male figures shown supported on the shoulders of other males (Figure 3-38); the lower men are interpreted as slaves (Haberland 1968, Sheets 2008).

FIGURE 3-38: LIFE SIZED VOLCANIC STONE FIGURES FOUND AT THE SITE OF BARRILES. FIGURES ARE NEARLY LIFE SIZED

For further discussion of these statues see Cooke and Sánchez Herrera (2004b). (Photos taken by K. Holmberg in the Museo Antropológico Reina Torres de Araúz, Panamá).

The rarity, size, and quality of figurines like those at Barriles are associated with a centralization of power at the site (e.g., Linares and Sheets 1980).[127] Sculptures made from volcanic stone became common in Chiriquí between AD 1000-1500; they are standardized, and associated with larger populations and the development of complex chiefdoms (Stone-Miller 2002: 141). No well-documented context of stone sculptures in funeral contexts exists, and yet sculptures and figurines are frequently found in the outskirts of cemetery areas (Quintanilla 2008). Large-scale stone sculptures were possibly used in public spaces or during public activities, and the wear on many sculptures indicates that they were used on multiple occasions and possibly moved in order to protect them during periods of non-use, though no indication of exactly how or why they were used is known (ibid.).[128]

In addition to the carefully executed sculptures found at Barriles, a predominance of incomplete or crudely made stone figurines and statues are found in Chiriquí (Quintanilla 2008: 7). Both stone and ceramic objects in Chiriquí are found in smaller iterations that are termed 'miniatures' (e.g., Quilter and Frost 2008: 37) or 'toys' (as is the case in the Smithsonian accession files). No well theorized or ethnographically backed explanation exists for the existence of these small or poorly executed representations of other larger, carefully manufactured items, though miniature tools are often found in Talamancan graves (Gabb 1875, Quilter 2004: 189).

Many of the small, crude lithic objects I recovered in the 2004 Chiriquí survey defied easy categorization as either artifact of ecofact. The Linares-Ranere project researchers included some of these objects in an appropriately titled chapter, 'Miscellaneous artifacts of special use' (Linares 1980f). Three pumice objects discussed by Linares (1980b: 140) are described as 'problematic', which I also find is an apposite

---

[127] Nicely done drawings of the Barriles sculptures can be found in Linares, Sheets, and Rosenthal (1975: 142, Figure 5) and reprinted in (Linares 1977b: 24, Fig. 7).

[128] The Chiriquí style of stone sculpture is significantly different from that found in central Panamá at sites such as El Caño (Linares 1977b: 35, Figure 15). Current work with these sculptures is being conducted by Julia Mayo.

assessment. Linares notes that one of the pieces is grooved at the top, but both in the written description and in the drawings of the small (2.4-4.5 cm long) objects no clear idea of their form or function is possible. I recovered four tephra objects from the BE-16-KH (KOT) site. No clear use or form is evident to the pieces, though they have clearly been worked and are very distinctively ‘something’.

FIGURE 3-39: KOT (8.2) TEPHRA OBJECT

FIGURE 3-40: TEPHRA OBJECT FROM KOT B.5

FIGURE 3-41: TEPHRA OBJECT FROM KOT D.6

FIGURE 3-42: TEPHRA OBJECT FROM KOT G.1

Two of the tephra pieces have holes that are drilled only part of the way through the object (Figures 3-39 and 3-40), which negates their possible use as beads. Two of the pieces seem somewhat complete (Figures 3-40 and 3-42), though the other two (Figures 3-39 and 3-41) appear to be missing a portion of the original form and appear to be fragments of stone sculptures.

Figurines of men, women, and anthropomorphic hybrids in the Barú area were made with similar forms and motifs but from materials of varying permanence and elaboration (Holmes 1888: 41, 45). A high level of detail and attention was paid to some figurines, while others of nearly identical form were crudely executed or seemed unfinished (ibid.: 23-24). One 'plain, rude specimen' made of copper-alloyed gold was described by Holmes (1888: 41) thus:

> The body is solid and the surface is rough and pitted, as from decay. In many respects it resembles the stone sculptures of the isthmus.[129]

This concept of decay as well as the reiteration of similar forms in multiple materials seems key to the understanding of 'problematic' artifacts like the tephra objects. The tephra represents a midway point between the organic items that other objects were likely created from and the more difficult to execute and permanent stone or metal objects. The multiplicity of materials used for similar representations could hint at a wide gulf of our understanding of the role the objects played in pre-Columbian life. Both in the looting and the archaeological assessments of Chiriquí artifacts, attention is weighted to the value of the material that comprises the object rather than to the value of the form represented. The friability of the tephra objects makes them impermanent in the archaeological context, though their ease of manufacture could have made them desirable if their function in grave contexts was just as 'potent' as similar forms make from more permanent material.

[129] This piece was excavated by J.A. McNeil. Holmes (1888:41) lists that this site was 'near the south base of Mount Chiriquí [Barú]'. The site that most matches this location from the records of McNeil's work is one I estimate was located in the vicinity of 8.716667 N 82.533333 W, which is 8 km west of the BE-17-KH (PLM) site in my 2004 survey.

Random ceramic nubs, *adornos*, and miscellaneous objects from the artifacts kept in the Benigno T. Argote grade school in Boquete provide slightly more durable, yet still eroded, examples of forms the tephra objects possibly once approximated (Figure 3-43). Like two of the four tephra objects (Figures 3-39 and 3-40), many of the ceramic figures are punctured by holes that are not meant for any obvious function but are instead part of a design or meaning given to the figure. The middle ceramic in Figure 3-41, which seems to resemble a human female with a hole marked in a pregnant belly, is quite similar to a stone figure found in Costa Rica (see Quilter and Frost 2007a: 38).

FIGURE 3-43: CERAMIC *ADORNOS* FROM THE BENIGNO T. ARGOTE SCHOOL (PHOTOS BY K. HOLMBERG)

Lithic objects from Costa Rica (Figure 3-42) also show grooving and holes that could indicate forms that were recreated in a spectrum of materials of different permanence, including tephra.

FIGURE 3-44: LITHIC FIGURINE MADE OF VOLCANIC STONE FROM COSTA RICA (PHOTOS BY I. QUINTANILLA)

One pumice object (Figure 3-41) lacks any holes or grooving, but has a carefully created, flat shape. The piece could potentially be seen as a miniaturized representation of objects generally created from much harder stone. Miniature celts and mace heads as small as 2 cm from a grave in Greater Nicoya, Costa Rica were made in a range of greenstones meant to approximate jadeite (Stone-Miller 2002: 159, Figure 384a-w). A wide array of stones of varying durability were used, so long as they were green, and the shapes of the miniature pieces was irregular, possibly in order to preserve as much of the original stone as possible (ibid.: 160). A similar desire to utilize the natural shape of the stone rather than modify it is noted in 'crude' limestone figurines in Panamá (Mitchell 1962).

An object (Figure 3-45) recovered from BE-14-KH (GON) appears to be a lightly sculpted stone figure and resembles similarly ambiguous sculptures from Costa Rica (Fonseca Zamora and Chávez Chávez 2003). The sculpting seems to play upon natural fissures and bands in the stone. This reinforcement and incorporation of geological elements of stone is described in other contexts as a way of 'releasing' or enhancing the character of the rock (Cooney 2002: 219, Thomas 2004a).

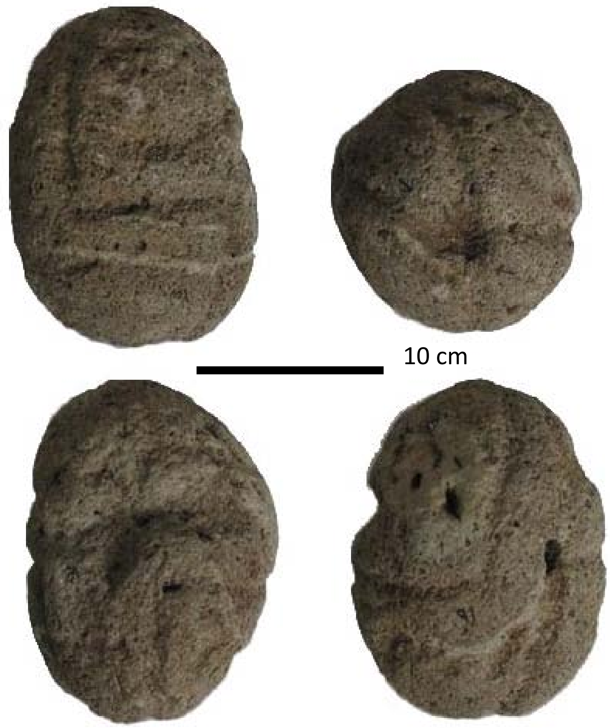


FIGURE 3-45: THE LITHIC FIGURINE FROM SURVEY AT BE-14-KH (GON). (110.0 X 95.8 X 61.4 MM; PHOTOS BY K. HOLMBERG)

The figurine was recovered from an area that separates a concentration of several dozen petroglyph boulders from a heavily looted cemetery in association with a number of *mano*, *metate*, and dacite slab fragments. The highly eroded and amorphous figurine (Figure 3-45) strongly resembles an unfinished, less carefully, or less permanently rendered version of more clearly 'artifactual' objects such as the Barú area figurines that were retrieved by J.A. McNeil (Figure 3-46).

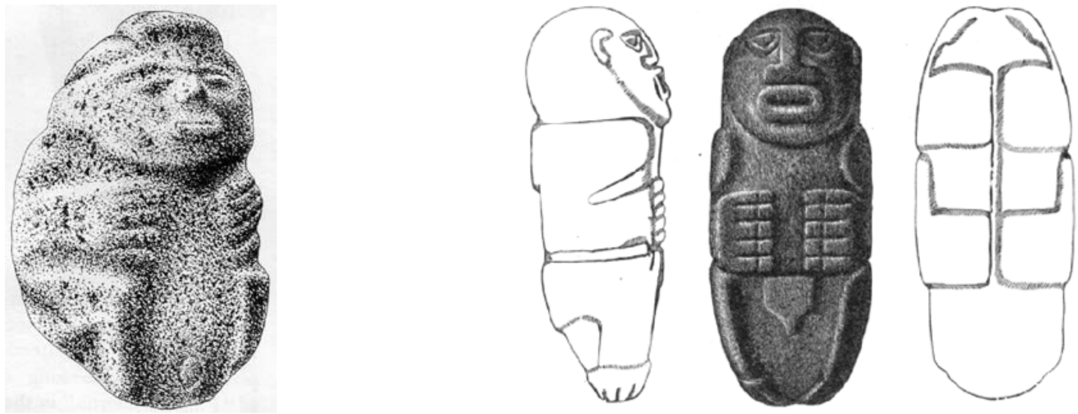


FIGURE 3-46: LITHICS MADE FROM VOLCANIC STONE AND RECOVERED FROM THE BARÚ AREA BY J.A. MCNEIL (LEFT IS FROM MACCURDY 1911 : 37, FIGURE 38, RECOVERED FROM BUGAVITA; RIGHT IS FROM HOLMES 1888: 24, FIGURE 7)

Faintly carved stone objects of up to 15 cm in length are commonly found in the Diquís sub-region of Costa Rica; though they may appear to be pre-forms for sculptures, many of them show traces of use wear on the base or lower portion (Ifigenia Quintanilla, personal communication). For *what* use is uncertain.

FIGURE 3-47: STONE FIGURES FROM COSTA RICA (PHOTOS BY I. QUINTANILLA)

The cruder figurines, like the more carefully executed ones in Figure 3-45, are identified by the circular grooving and an ovoid shape. A re-analysis of the 214 objects defined as notched and grooved stones from the site of La Pitahaya by Shelton Einhaus (1980: 459, Figure 15/12), in light of the recent work by Quintanilla (2008) with Chiriquí figurines could provide interesting new data from the stored artifacts. Shelton Einhaus (1980: 459) tentatively suggested that these objects were used as fishing net weights. She also notes that they are almost uniformly made of green siltstone. This matches the already noted pattern in Costa Rica for replications and miniature versions of valuable objects in less durable material (Stone-Miller 2002: 160). It is highly probably that at least some of these objects should be reclassified as figurines.

The Diquís region of Costa Rica is known for its monumentally sized stone balls that dwarf the human form and can be seen for great distances in the landscape. Similar but far smaller stone balls are found throughout the Costa Rican portion of Greater Chiriquí (Ifigenia Quintanilla, personal communication).[130] The miniature monumental balls are also found in the Barú area in the family collection held at the site of Barriles and the Benigno T. Argote school collection in Boquete (see Figure 3-2). A stone sphere with a diameter of roughly 18 cm (Figure 3-48) was recovered from my surface survey at a midway point between the lithic manufacturing site of BE-19-KH (JRC) and the occupation site of BE-18-KH (MAR).

FIGURE 3-48: SPHERE RECOVERED FROM THE SURFACE AREA NEAR MAR (PHOTO BY LEZLIE MILSON DE ICAZA)

These smaller versions of the stone balls differ from grinding or nutting stones as they show no use of working surfaces. Linares-Ranere project researchers reported 18 specimens of volcanic stone balls and ovals from the Barú area and noted that their

[130] Many thanks to Ifigenia Quintanilla, who provided photos for similar stone balls found in Costa Rica and at Barriles and invaluable information to which I would not otherwise have had access.

function is unknown (Sheets, Rosenthal, and Ranere 1980: 428). I anticipate that these stones were similar to the one in Figure 3-48, which is tantalizing but perplexing as faint, barely perceptible marks for the fingers of a right hand are found at the top of the object. The bottom of the sphere, though worked in order to be perfectly balanced, shows no evidence of use as a grinding tool.

An unusual object recovered 0.5 km north of the stone sphere at the site of BE-18-KH (MAR) strongly problematizes the artifact and ecofact division (Figure 3-49). The object appears to be a volcanic bomb, which is defined as any volcanic material ejected during an eruption that is larger than 64 mm diameter. Volcanic bombs are found at the site of Ceren in El Salvador in a structure interpreted from its unusual artifact assemblage as a divining site associated with a female shaman (Simmons and Sheets 2002). The bombs at Ceren, however, were part of the heavy inundation of tephra that destroyed and preserved the Maya farming village (see Miller 2002: Figure 2.7 and 2.8). The low level of impact from volcanic materials on the eastern flanks of Barú, the lack of an impact crater, and the fact that the BE-18-KH (MAR) site is in the farthest ring of the heuristic tephra zones for my 2004 survey sites (14 km from the summit) clearly indicate that a volcanic bomb would not be expected at this location. A bomb of this size would likely fall within several hundred meters of the vent (David Sherrod, personal communication).

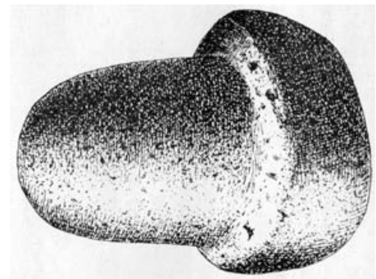


FIGURE 3-49: VOLCANIC BOMB OR SPHEROIDALLY WEATHERED ROCK FOUND AT BE-18-KH (MAR) (LEFT) AND A PESTLE FROM THE YALE COLLECTION OF ARTIFACTS COLLECTED BY J.A. MCNEIL FROM THE BARÚ AREA (FROM MACCURDY 1911: 34, FIGURE 32)

At least two explanations of the object's presence at the site are possible. One possibility is that a bomb fell somewhere near the volcano summit and was carried to the BE-18-KH (MAR) site. As I noted in the introduction to the thesis, casts of corn cobs made of lava from the Sunset Crater volcano in the US southwest were carried four kilometers and then broken attest to the transporting of volcanic materials devoid of tradition functional purpose in the prehistoric past (Elson et al. 2007, 2002). A second possibility is that the object strongly resembles a volcanic bomb but was formed by some different process, such as spheroidal weathering, in which fractured blocks are converted to clay minerals by groundwater dissolution (David Sherrod, personal communication). This phenomenon tends to occur in outcroppings, yet no other similar objects were found in the area, which suggests that no matter what the object is, it was purposefully brought from somewhere else and hence had some form of cultural significance. The bomb or bomb-like object is clearly 'natural' and shows no evidence of modification, though it resembles a stone pestle from the Barú area (MacCurdy 1911: 34, Figure 32). It was found in association with both chipped and ground stone tools that show obvious utilitarian use as well as a stone obelisk that was clearly modified and has a smoothed base, but shows no evidence of use as a grinding or pounding tool (Figure 3-50). The bomb or bomb-like object was brought from somewhere else and has no perceptible functional use. While Chiriquí artifacts comprise collections around the world, this seems to indicate a pre-Columbian collection and curation of an object from 'somewhere else'.

FIGURE 3-50: 'OBELISK' FROM BE-18-KH (MAR) FOUND NEAR THE BOMB OR BOMB-LIKE OBJECT

Discussion: The anti-Pompeii and material nature

> I know why we bury our dead and mark the place with stone, with the heaviest, most permanent thing we can think of: because the dead are everywhere but the ground.
>
> Anne Michaels, *Fugitive Pieces* (1996) , p. 8

Unlike preternaturally preserved volcanic contexts like Pompeii or Ceren, organic material is largely absent in the Barú area. A quirkiness is inherent to the preservation, particularly at sites such as BE-16-KH (KOT) where human bone and what I interpreted to be palm casts should leave no trace but somehow did.[131] These objects are synecdochical for a vast amount of material that remains out of grasp. If the principle tool of cultivation was the digging stick (Joyce 1916b: 113) and maize agriculture was

[131] To reiterate, Richard Cooke instead feels that the spheres are not palm casts but are made by insect larvae.

integral to the occupation of the Chiriquí highlands (Linares and Ranere 1980a), then how many thousands of digging sticks have escaped the archaeological record? That number, multiplied incrementally, reflects the absences, gaps, and ghosts in the archaeological record in a context in which acidic volcanic soils consume non-carbonized organics. While this creates an obvious constraint, even in contexts of the most ideal preservation a great deal of the material culture important in the past will not survive.

Peter Stahl's (1995) tribute volume to Donald Lathrap, *Archaeology of the Lowland Tropics*, makes a pertinent call for rejection of the idea that preservation problems and logistical difficulties justify archaeological neglect in the lowland tropics; I extend that call throughout the isthmian area. Absences, at times, can themselves provide information. Sites like Harappa in the Indus Valley provide important and provocative data despite the heavy disassembling of the city in the late nineteenth century by the British as they sought to build a railroad from Lahore to Moultan and mined the ancient city for its baked bricks. Like the site of Pompeii, where voids and negative spaces provided as much or more information than actual objects when filled with dental plaster, negative spaces at the site of Harappa provide data on walls and foundations that are no longer present. Data do exist throughout the understudied areas of the isthmus and new research should seek to identify sources of data that are overlooked.

As I discussed at length in Chapter two, an eruption of the Volcán Barú is associated with settlement changes in the archaeological record from the western flanks of the volcano (Linares and Ranere 1980a, Linares, Sheets, and Rosenthal 1975, Sheets 2008). Ceramic chronologies and AMS dates from my Boquete survey (see Appendix K) suggest a concomitant interruption at several sites in the 2004 Boquete survey at roughly AD 600 (as shown in Figure 3-10). This could indicate a social and non-volcanic cause for settlement changes or perhaps an indirect and undetected volcanic hazard, or an artificial gap created by the current ceramic chronology used to provide the temporal anchor for the sites. As noted in the prior chapter, palaeoecological and geological data indicate that a catastrophic eruption of Barú is plausible within the last 600-800 years, but large-scale social changes cannot be directly linked to volcanic eruption at AD 600. While I propose that the volcano needs to be de-centered as the cause of the AD 600 social changes, I argue for its centrality in pre-Columbian life due to its monumental landscape presence and the regularity with which it erupted. In particular, I argue for the closer examination of volcanic materials; as they were not valued by looters they remain in the landscape, and as they have not been valued archaeologically they are an untapped source of information.

Objects and value

Modernity is often seen as a point of rupture or disjunct from the past. In this chapter I described the rampant looting of archaeological contexts in the Barú area. The circulation of material and the social effects of objects are facilitated by destruction and removal as much as in preservation and persistence (DeSilvey 2006, Edensor 2005, Hansen 2003, Hetherington 2004, Lucas 2002, Van der Hoorn 2003). It is patent that the most cogent form of archaeological data – context – is absent; the tremendous amount of past and current looting in Chiriquí may make certain research questions untenable (Cooke 1997a, Cooke and Sánchez 2003: 21). The materials, however, largely still exist and now circulate as commodified, decontextualized, or recontextualized objects rather than as artifacts. These myriad collections are not static, but are altered by theft, gifting, and resale. In this chapter I touched upon issues of social value, both past and present.

Social value is a dialectical process of which discard and destruction are necessary components (Bataille 1988, Hawkins and Muecke 2003). Two issues of contemporary social value are invoked when trying to analyze the impact of looting and loss in highland Chiriquí materials. The first issue is that of the value assessed to the materials by the looters. Gold objects were most highly valued due to the contemporary value of the metal, while ceramic vessels maintained a secondary value depending on the wholeness or perceived quality of the workmanship. Uniquely made ground or chipped stone tools or objects were given a tertiary value, though the remainder of the grave goods, including the materials used to construct the graves, were viewed as lacking in value and were discarded. This does not necessarily parallel the values placed upon grave goods at the time of their interment and could seem a highly artificial hierarchy of values to the pre-Columbian individual. The stone objects were carried over long distances; I suggest that they were likely endowed with a greater value in the past than they now currently hold. A second issue of social value invoked in Chiriquí archaeology is the definition of what are *data* by the research questions that we frame. Given the reality of the destruction created by rampant looting, a reassessment of what are used as data can reveal unexamined artifact classes that remain due to their lack of value for looters.

Just as artifacts themselves have no inherent meaning but are instead receptacles and shapers of contextual meanings, the commodified state of artifact or non-artifact (or data and non-data) is related more to the valuation of certain objects over others within the discipline of archaeology (or the larger culture) than to something inherent within the data or objects in the past (Kopytoff 1986). The culturally embedded issues of exchange, circulation, and value – in this sense – are not limited to the archaeological past but are also at play in the present interpretation of the past. Value can be seen as a process rather than a state (Munn 1986, Strathern 1988: 32, Thomas 1991), and a reassessment and readjustment of *data* and *artifact* in conjunction with new techniques and research structures are warranted and required to elucidate a greater understanding of past life in the Barú area.

In this chapter I provided a detailed description of the only radiocarbon dated grave context from highland Chiriquí, which is AMS dated to roughly AD 1300. While thousands of Barú area graves have been opened in the past century and a half, only a small handful were ever described. This largely removes the ability to incorporate more multi-dimensional work on burials that focus on experience, creation of memory, identity, and agency in contextually rich settings that are the hallmark of provocative recent studies (see Bradley 2000, Chesson 2001, Gilchrist 1999, Jones 2001, Joyce 2000, 2001, Meskell 1999, Meskell and Joyce 2003, Meskell and Preucel 2007a: 126). The material that is archaeologically assessable, however, can provide a more complete vantage of life and death in the pre-Columbian Barú area than currently exists.

I will discuss the sourcing and transportation of these stones further in Chapter four. While grave goods with a contemporary value stemming from their material (especially gold) or aesthetics (especially ceramics) have circulated widely on the world market, objects like dacite slabs and basalt columns were discarded in piles near the looted tombs and given little consideration.[132] An element of irony exists regarding dacite slabs, as they were the primary source of both the preservation and destruction of the grave sites. As capping stones, the dacite slabs were intended to protect the dead and the grave goods from the process of decay. The construction of the KOT-J grave at BE-16-KH (KOT) remained tightly imbricated after nearly 700 years and prevented soil from collapsing into the chamber. The dacite slabs that were meant to protect the grave context, however, also abetted their wide scale desecration as the wide-subsurface stones allowed looters to detect their presence with a probe.

Alphonse Pinart (1885) provides an ethnographic description of burial practices from the Ngöbe of Chiriquí, which he believes were merged with earlier practices by the Bribrís or Cabeçars. While Pinart's interpretation of nineteenth-century Ngöbe practices with Bribri myths cannot be accepted uncritically, it does offer some interesting considerations for the use of grave goods as an indication of wealth or status. Pinart notes that in the past, individuals were buried with everything they owned. Ostensibly these objects were meant to help the individual through the dangerous journey of the soul in the underworld and provide them items they may want in Sibú, or the fish and

[132] Though note that I did find one reference of the collection of a dacitic slab in Boquete, though I am uncertain whether it was sent to Sweden (Wassén 1949: 168).

fruit-filled paradise found at the zenith. More recent practice, according to Pinart, was to bury the person with objects without value and to create representations of any valuable objects. These replicas, called *ñumi*, were buried with the person and the original object remained with the relatives. This parallels the description by Joyce (1916: 104, see also Gabb 1875) that if the deceased owned a gold figure of rank, an replica of the gold figure was cut from yucca rind and placed on the chest of the corpse.

This raises some interesting questions regarding archaeological assessments of status and power from mortuary contexts in Chiriquí. Graves that are richer in objects could simply be older. Joyce (1916: 108) describes graves at Bugavita as being of mixed construction. Graves covered with dacite slabs in the southern and eastern portions of the cemetery were poor in grave goods, though the graves were better preserved and the ceramics were higher in quality than the graves constructed with rounded stones in the northern and western portion of the cemetery. It seems highly likely that later period graves constructed with dacite slabs and basalt columns correspond to burial goods made in miniature form or less permanent materials. This doesn't indicate that the individual was less wealthy, but that the family members retained the wealth.

If the objects were still associated with the deceased relative, potentially the family members did not in fact feel as if they were 'taking' something from the dead person as the replica would be as useful or perhaps more useful in the afterlife than the original. In this sense, the original object is an inalienable possession, yet still remains in circulation (Mills 2004, Weiner 1992). If *ñumi* made from something as impermanent as yucca rind was considered as useful to the dead person as the same object made of gold, it seems logical that the preponderance of miniature objects found in Chiriquí may also indicated that the dead were able to access the same use from the representational version as from the full sized object.

The examination of miniaturization and figurines in Chiriquí could usefully draw on better theorized cases such as Neo-Assyrian apotropaic assemblages. These present logics that are material manifestations of complex relationships between humans and deities in space and time (Nakamura 2005). Miniature figurines are loaded with symbolic meanings and power from supernatural realms. The possibility that the small stone spheres in my survey sample and from other sites in Greater Chiriquí were (non-figural) miniatures of the enigmatic giant stone balls of the Diquís is an interesting consideration. This does not, of course, address what the thoughts or functions behind the objects might have been. My data do not satisfactorily allow for an in depth discussion of miniaturization, though perhaps this is a consideration that can offer useful research channels in future work. I do, however, argue for the examination of the contexts and materials that do exist. The crude tephra sculptures recovered both by the Linares-Ranere project and by my 2004 Boquete survey fall firmly within this realm of unexploited data. They are small, difficult to identify, and like the dacite slabs and basalt columns represent unutilized sources of data that will not have circulated far from their original context due to the lack of contemporary value assessed to them.

Particularly for looters, the material used in grave goods may be more important in the modern context than it was in the past. If the dead person was able to utilize a celt in the underworld, it might not have mattered whether it was made from yucca or stone or was full-sized or miniaturized. The presence of such objects in smaller form or cheaper materials does not necessarily indicate an aping or aspiration for elite objects. The gold objects may have been replicated in wood, clay and carried the same symbolic load. The shared iconographic details between many locally produced objects made from various materials (e.g., gold, shell, and clay) is an important element of pre-Columbian archaeological record from the isthmus (Bray 1992, Cooke and Bray 1985, Sánchez H. and Cooke 1998, Snarskis 1986). While figurines that were crudely created from tephra or other volcanic stones may not have had the same potency as the well-made and large-scale Barriles statues of men riding the shoulders of other, presumably subservient men, the mimetic capability of the miniaturized reproduction might not have been lessened (Nakamura 2005, Taussig 1993).

In this chapter I have touched upon the mutability that existed in the materials used to create objects with similar forms or uses in the past. A figurine made of friable tephra very well could have functioned as well as a figurine made of jade in a mortuary context just as a miniature could have functioned as well as a full-scale vessel or tool. Archaeological interpretations generally assume that a higher quality material or crafting standard indicates a higher status or wealth. An added consideration, however, is simply that materials were less rigidly categorized in the past, particularly when the traversal of the unstable boundaries between the physical and the unseen or the living and the spirit realms are involved. This was not necessarily an act of economic rationalism on the part of the family members but instead a possible acknowledgment that the rules of the afterlife are not the same as those for the current one. Things can be different and reversed. As I noted in this chapter, the inversion of tripod pots could potentially have been such a reversal either as a means to flip the usual position of the pot so that it was more accessible from the underworld or to turn 'legs' into 'eyes' that could guard the grave context.

The identity of objects are not fixed, but are complex and mutable processes (Appadurai 1986, Buchli 2002, Thomas 1991). Objects had a symbolic load that was changeable. Both objects and people could become ceremonially unclean (Gabb 1875, Joyce 1916b, Pinart 1885), and could be cleansed by ritual. In the case of a weapon or tool that was *nya (*the less serious version of uncleanness) through disuse in ethnographic accounts from the Chiriquí province, the evil influence that has entered it could be dispelled by beating it with a stick (Joyce 1916: 102).[133] This indicates a transgression between categories. A ritually killed object, like the animal-shaped pot with drilled holes or the figure-handled smashed pot in KOT-J were just as valuable if not more valuable in the grave context; like the inverted pots with their feet/eyes toward the living, the transformed objects were more easily able to traverse from the living

[133] The more serious form of ceremonial uncleanness, *bukuru*, was reserved for women in their first pregnancy and corpses according to Joyce (1916: 102).

realm to the spirit realm. The division between natural and cultural objects, in the case of the volcanic bomb (or other 'natural' cultural objects) carried to the BE-18-KH (MAR) site, may be less flexible in the contemporary context than in the past.

In sum, different forms of destruction, vanishing, loss, and change are integral to the archaeology of the Volcán Barú area. Volcanic eruptions, ritual killing of artifacts, and looting combine with low levels of organic preservation to create large gaps, but also have their own form of materiality. The Barú area artifacts hint at divisions between nature and culture and ecofact and artifact that are inverted, admixed, and problematized. It is incumbent upon archaeologists to develop new methodologies, techniques, and research questions to examine the data that do exist in contexts of non-ideal preservation. The surge and diversification of palaeobotanical studies in Panamá, for example, is one exemplary way that researchers have overcome poor preservation or the difficulty of attributing function to stone tools in recent decades. I urge the closer examination of volcanic materials in highland Chiriquí. These objects occupy a liminal position between the categories of artifact and ecofact. They were not commodified by looters and collectors and are not prone to organic decay. By re-valuing the volcanic objects by constructing research questions and frameworks that allow us to consider them, possible new sources of data can be materialized.

Chapter 4 • MAPPING THE NARRATIVES OF STONES

In this chapter I discuss the rock art from my Boquete survey area, provide a critical discussion of mapping and the Geographical Information System (GIS) I used throughout my fieldwork and analysis, and discuss the use of oral traditions in archaeological interpretation.[134] In previous chapters I have focused upon how volcanic eruption may have impacted pre-Columbian life near the Volcán Barú. In the current chapter I would like to shift the focus to the long periods of time when the volcano was *not* in eruption. During these time periods, rather than a source of disruption or destruction, I suggest that the volcano would have acted as a material anchor within the landscape and the circulation of objects and people around it.

Current trends in the social sciences highlight the concept of 'unsettling' established notions of place and other conceptual categories (e.g., Bailey, Whittle, and Cummings 2005). The concept of balance in nature is rejected and constant mutability and inexorability of process and change is accentuated (Massey 2006: 40). This initially

[134] The opening photo shows Clavdia Gonzalez at the opening of the rock shelter at the top of the geodesic ridge of *La Artilleria* in Boquete. Photo by K. Holmberg.

provided an important corrective to Lasparian concepts of a foundational or pristine landscape.[135] A now well-developed archaeological literature formed around important early discussions of landscape as more than a static backdrop for human life and emphasized their inherent dynamism and changeability (e.g., Bradley 1984, 1998, 2000, Edmonds 1993: 107, Hobsbawm 1983). This discussion is now established to a level that some authors call for a redirection of research attention, particularly in regards to anthropogenic elements of landscape change (e.g., Head 2008).

In relation to human experience and life spans there *are* periods and aspects of stabilization, temporary though they may be in the *longue durée*. The geological time span required in discussing the tectonic history of the isthmus provides a very turbulent and mobile vantage of the Barú landscape. The human scale of memory and experience, however, provides a relative sense of permanence to the landscape (Ingold 1993: 166, Massey 2006: 41). Particularly in the Boquete area, where catastrophic flooding of the Rio Caldera occurs every few decades and several earthquakes occur each year, the centuries in between volcanic eruptions potentially allowed the volcano to perceptually provide a more stable base in human life spans than the ground beneath peoples' feet or the rivers they likely used for orientation and sustenance. If this is accurate, the volcano played a conflicting role as a source of permanence and stability as well as a source of imminent change and instability depending on the time frame with which it was viewed.

Mountains and volcanoes are symbolically and ideologically important throughout many of the world's cultures, past and present, including many ethnographic Amerindian contexts. Mountain peaks and volcanoes in the Andean world, for example, were seen as the residence of spirits in Inka cosmology, which linked the peaks to deities for the sea and weather (D'Altroy, Williams, and Lorandi 2007: 111-113). Worship of particular volcanoes was noted by the chroniclers Pascual de Andagoya

---

[135] Lapsarianism entails a focus upon the fall of humans from a state of grace or innocence; it frequently cites the role of women in the downfall of men.

and Oviedo y Valdés, who described how people gave the volcanoes offerings and sacrifices (Joyce 1916b: 25-6). Groups living near the Arenal volcano in Costa Rica believed a fire god lived within it. Legends attached to the volcanoes Turrialba and Poás show both pre-Columbian and post-contact elements of the anthropomorphized power of the volcanoes (Alvarado and Soto 2008: 4). The Bribrí people of the Valle de General in the Costa Rican portion of the Greater Chiriquí culture area believe that mountains and boulders are inhabited by invisible beings that move with the wind through the upper and lower levels of the world (Garcia and Jaén 1996, Künne, Beilke-Voigt, and Voigt 2000: 137). In reference to Barú, Pinart (1885) states that the indigenous people (whom he calls *Guaymies)* who lived to the north of the volcano, blamed the frequent earthquakes on a spirit living in the volcano and would shoot arrows at Barú to scare it.

A conception of monumentality is one way of plumbing a more socialized role for Barú its non-eruptive periods. This classification is a slippery one, though, as the volcano is not 'built', but 'natural' and drawn in to the social world. Like all volcanoes and mountains, however, Barú will never have the 'afterlife' characteristic of built monuments (e.g.; see Bradley 1998). Through both their permanence and their ambiguous placement along the nature-culture continuum, volcanoes form unique monumental spaces. No universality of bodily relationship to landscapes and monuments can be assumed (Lazzari 2003: 201, Meskell 1996). Monumental spaces, however, clearly shape movement, vision, and thought and create a shared frame for divisions between people, places, and things (Edmonds 2006: 170). I suggest that Barú can be seen as an acculturated natural monument and that the volcanic materials that circulated widely as pre-Columbian construction materials in the Barú area tapped into associations people held to the volcano.

The lack of monumental architecture – in the form of pyramids or megaliths - has been used in the past to define Greater Chiriquí by what it lacks relative to the Mesoamerican or Andean worlds. This frames the area in a negative light rather than focusing on the data that do exist (Sheets 1992). Monumental architecture in Chiriquí perhaps can be rethought as any construction that requires 'significantly greater energy investments to build than quotidian structures' (Quilter and Blanco 1995: 209, drawing from Renfrew 1973, 1974). The many thousands of graves built in the Barú area, in this definition, clearly comprised monumental architecture through the mining and long-distance transport required for their construction materials.

Barú area grave construction drew heavily upon the volcanic materials of dacite slabs and basalt columns that were quarried and transported from and through the volcanic landscape. Thousands of these graves were opened within very concentrated time spans in the late nineteenth and early twentieth century, making Chiriquí pre-Columbian material culture globally known and yet removing vast quantities of its material culture from archaeological study. Dacite slabs and basalt columns, unlike gold objects and ceramics, were generally not removed from the grave areas due to their lack of contemporary value and their ambiguous classification as natural or cultural objects. The dacite slabs and basalt columns therefore can provide untapped sources of data regarding spatial relationships in the past.

In addition to Barú and the dacite slabs and basalt columns used for grave construction, the most stable physical commonality between past and present landscapes is comprised by the petroglyphs on non-portable boulders. While it is uncertain what Chiriquí petroglyphs were meant to 'do', it seems clear that they likely served different uses and these could change over time and vary by region (Quilter and Blanco 1995). I incorporate 24 previously unknown petroglyph boulders that I found and recorded in my survey area and 5 commonly known boulders to discuss three different 'uses' or possible functions of rock art in the Boquete survey area.

Petroglyphs in the Boquete survey area

'Art' is, of course, an extremely abstract concept and category (Gell 1998). The linkage of functionality and aesthetics in Amerindian objects has led to the use of the term 'art-tools' (Graham 1992, Stone-Miller 2002: 134). This concept provides one way to think of the petroglyphs without needing to necessarily 'translate' the iconography of their markings. The location of rock art can be just as important, or possibly more so, than the representations and designs themselves (Leroi-Gourhan 1982, Thomas 2004c). I focus more heavily upon the landscape positioning of the Boquete petroglyphs rather than upon their designs to query how 'lines of sight', both literal and metaphorical, translated into possible 'lines of site' (or place) in drawing different aspects of the Boquete landscape into a cohesive, symbolic unit. These 'functions' of the Boquete rock art, based upon my interpretation of their locations, involve their association with paths, cemeteries, and possible calendrical use.

I propose that the 'uses' of rock art are concatenated with the use of the volcanic materials of dacite slabs and basalt columns. I suggest a narrative of linkages between artifact classes that were generally seen as separate or not 'seen' as sources of archaeological data to date. My conceptions are based upon mapping and Geographic Information Systems (GIS), which provide their own particular form of story-telling. A fully fleshed understanding of the Boquete rock art and landscape is likely infeasible without the oral traditions that gave them meaning at the time of the petroglyphs' creation and throughout subsequent periods during which they likely held very different meanings and resonances. I highlight three stories of the Barú landscape from Doraz, Bribrí, and Ngöbe linguistic traditions. I use these narratives as an entrée to discussion of debates over oral traditions' role in archaeological interpretation and the possibility of more socially rich conceptions of the pre-Columbian Barú context.

Rock art studies can provide theoretically provocative discussions of social meaning (e.g., Bradley 1997, Chippindale and Nash 2004a, Lewis-Williams 2002a, b, Lewis-Williams and Pearse 2005, Solomon 2008). Relatively little attention, however, has been given to the rock art of Latin American in comparison to the better studied contexts of South Africa, Australia, or Neolithic Europe. Petroglyphs in the Chiriquí region were largely ignored throughout most of the nineteenth and twentieth centuries (Zilberg 1986), barring the registry of rock art designs and locations created in Panamá by Neville Hart (1959, 1960).[136] I have argued elsewhere that the petroglyphs in the Boquete area were in essence 'immaterial' because they were not assigned artifactual value by looters or archaeologists (Holmberg 2005, though see Lutz 1922).[137] The unstable terrain between the material and immaterial can helpfully inform conceptions of agency, social change, and materiality itself (Buchli 2007: 192), and rock art in particular occupies this liminal category. While clearly the product of human agency, the petroglyph boulders have no particular material value and are not portable, sellable, nor collectable. I argue later in this chapter that petroglyphs in the Boquete area were possibly created at a time of social change.

Recent research throughout Panamá is beginning to place a renewed emphasis on rock art (e.g., Brizuela 2006, 2007, Cooke et al. 2001, Joly Adames 2007, Künne 2005, 2008a, Mayo and Mayo 2007, Mayo 2003).[138] Recent Panamanian legislation declared petroglyph boulders to be national monuments.[139] A 'petroglyph park' in Nancito, Panamá (*El Parque Arqueológico de El Nancito*) was opened in 2002 (Künne 2005, 2006), and I attended the inauguration of its interpretive center in 2004. The role of petroglyphs as important components of the past is receiving legislative and archaeological attention, yet the way in which to conceive of the role of rock art is not

[136] The presence of the large petroglyph boulder, the Caldera *Piedra Pintada*, was noted in several late nineteenth and early twentieth century publications which I will discuss later in this chapter.

[137] Otto Lutz (1922: Plate IV (II) photo 4 shows a portable cobble with a petroglyph design that Lutz interprets as zoomorphic. I believe there is a high probability that the stone Lutz photographed came from the *El Huacal* site of BE-14-KH (GON) site that I will discuss later in this chapter.

[138] For an annotated bibliography of rock art work in Panamá, see (Künne and Strecker 2008: 272-3).

[139] *Ley* 17 was enacted in April 2002.

yet determined. My own perspective derives from archaeological discussions of landscape.

The investigation of *landscape* is deeply entangled with discourses of identity and can be seen as having a distinct link to the Romantic tradition that cannot be uncritically accepted (Edmonds 2006). Landscape studies in the social and physical sciences also incorporate varied perspectives premised upon researchers' interpretation of the nature-culture paradigm (Anschuetz, Wilshusen, and Scheick 2001: 158). The US processual tradition of landscape and the predominantly British postprocessual interpretive tradition of landscape in archaeology are unhelpfully dichotomized; researchers from either tradition examine overlapping but differently weighted aspects of landscape 'as ecology, palimpsest, meaning, memory, identity, social order, morality, and social transformation' (Ashmore 2007: 256). For the context of this discussion I draw upon the belief that landscape is helpfully envisioned not as a place or thing but as a collection of actions and happenings (Bender 1998, Massey 2005, 2006: 46). These actions and events help form people's sense of identity (Edmonds 2006).

Archaeologists are clearly aware of the amount of material loss inherent to the largely organic material culture of the past, yet people in the past were themselves quite aware of this and likely felt an impetus to create objects in stone or to mark stones as a more permanent statement (Bradley 2002: 21, Gosden and Lock 1998: 11, Loendorf, Chippendale, and Whitley 2006: 4-5, Stone-Miller 2002: 142, Stone 2007). Stone provides the most lasting evidence of past life in the Barú area and incorporate the 'mystical aura of longevity' in the Chiriquí area (Quilter 2004: 146).

Nineteenth and early twentieth-century ethnographic studies indicate that great value was attributed to stones and rocks in the Chiriquí past. The Bribrí, for example, believed their powers came from associations between the stones and animals (*calculi*) which allowed shamans (*Awa*) to use them for purification ceremonies, rain-magic, and healing the sick (Gabb 1875, Joyce 1916a: 103). This value did not translate into the contemporary period. Both due to their lack of portability and their ambiguity as 'artifacts', petroglyphs and other ambiguous stone artifacts like dacite slabs and basalt columns were not attributed value by looters and collectors and were not removed from grave areas. In a sense, the stone materials became inalienable from the landscape while ceramic and gold artifacts circulated far more widely due to the economic value they were given. As Barbara Mills (2000, 2004) discusses in her examination of social valuables in the Zuni area of the US Southwest, inalienable goods can be more useful than prestige goods in interpreting the role social valuables play in non-state societies, particularly those in which inequalities are based on ritual knowledge (cf. Helms 1979).

In the ensuing discussion, I describe three 'uses' or functions of rock art in my Boquete survey area. The GIS maps that I have prepared intentionally utilized the cartographic symbol for 'buried stone' for petroglyph locations. While at times the rock art boulders were literally buried, they were also figuratively buried or hidden due to the lack of interest in them. I have provided the most accurate drawings for the known petroglyphs in my study area and have identified an additional 22 petroglyphs from my survey work. With the current and growing archaeological interest in rock art I anticipate that more rock art will be identified in the Boquete area, and do not anticipate that my research represents the entire corpus of petroglyphs in Boquete.

As it is no longer acceptable archaeological practice to use chalk on petroglyph designs, I found that the most efficient and non-invasive means of recording the designs was through the use of a weak masking tape placed over the contour of the carved petroglyphs for photographs. This proved more effective than *frottage* rubbing or tracing on clear plastic with permanent marker as both techniques prove problematic in the extremely humid and frequently rainy Boquete climate. The tape is easily removed immediately after the photographs are taken and leaves no visible or perceptible residue, but allows one to easily highlight markings that otherwise do not photograph well. I generally took photos from a standardized distance and scale from cardinal directions both with and without tape, then created a digital schematic for each petroglyph. The digital technique offered an easy way to scale the schematic when the size of the boulder or field conditions forced me to take the pictures from distances or angles that varied from my ideal standard. In future work, scaffolding or a camera attached to a balloon (see Quilter 2004: 67) or perhaps even a remote-control airplane would be helpful in taking photographs from above the petroglyph.

Three 'uses' of rock art in the Boquete survey area

In the ensuing section I will describe three centers of rock art in my Boquete survey area (see Appendix O for locations and descriptions of the petroglyph boulders). I propose that each group of petroglyphs served a different 'purpose', though they were each drawn into relation with one another by their positioning in the landscape.

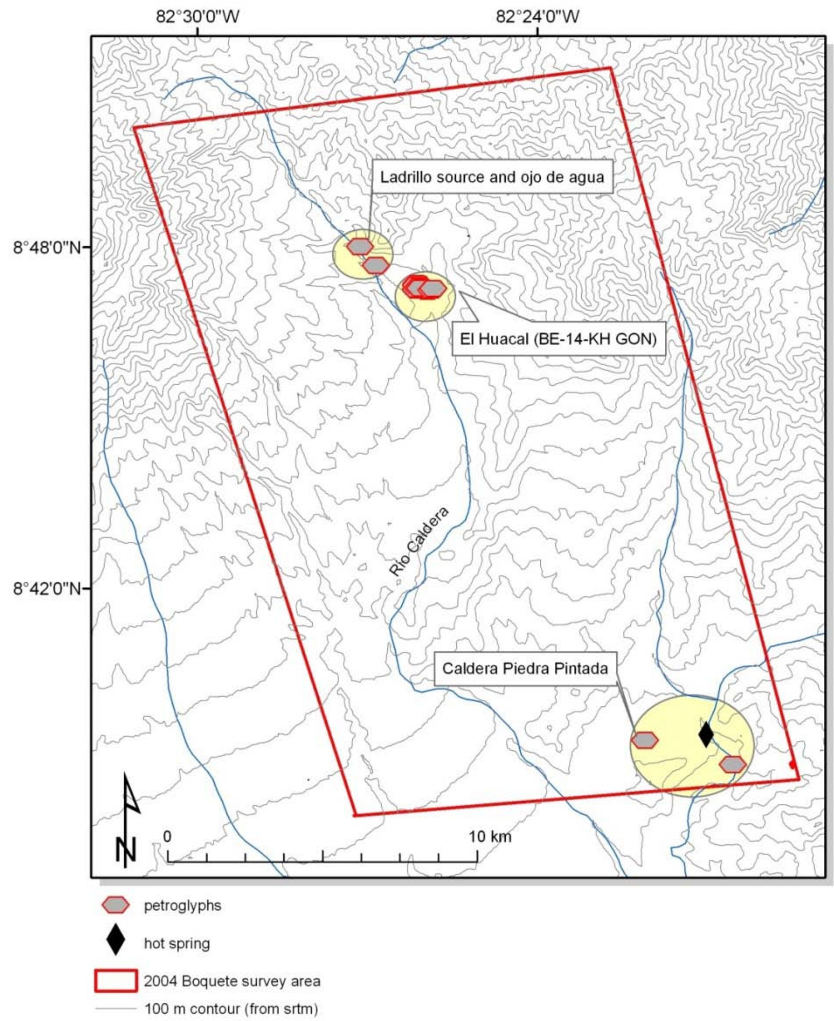


FIGURE 4-1: THE THREE PETROGLYPH CENTERS IN THE 2004 BOQUETE SURVEY AREA

Rock art and paths: consuming the volcanic landscape (dacite slabs and basalt columns)

As discussed in Chapter three, early descriptions of Boquete area burials note the characteristic use of dacite slabs and basalt columns in pre-Columbian grave construction (Bateman 1860, Bollaert 1863, De Zeltner 1866, Holmes 1887, 1888, Wassén 1949). These stones were not worked or altered significantly from their original forms once quarried. The prodigious grave exploiter, J.A. McNeil, believed that these stones were transported great distances from their original quarry area (Holmes 1887: 7, 1888: 20).

While cursory attention has been given to the fact that dacite slabs and basalt columns in Boquete graves were transported from considerable distances, little attention has been paid to *how* the heavy stones were transported or from where.[140] It is clear that these objects were consumed as a resource. One way of defining consumption is as 'an active process in which all the social categories are being continually redefined' (Douglas and Isherwood 1996 [1979]: 45). Another way of looking at consumption is through the small choices of everyday practice, movement, and flow (De Certeau 1988). Combining these two ways of viewing consumption, the movement of dacite slabs and basalt columns long distances into grave contexts invoked both a consumption of the volcanic landscape and a redefining of materials from *natural* to *cultural* with minimal processing or manufacture effort. Both literally and metaphorically this entails a disaggregation of 'nature', as the act of removing the dacite slab or basalt column from its source and transporting it transformed it from ecofact to artifact with very little modification to its form and drew it deeply into a 'cultural' realm. [141]

The source of basalt columns in the Boquete area is well known, as it is a local landmark adjacent to the municipal water source (Figure 4-2).

[140] The site of Panteón de la Reina in Costa Rica has 'pillars' (basalt columns) used in grave construction; while the quarry sites have not been identified, the researchers clearly note that effort was invested into quarrying and transporting the materials to a grave or ceremonial site. See p. 139-40 of (Quilter 2004)

[141] For discussions of basalt columns in other cultures and in geological debates see p 112-115, 133-134 of (Sigurdsson 1999)

FIGURE 4-2: THE BASALT COLUMN SOURCE NEAR THE BAJO MONO AREA OF BOQUETE

The word *ladrillo*, used locally to refer to the basalt columns, translates as 'brick' in English; while a 'natural' outcropping, contemporary vocabulary still envelopes the basalt columns as an acculturated construction material rather than a purely natural phenomenon.[142]

I assume that the basalt columns in the BE-16-KH (KOT) graves are from the outcropping 3.4 km west of the site. No waterways link the basalt column source to the BE-16-KH (KOT) cemetery, hence I presume that the stones were carried over land. In order to examine possible routes utilized to transport the heavy materials over land I executed a least-cost path analysis weighted by slope in order to find the most likely route between the two points.

[142] The columnar joints were used as building materials in Boquete until recent decades when quarrying them became illegal.

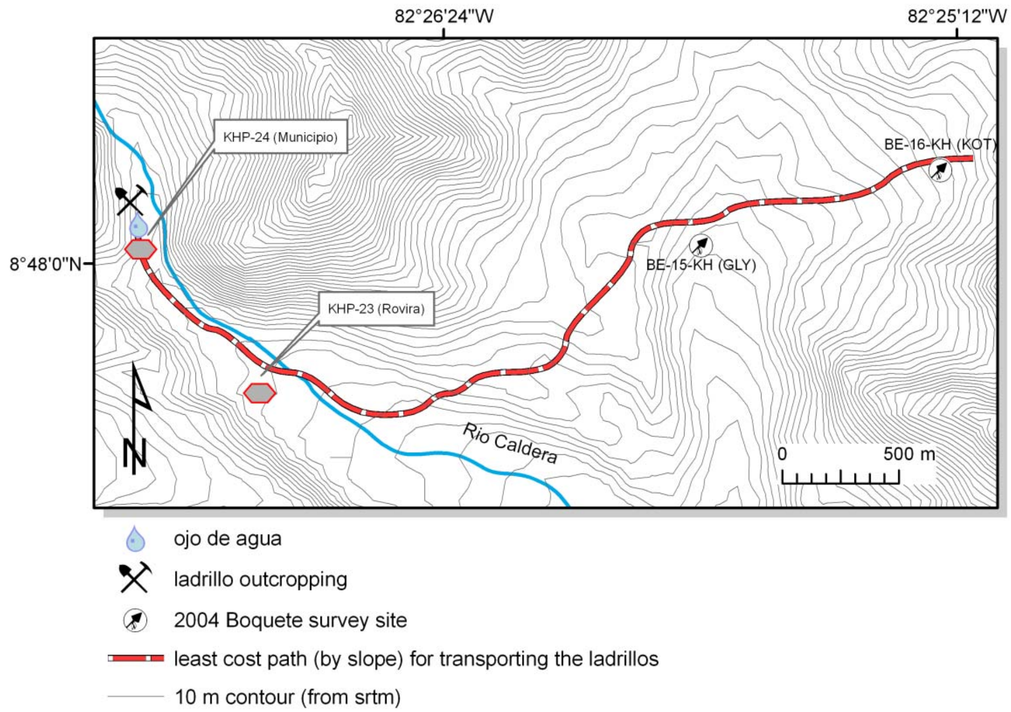


FIGURE 4-3: LEAST COST PATH, GAUGING BY SLOPE, TO TRANSPORT BASALT COLUMNS FROM THEIR SOURCE TO THE GRAVES AT BE-15-KH (GLY) [A 2.8 KM DISTANCE] AND BE-16-KH (KOT) [A 3.8 KM DISTANCE]

The results of the analyses were striking, as the path is flanked by the only two isolated petroglyphs boulders (KHP-23 and KHP-24) that I recorded in the Boquete town area (Figure 4-3). This seemingly associates the petroglyphs (modified and spatially stationary stones) with the basalt columns (barely modified and frequently transported over long distances) into a cohesive unit of socially meaningful stones. I suggest that one possible purpose of the petroglyph boulders was a ritualized or symbolic marking of the route by which basalt columns were transported from the source to the BE-15-KH (GLY) and BE-16-KH (KOT) cemeteries.[143]

[143] While I don't intend to focus on the designs of the petroglyphs lining the probable basalt column least-cost path, it is worth noting that the designs on the KHP-23 and KHP-24 petrolglyph boulders are markedly similar to designs at the sites of Finca Sonador, Costa Rica and Piedra Muñeca, Panamá that Martin Künne interprets as hermaphroditic twins. These twins, according to Künne represent the Bribrí and Cabécar hero, Sibú, as described in 19th century ethnohistory. How this translates to their original creation is unknown, though it adds to the list of possible interpretations of Barú area petroglyph designs. See (Künne 2008b: 269)

The KHP-24 (Municipio) boulder is found at the already mentioned basalt column source, which is distinctive on its own but is additionally adjacent to the largest *ojo de agua* (natural spring source) in Boquete, which serves as the contemporary municipal water source.[144] The KHP-23 (Rovira) boulder, which is currently in the back yard of the Rovira family home, is located at the intersection where the least-cost path I have just discussed crosses the Caldera river and becomes a forest foot path rather than a riverside path. The KHP-23 (Rovira) boulder, while significant in size, is also notable for its striking location directly east of Barú, which is visible through a 'V' created by closer peaks, as well as a distinctive view to the west where the setting sun drops over another ridge of peaks. These highly distinctive locations and the close association with the least cost path do not seem accidental. If the rock art and basalt columns were meaningfully linked, this provides an interesting contrast in the nature and culture divisions; as Quilter (2004: 150) touches upon, if petroglyphs are a way of culturally marking the natural world, basalt columns reverse this order as they reflect the drawing of a largely unmodified (super)natural object into the cultural world.

[144] Note that Boquete is the name both of a town and of the district in which it is located. Unless specifically referred to as the Boquete district I refer to the town of Boquete in this discussion.

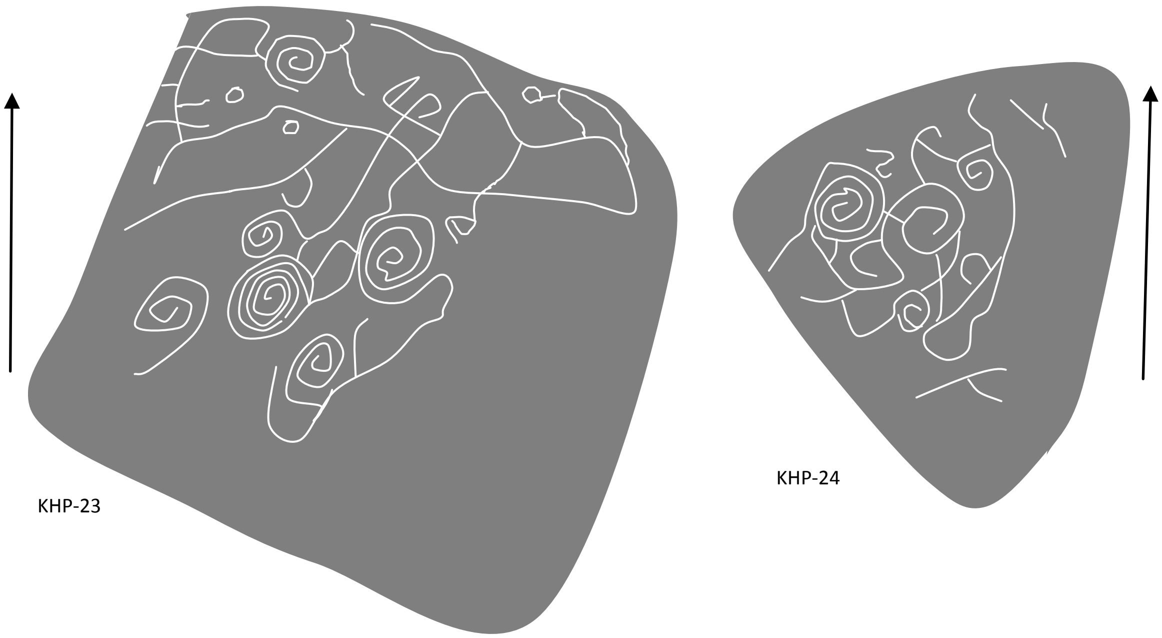


FIGURE 4-4: KHP-23 AND KHP-24 PETROGLYPH BOULDERS. THE NORTH ARROW IS A ONE METER SCALE [FOR PHOTOGRAPHS OF THESE BOULDERS SEE APPENDIX P]

The investigation of people's movement in space is a relatively understudied archaeological concept, as the study of space tends to preference the 'settlement' of space. Though well-developed road systems such as those of the Romans, Inka, southwestern US, and the causeways of Mesoamerica have received a relatively large amount of research attention, less formal, institutionalized or monumental forms of paths have received less attention in the overall archaeological literature (per Nieves Zedeño and Stoffle 2003: 59-60, though see Tilley 1994).

The concept of 'paths' and the places where people regularly move on the landscape have received considerable attention in the isthmian area. This attention can be figurative, as shown in the title of the, *Paths to Central American Prehistory* (Lange 1996b). It can also be literal through discussion of the proximity of the Java site in Costa Rica to the *Camino de Mulas*, an indigenous road in the pre-Columbian era (Fonseca Zamora and Chávez Chávez 2003: 28). Payson Sheets' work in Costa Rica in particular pays close attention to the way that travel can become an artifact, with foot paths detected through remote sensing as their trace (Sheets 2004, Sheets and Sever 1991).[145]

Petroglyphs near the Rivas site in Costa Rica are interpreted as having association with paths and boundaries used to access the site (Quilter and Frost 2007a: 41). Petroglyphs seem associated with water in the Costa Rican Diquís region (Zilberg 1986) and the sites of Java (Fonseca Zamora and Chávez Chávez 2003) and Guayabo de Turrialba (Fonseca Zamora and Acúña Coto 1986). I feel that this waterway association likely can be considered an association with a path as well, as both in the modern era and pre-Columbian period rivers and streams provide a means of transit even if a person is not utilizing a canoe or raft but simply walking beside the water in order to navigate.[146] Basalt columns were used to line paths in the site of Pueblito in Colombia (Reichel-Dolmatoff 1954).

Methods that have been used to estimate the relative ages of rock art by patination, lichens, or iconographic superimpositions are problematic in the Boquete study area due to the lack of differential patination of basalt and diorite in wet climates as well as the lack of reliable reference curves for lichen growth. Additionally, as many rock art sites are located in desirable agricultural and occupation areas in the Barú area, petroglyph boulders are often visited and their designs are regularly chalked by local residents who remove lichens from the boulders. Neville Harte (1960: 17-8) suggested the designs would have been renewed from year to year due to the rapid growth of algae during the rainy season; he believed they may have been re-engraved to commemorate religious festivities that would occur in the dry season. Multi-spectral analysis has proven helpful in revealing obscured elements of pre-Columbian rock art

[145] See also Butler (2005). Also note that Julia Mayo is conducting new work on stone paths at the site of El Caño in the Coclé province of central Panamá.

[146] While I am assuming that in the past rivers and streams were used as navigation, not necessarily by using canoes or boats, but by walking beside them, I am certain of it for the historical period as distances provided to cemetery sites in written records clearly indicate that the authors walked along the rivers rather than walking a direct route.

designs in other areas of Latin America (Bassie 2002, Brady 1997, Robinson and Ware 2001, Ware and Brady 1999, 2001). Multi-spectral analysis to see whether the Boquete rock art designs were retraced over time could potentially offer future insight.

While the Boquete rock art is not dateable using stylistic or residue analyses, I interpret the close correlation of the KHP-23 and KHP-24 petroglyphs to the least-cost route possibly used to transport basalt columns to the BE-16-KH (KOT) and BE-15-KH (GLY) sites as an indication they were likely utilized and possibly created during the later Chiriquí period (AD 1000-1500). This relative time span is in accordance with the dates attributed to rock art in other parts of the Greater Chiriquí culture area, where similar spirals and free-form lines and cupules were associated with structures or burials at Rivas and Guayabo de Turrialba and are thought to date to the periods between AD 500-1000 and AD 1000-1550 (Fonseca Zamora and Acúña Coto 1986, Quilter 2004: 29).

According to one recent assessment, rock art is currently associated with isthmian agricultural societies and sedentary village life (Künne 2008b: 258-9). Petroglyphs in the Greater Chiriquí culture area have been interpreted as reflections of hierarchy that entailed a consolidation of artisans and specialists attached to elites, rulers, and religious specialists who were interdependent and in competition for local and regional power (Fonseca Zamora and Chávez Chávez 2003: 33, Zilberg 1986: 347). Fonseca and Chávez (2003: 33) link the rock art at Sitio Java in Costa Rica specifically to 'power plays and the transmission of ideologies through creative personae' during a time of increasing sociopolitical complexity; the dating of petroglyphs to the Chiriquí time period may, however, obscure an earlier tradition of rock engraving. While no rock art is associated with preceramic periods in the isthmian area, this may be due to poor preservation and the complications inherent to dating the palimpsestic archaeological record (ibid.). Rock art could certainly have been created prior to the construction of socio-ceremonial centers, such as Barillas and Guayabo de Turrialba, then appropriated and re-used (cf. Zilberg 1986: 342).

Sourcing the dacite slabs

Like basalt columns, dacite slabs were clearly important throughout volcanic contexts in pre-Columbian contexts. Dacite slabs were used at the site of Ceren, El Salvador in several features, including a structure interpreted as a sweat bath (McKee 2002: 92-3). A repository of dacite slabs was found near the Arenal volcano in Costa Rica (Sheets 2004: 10), which is interesting as it indicates a quarrying effort likely designed around the difficulty of transporting the heavy (~25 kg) stones during the height of the rainy season. Carefully made cist tombs in Costa Rica at the Rodriguez site were made with exceptionally heavy (700 kg) dacite slabs as capping stones (Snarskis 1992).

Only one reference to a possible source for the Boquete area dacite slabs exists. This suggested source location was provided by geologist Robert Terry (whose work was referenced in Chapter one) to Swedish archaeologist Henry Wassén. Terry surmised that the dacite slabs used in pre-Columbian grave construction came from a formation near the Algarrobos railroad station (Figure 4-5) on the now dismantled train line that ran from David to Boquete (Wassén 1949).[147] Indirect confirmation of this area as a possible quarry site is provided by place names; for example, a stream named Quebrada Las Lajas is located roughly 20 km east of the train station location.[148]

I would anticipate, however, that the paths used to transport the dacite slabs to Boquete cemeteries like BE-16-KH (KOT) most likely followed the primary rivers and streams of the area. Callaghan and Bray (2007) have proposed that seafaring trips and canoes existed in the isthmus as early as the Pleistocene; ostensibly smaller river canoes also have an extremely long time depth of use. While forest footpaths were commonly utilized, streams and waterways were more important in the isthmian context for

[147] The Ferrocarril de Chiriquí was in operation from 1916-1974. I am indebted to Dra. Maria Elisa Ruiz A. for her help in identifying the location of the former train station.

[148] As noted earlier in this chapter, *laja* is the locally used term for a dacitic slab.

transportation of goods and people by ethnographic populations (Joyce 1916b: 4). It is possible that this pattern existed in pre-Columbian periods.

Transportation of goods using human porters who were referred to as slaves (*esclavos)* was repeatedly noted by the Spanish during the contact period (Andagoya in Jopling 1994: 30, 39, Oviedo y Valdés 1851-55 [1535-1547]: 1853: 8, 129, 140, Santos-Granero 2009).[149] The smaller, lighter basalt columns could more easily be transported using tumplines, or straps placed over the top of the head and attached to the object. This is one likely way that basalt columns were transported to the BE-16-KH (KOT) graves due to the lack of a direct waterway between the source and the cemetery. The heavier dacite slabs, however, were less wieldy and could more easily be transported by ropes attached to a shallow canoe or raft and pulled along rivers and streams.[150] Alternately, heavy loads could have been placed on litters made of organic material that multiple people helped to carry. Even if the dacite slabs were not transported on the waterways, walking on foot along the streams and rivers would provide the most efficient form of navigation for long-distance transport.[151]

If dacite slabs for the BE-16-KH (KOT) graves discussed in the prior chapter were transported either by boat or foot along the Rio Caldera, the point at which the porters would have to leave the river and begin walking along a forest footpath would be precisely the point marked by the KHP-23 (Rovira) petroglyph. Alternately, if the dacite slab porters left the Rio Caldera just prior to the cemetery and petroglyphs at the BE-14-KH (GON) site, they could have then followed the smaller Rio Palo Alto to reach the BE-16-KH (KOT) site. In future survey, I suggest the careful examination of the area where the Rio Palo Alto diverts from the Rio Caldera to determine if any further petroglyphs

[149] My thanks to Richard Cooke for these citations.

[150] Though from Nicaragua and from a mixed indigenous-African slave community, an idea of this form of transport, using a pitpan (flat bottomed canoe used in rivers and lagoons in Central America) is described and illustrated in p 68-75 of Squier (1891).

[151] My thanks to Jeff Frost for helpful conversations on this topic.

support or weaken the theory that the petroglyphs marked paths used to transport the grave materials.

It is worth noting that if the dacite slab source was in the Algarrobos area, this places it close to a sulphur spring formed from escaping volcanic gases. Contemporary Ngöbe people bathe in the sulphur spring for skin afflictions; conjecturally, the association of the sulphur spring and dacite slabs could have been significant to the meaning and symbolic load of the location in the past. Algarrobos is also interestingly located in relation to the many grave locations provided by J.A. McNeil as the source for many of the Chiriquí artifacts now in the major US museum collections; in particular, the site of Bugaba (which is outside of my research universe) is due west of the possible dacite slab source. No direct, major waterway route would be feasible for transporting dacite slabs for the Bugaba and Bugavita graves from Algarrobos. Further investigation of smaller (possibly seasonal) streams and terrestrial footpath routes is required to understand more clearly how the materials could have been transported.

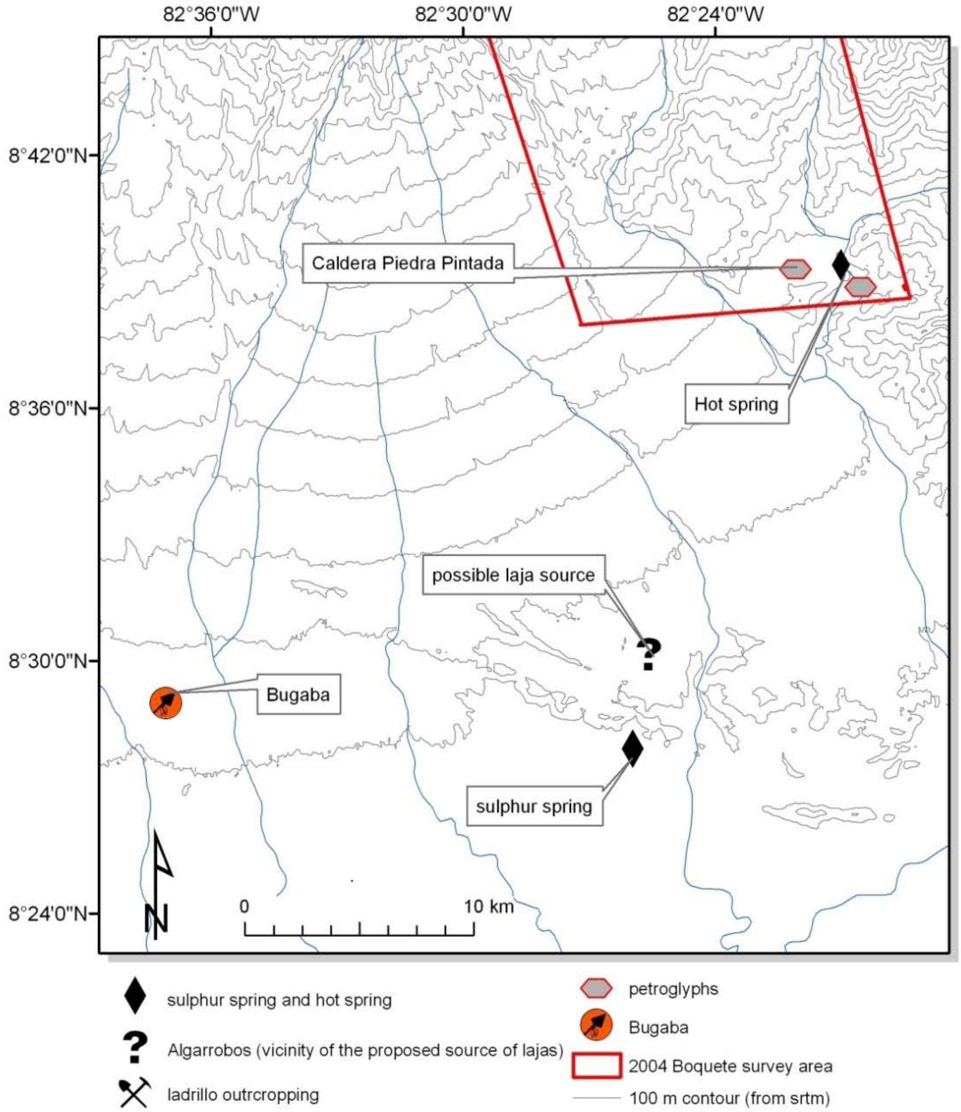


FIGURE 4-5: ALGARROBOS DACITE SLAB SOURCE AND SULPHUR SPRING IN RELATION TO THE 2004 BOQUETE SURVEY AREA AND THE SITE OF BUGABA

Rock art and cemeteries: the BE-14-KH (GON) site in El Huacal

In addition to the KHP-23 (Rovira) and KHP-24 (Municipio) petroglyph boulders, only one other petroglyph near the town of Boquete was commonly known to local residents when I began my fieldwork. This third petroglyph boulder (KHP-18) is on the property of the Café Ruiz coffee roasting facility. I uncovered this petroglyph boulder in 2000 as it was almost completely submerged in mud along a ditch. Local residents subsequently kept the boulder cleaned in order to view the designs and the boulder became an informal tourist and local attraction. When I returned in 2004, the petroglyph was markedly less distinct. If this level of deterioration occurred over only four years, clearly the passage of more than a millennium would easily remove designs from the rocks. My experience of noticeable petroglyph deterioration after only a few years mirrored that of researchers in Costa Rica.[152]

In 2000 and 2004 I conducted a surface survey of the property near the KHP-18 petroglyph. This survey resulted in the recording of an additional 24 petroglyph boulders (see Figure 4-6).[153] I assigned the petroglyph area - most of which is on the Gonzalez family *finca* - the site number of BE-14-KH (GON). These petroglyphs are located in an area known locally as *el Huacal*.[154]

---

[152] Jeffrey Quilter (2004: 36-8) describes an even more striking rate of degradation in Costa Rica, where researchers examined a boulder in 1991. The researchers determined that the boulder had once had more complex designs which were eroded, then returned only a year later in 1992 to find the designs almost erased. As Quilter (ibid.: 37) aptly notes, 'Such rapid rates of weathering made us wonder how many other boulders at the site may once have had engravings that can no longer be seen'.

[153] I used a Garmin GPS-III+ unit to assign coordinates to petroglyphs. To hire a theodolite was prohibitively expensive for my 2004 Boquete survey budget, but I would like to do so in future fieldwork in order to make a more accurate representation of the spatial relationship between the petroglyphs.

[154] A *huaca* is the term applied in the area both to a grave and to artifacts found as grave offerings, and the name referenced the high number of graves opened in the area during the late nineteenth and early twentieth century. Stories of the past richness of the grave area and piles of *lajas* are the primary indicators of the cemetery's location. The petroglyph concentration is today contained in a field of coffee and orange trees, though in the 1950's when the Gonzalez family first began farming the property it produced tomatoes and lettuce (Clavdia and Jorge Gonzalez, personal communication).

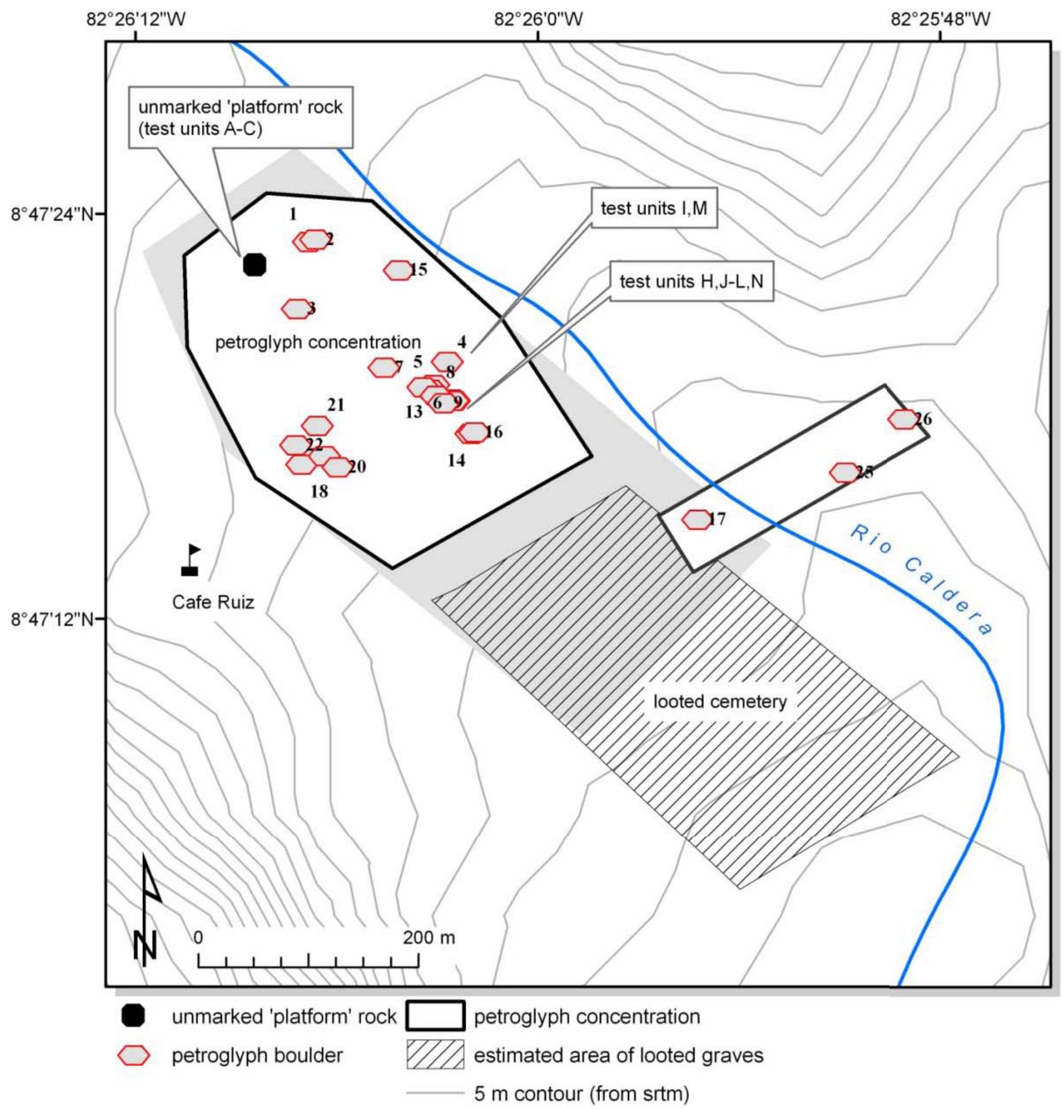


FIGURE 4-6: OVERVIEW MAP OF THE BE-14-KH (GON) PETROGLYPH CONCENTRATION

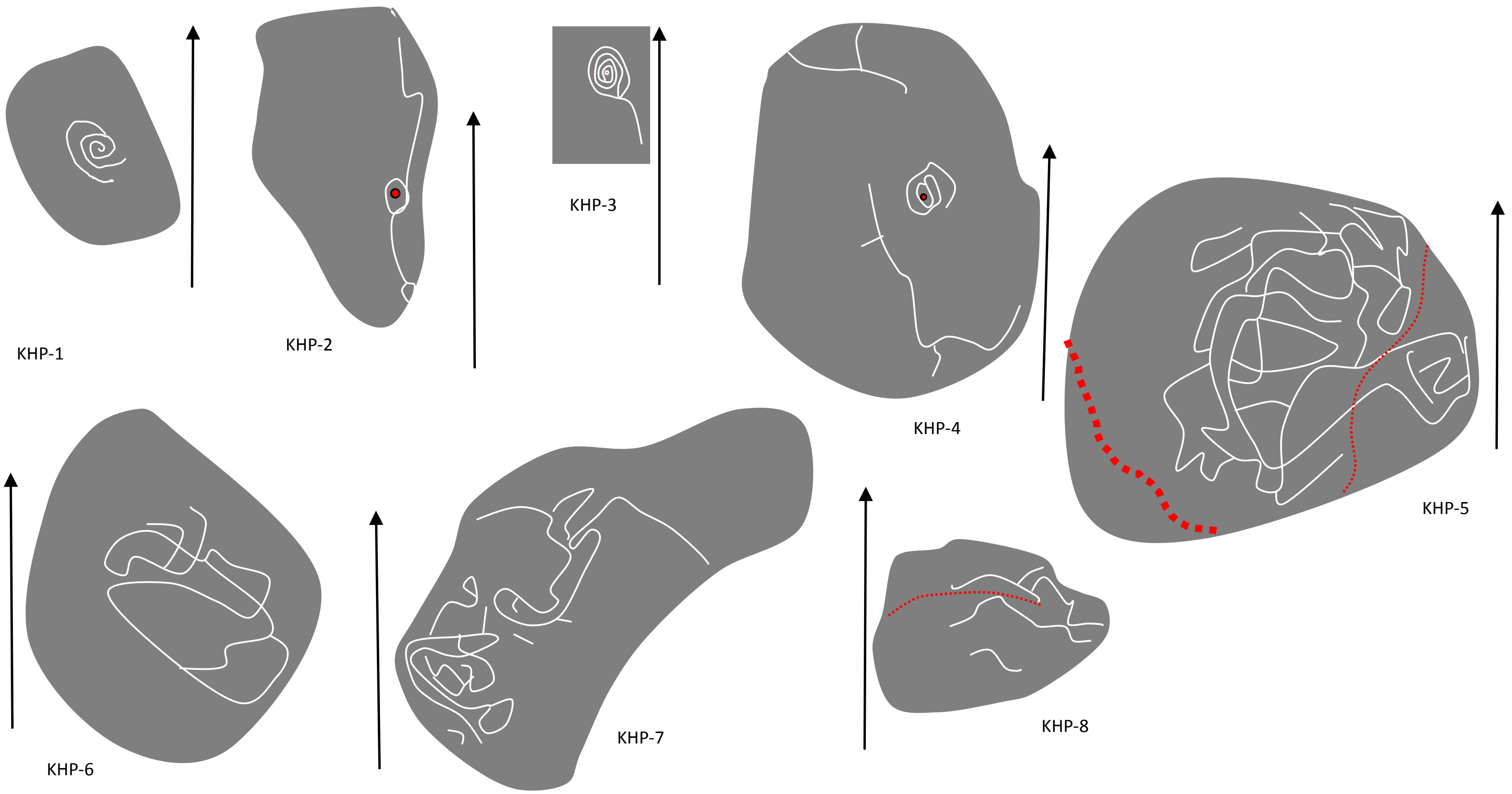


FIGURE 4-7: BE-14-KH (GON) PETROGLYPHS KHP-1 TO KHP-8 [ARROW INDICATES NORTH AND IS A 1 M SCALE]. RED MARKS INDICATE NATURAL SPLITS IN THE ROCK

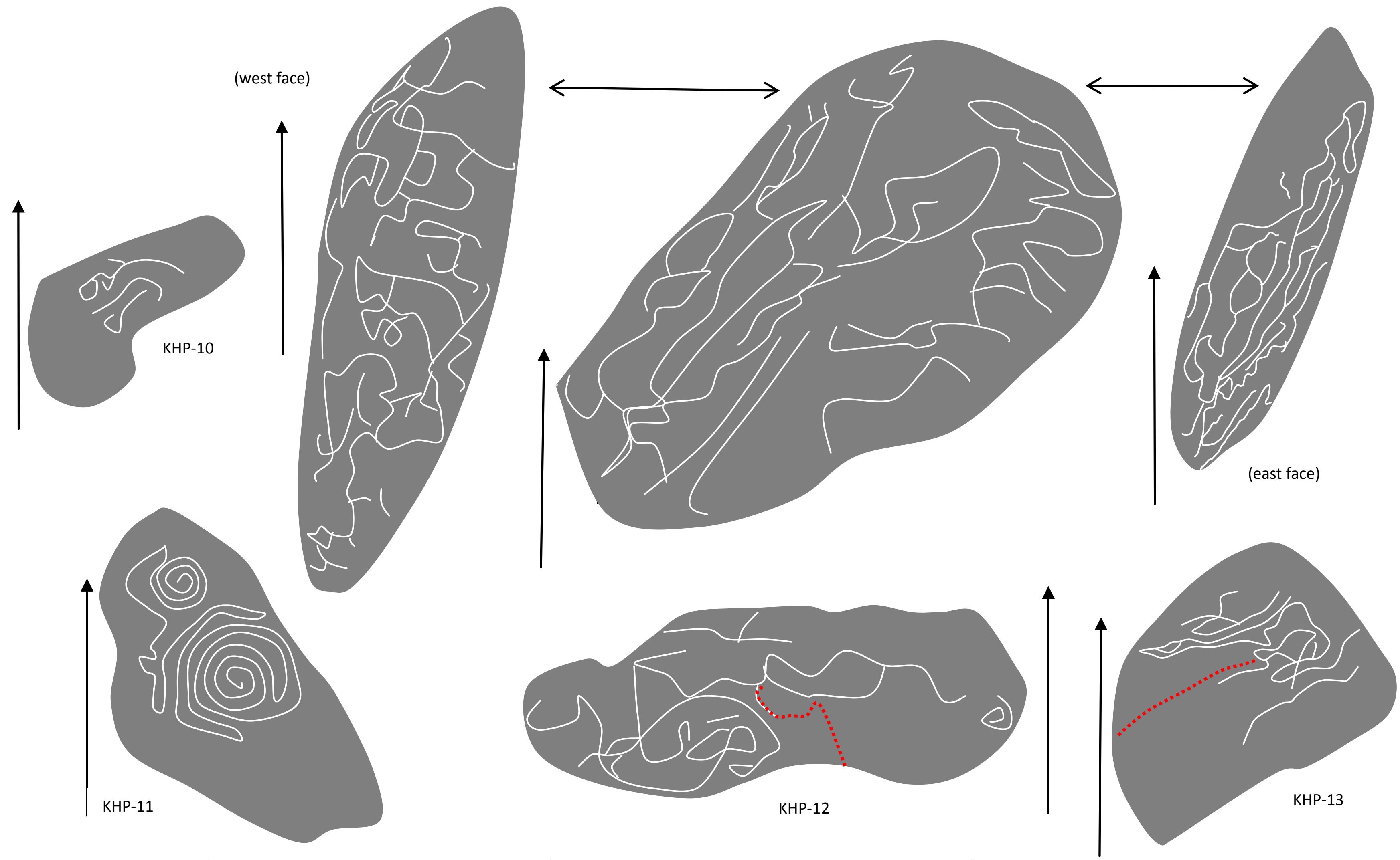


FIGURE 4-8: BE-14-KH (GON) PETROGLYPHS KHP-9 TO KHP-13 [ARROW INDICATES NORTH AND IS A 1 M SCALE]. RED MARKS INDICATE NATURAL SPLITS IN THE ROCK

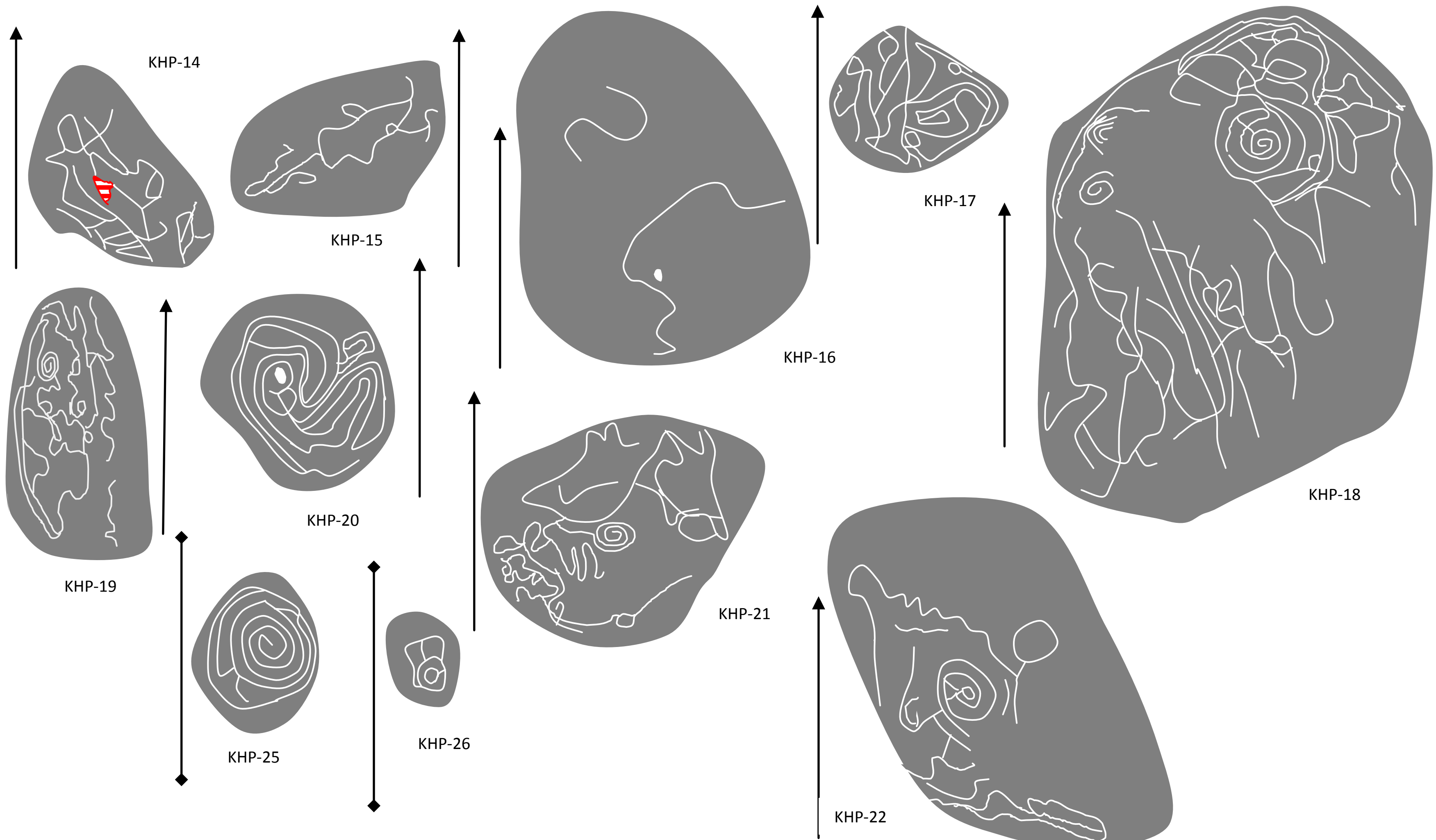


FIGURE 4-9: BE-14-KH (GON) PETROGLYPHS KHP-14 TO KHP-22, 25, 26 [ARROW INDICATES NORTH AND IS A 1 M SCALE]. RED MARKS INDICATE NATURAL SPLITS IN THE ROCK

One of the most distinctive rocks in the mist of the BE-14-KH (GON) petroglyphs is unmarked by petroglyphs. The boulder is broad and flat, like a platform or stage, and is roughly 1.5 meters high, 8 meters long, and 3 meters wide. An *ojo de agua*, or spring source, emerges from the northeast corner of this 'table' rock, which is located at the northern limits of the recorded BE-14-KH (GON) petroglyph cluster. When standing upon the unmarked rock, one can clearly see Barú to the west and the distinctive geodesic peak known as Piedra Lino.[155] Ambiguity often exists between 'natural' and 'cultural' elements of monuments (Bradley 1998, 2000). The unmarked boulder at BE-14-KH (GON) is particularly ambiguous in its identification as an acculturated element of past social life.

FIGURE 4-10: PHOTOS OF THE 'PLATFORM' ROCK AT BE-14-KH (GON)

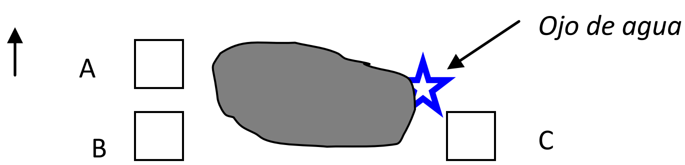


FIGURE 4-11: SCHEMATIC OF THE UNMARKED ROCK AT BE-14-KH (GON) IN RELATION TO THE *OJO DE AGUA* AND 1X1 METER EXCAVATED UNITS A-C

155 I surveyed another large, distinctive, unmarked rock (8.83432 N/-82.4873 W) with an *ojo de agua* emerging from it near looted graves (8.83323 N/-82.4847 W) in the Boquete area of Quiel, though did not place test pits at the location due to the difficulty of accessing the site.

The appreciation of unmarked stones or the 'cultural' accentuation of 'natural' attributes of stones is found in a wide swath of past cultures (Cooney 2002, Morrison 2007, Parkes 2005: 219, Thomas 2004c). Rock art, in turn, is frequently placed in association to naturally distinctive elements of the landscape (Bradley 2000: 36, Nash 2000). The decision to place the petroglyphs at the BE-14-KH (GON) site was arguably prompted by the natural significance that the location already held through the platform rock with its *ojo de agua*, and the clearly collocated position of that rock in relation to the volcano and Piedra Lino.

Similar interpretations are made at a number of sites in Costa Rica and Panamá. Quilter (2004: 39) argues that rock art in the Rivas area was placed in special places which conferred it status rather than vice versa. A boulder in the Rivas area also had a large flat area and an *ojo de agua* that emerged from the stone (ibid.: 149), though it was marked with a spiral rather than unmarked like the BE-14-KH (GON) rock. At the Costa Rican site of Java, petroglyphs and graves are also found in association with a stone 'table' (Fonseca Zamora and Chávez Chávez 2003). The pre-Columbian resonance of these stones is possibly paralleled by ethnographic treatment of 'special' rocks by native American peoples during historic periods. One such example from the southern General Valley of Costa Rica is unmodified, but is known as *mano de tigre* (claw of the jaguar) by contemporary Térraba and Brunqua groups. People in these groups associate the unmarked rock with the creation of their ancestors and until recent decades left it offerings of food, while ignoring petroglyph boulders near it (Künne and Strecker 2003: 113, Stone 1961: 136).

Recent literature also addresses the concept that non-anthropogenic environments and landscapes do not exist in areas where people have lived for long periods of time (e.g., Head 2008, Heckenberger et al. 2003, Morrison 2007, Thomas 2004c). Consequently it is reasonable to infer that in heavily occupied pre-Columbian areas like the Boquete area, prominent unmarked stones like the platform rock at BE-

14-KH (GON) did not have 'cultural' significance. Once can speculate therefore that - if the unmarked rock was the source of sacredness at the site and hence prompted the creation of the rock art around it - the boulder may have been construed as the literal beginning of the 'building' of the site. Similar examples are documented from the Inka world, such as the Observatory at Machu Picchu and Inka walls, which were formed around pre-existing stones (Stone 2007: 22-3). In the pre-Columbian Andes, stones marked, in essence, the beginning of the Andean social order through venerated origin places called *pacarinas* where human ancestors manifested from stones (Hyslop 1990: 107, Stone 2007: ibid.). Rebecca Stone (ibid.) terms this creation of human from rock as 'lithogenesis' and frames it as a foil of lithomorphosis, or the transformation of a stone. Thus the Inka case provides a confirmatory example of how stones can be highly socialized.

The location of the looted graves of *El Huacal* and the BE-14-KH (GON) petroglyphs are clearly related to one another spatially (Figure 4-6).[156] Their temporal and symbolic relationship, however, is uncertain. The graves at the BE-14-KH (GON) site, which are located in the Boquete valley bottom, represent an exception to the hilltop location of many cemeteries in the Greater Chiriquí culture area (Cooke 2005: 159). Could the petroglyphs have been a way of appropriating an earlier cemetery space and pulling it into a new belief system? Alternately, perhaps the landscape location was seen as symbolically charged due to 'natural' elements like the unmarked rock and the *ojo de agua*; if the petroglyphs and cemetery were coeval they possible drew upon this chthonic power as a source of social resonance.

Petroglyphs are proposed as one way people delimited spaces with different functions in pre-Columbian contexts (e.g., Oliver 1998). If the petroglyphs and cemetery

---

[156] I anticipate that the *Huacal* graves are the ones described by German archaeologist Otto Lutz (1922: 364-5). He describes the graves as being located by the Rio Caldera. Lutz (ibid.) provides an image of a petroglyph cobble, but does not describe its original location. Lutz believes that the cobble design was zoomorphic.

were seen as a contiguous unit by the people who utilized and created them, however, the layout of the petroglyph concentration separate from the grave concentration could support concepts of Amerindian dualistic construction. The incorporation of dualism into architectural designs in the Greater Chiriquí culture area is currently receiving fresh attention based upon ethnographically known moiety divisions (Frost *in preparation*). The pertinence of dualistic conceptual organizations to the Amerindian past is strongly challenged in numerous Amazonian cases (e.g., Heckenberger 2004, Viveiros de Castro 1998), and researchers who address concepts of dualism are now careful to point out the complexity and imperfection of the conceptual application to the data, which are cross-cut by multiple factors (e.g., Sendón and Villar 2007). Without further data it is impossible to know if the earlier ceramics from the *Huacal* area represent an occupation that predates the petroglyphs and graves or if graves and petroglyphs were coeval. As Cooke (2005: 159) notes, burial areas were frequently kept separate from living areas, hence perhaps no one lived in the area during the time of the cemetery construction.

One important consideration in the BE-14-KH (GON) layout depicted in Figure 4-6 is the presence of both portable and non-portable rock art at the site. While larger boulders are clearly in their original locations, numerous smaller petroglyph rocks were probably moved from their original context. The KHP-24 and KHP-25 cobbles were removed during the construction of a new residential subdivision in 2005; their location on the map in Figure 4-6 is approximate and likely quite close to their original location, but not as precise as the positions for the immobile petroglyph boulders to the north of the petroglyph cluster. The González family has several smaller rock art covered cobbles in its collection of artifacts recovered during agricultural work (Figure 4-12), and I would anticipate that numerous other cobbles were removed from the site in the twentieth century before this family owned the land. Petroglyphs on smaller (<1 m) stones seem to have been closer to the main grave area, while the larger, immobile petroglyphs are concentrated in a 50 m^2 sector north of the burial area.

FIGURE 4-12: STONE ARTIFACTS COLLECTED DURING AGRICULTURAL WORK BY THE GONZÁLEZ FAMILY FROM THE BE-14-KH (GON) PROPERTY. THE COLLECTION INCLUDES STONE SPHERES, *MANOS*, *METATES*, AND PORTABLE PETROGLYPH COBBLES

I placed a series of excavated test units near petroglyphs and the unmarked 'platform' rock at BE-14-KH (GON). This work recovered numerous ceramic and stone artifacts and provided a chronology that, based on current typological schemes, extends from roughly 200-600 BC to AD 700-1500. The highest concentration of diagnostic artifacts came from the earlier (AD 200-600) period, a relatively small amount from the AD 700-1100 period, and somewhat more from the AD 1000-1500 period. None of the artifacts, however, gave an indication of 'how' the petroglyphs were used. I was very excited, therefore, to uncover a clay-lined pit filled with heavy amounts of charcoal abutting KHP-9.[157] The 190 centimeter pit was lined with a reddish yellow (7.5 YR 5-6) clayey-sand, and graded from 33 cm below the surface at its 'rim' to 56 cm depth at its bottom; the surface of the pit during its use was roughly 6 cm deep below the rim. The pit contained heavy concentrations of very large chunks of carbon. The presence of a ritual fire pit could possibly have parallels in the Costa Rican site of Panteón de la Reina,

[157] For reference to the artifact counts listed in the Appendices, these units were H, J-L, and N.

where a patio associated with a ‘false’ cemetery and a platform mound had two 3x3 m hearths that Quilter and Frost (2007a: 42) interpret were possibly located with funeral ceremonies that were carried out at night. It could also represent a *hornilla* (a pit used for cooking food) that can be found in pre-Columbian and modern domestic structures (Cooke 1979).

FIGURE 4-13: EXCAVATED TEST UNITS AT THE KHP-9 PETROGLYPH BOULDER DURING EXCAVATION (RIGHT PHOTO SHOWS THE RELATIONSHIP OF THE CLAY-LINED PIT TO KHP-9)

The interpretation of the KHP-9 pit as an intact pre-Columbian context, however, was weakened rather significantly by the recovery of an amber colored glass beer bottle embedded in the pit wall. The molded bottle has vertical side mold seams and a suction mark edging onto the heel of the bottle from the base. The ‘Saturn’ (or Diamond Owens-Illinois) makers mark on the bottle bottom is extremely common on bottles made during 1930-1956, with limited use of the mark until 1959 (Lockhart 2004, Toulouse 1971). The bottle is labeled in English and Spanish with the ‘German Pacific Brewery, *Cerveceria Alemana de Pacifica’* and the brand name of the beer, which is “Milwaukee”. This Panamá City based German Pacific Brewery only existed under that name from 1927 through 1938 (Plano 2008), hence the hand engraved ‘3’ to the right of the makers mark, which indicates the year of manufacture, dates the bottle’s manufacture to 1933 (rather than 1943 or 1953).[158] This is further supported by the lack of a mark for the ‘Duraglass’ technique, which was introduced after 1940.[159] The labeling is a faded Applied Color Lettering, which was a technique introduced in 1934 and popular by the late 1930’s and early 1940’s (Schulz et al. 2009), hence it appears that a new label was placed upon an older bottle at some point before 1938 when the brewery changed its name. The creation of the clay lined pit could certainly date to later than 1938 if the bottle was collected and re-used, though the bottle does provides a *terminus post quem.*

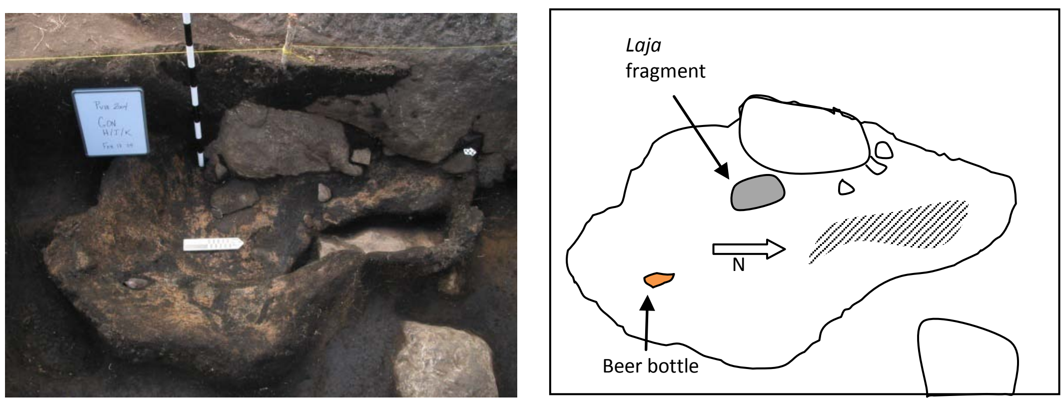


FIGURE 4-14: THE FIRE PIT AT KHP-9, WITH BEER BOTTLE AND DACITE SLAB FRAGMENT *IN SITU* (LEFT: PHOTO; RIGHT: SCHEMATIC)

[158] The bottle base is also imprinted with a plant number (21). This Owens-Illinois plant was located in San Francisco from 1930-1937, and was the former plant of the Illinois-Pacific Glass Co, Illinois-Pacific Glass Corp., and Illinois-Pacific Coast Corp, see Lockhart et al. (2005).

[159] I am indebted to Bill Lockhart (Bottle Research Group; affiliated with the Society for Historical Archaeology) for his insight on twentieth-century bottles and help in identifying this one.

FIGURE 4-15: GLASS BEER BOTTLE EMBEDDED IN THE KHP-9 FIRE PIT

In addition to the beer bottle, the pit also contained a portion of dacite slab used to cap one of the graves from the BE-140KH (GON) site. I was originally disappointed at the modern context of the clay-lined pit, though in retrospect the conjunction of the petroglyph boulder, dacite slab, and fire pit is a fascinating merging of time periods and uses of the location and stone objects and worth consideration in its own right. Why the pit was built against the petroglyph boulder and for what purpose is unknown.

Rock art and calendrics: the Caldera Piedra Pintada

The best known petroglyph boulder in the Barú area is the *Piedra Pintada* (Painted Rock) of Caldera, which is located in the far southeast portion of my 2004 Boquete survey area in association with a volcanic hot spring and an additional petroglyph boulder (KHP-27).[160]

[160] Many of the nineteenth and early twentieth century sources refer to this same petroglyph boulder as the *Piedra Pintal*; it is generally referred to as *Pintada* in the local area today.

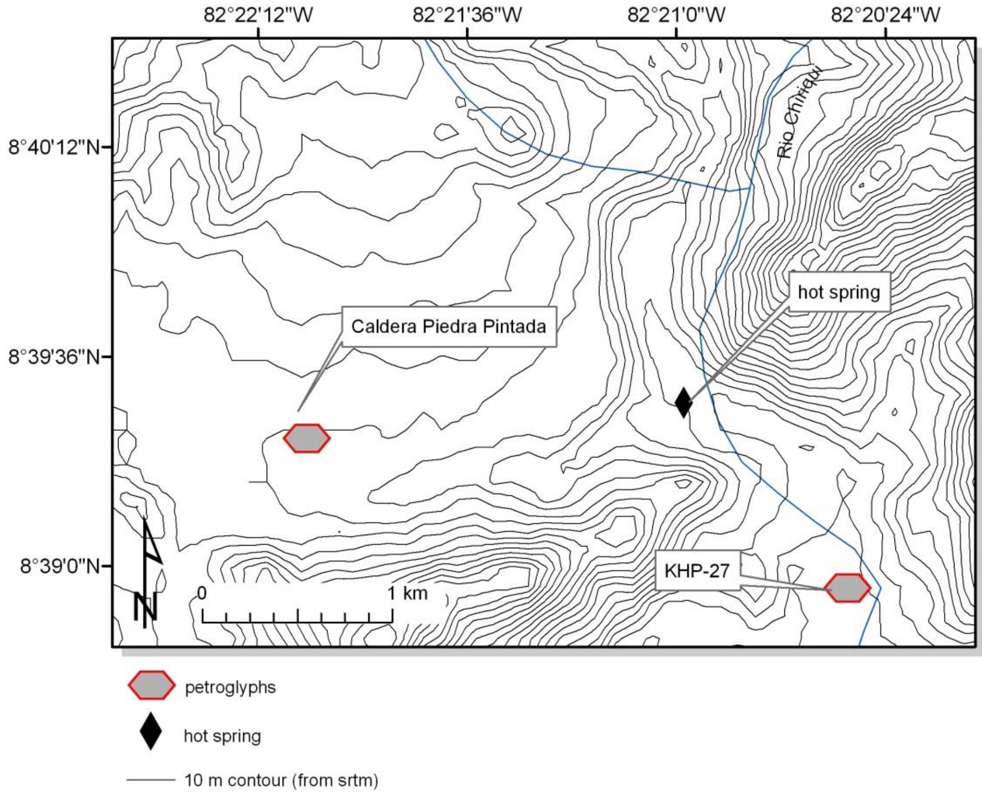


FIGURE 4-16: MAP OF THE CALDERA PETROGLYPHS

This large petroglyph boulder is mentioned and depicted in a number of nineteenth-century archaeological discussions of Chiriquí that followed the looting rush for gold grave objects (Andree 1878, Bollaert 1863: 148-9, Holmes 1888: 22, Lutz 1922: 365-6, MacCurdy 1911: 43, Mallery 1893: 143-4, 194, 615-6, McNeil n.d., Pim and Seemann 1869: 29-32, Pinart 1885, Seemann 1853b: 325-6, 1866: 312). As Holmes (1888: 22) points out, representations of the petroglyph boulder varied dramatically, with some sketches of the designs only nominally similar to others.[161] The most accurate in terms of the number of designs was likely by Pinart as it was a tracing rather than a sketch, though the designs portrayed by Pinart are less detailed than the sketch by J.A. McNeil (n.d.) and reproduced by Holmes (1888: 22), Mallery (1893: 193), and (Lothrop 1948:

[161] Holmes specifically mentions the sketches by Seamann, Pinart, and McNeil.

161), amongst others.[162] A number of twentieth-century descriptions and depictions of the Caldera *Piedra Pintada* exist (Fitzgerald 1999, Gonzalez 1998, Holmberg 2005, 2007a, Künne 2008a: 244, Figure 97, Lothrop 1948: 161, Pérez Franco 2007, Quesada Pacheco 2001: 509, Schobinger 1997: 174), though none of these provide detailed or more accurate schematics of the designs on the boulder's faces than was already provided over a century ago.

The designs on the boulder consist primarily of pecked and chiseled spirals, circles with crosses or lines within them, and assemblages that resemble faces and lizards (for further discussion of the designs, please see Appendix Q). Almost invariably, the western face of the *Piedra Pintada* is depicted in sketches and photo references to it. In this thesis I provide a schematic of the designs currently visible on the boulder using digital photography and digital drawing, which is ostensibly more accurate than the nineteenth-century recorders were able to create but also suffers from the likely degradation of the designs in the past century (Figure 4-17).

[162] The most aesthetically romanticized sketch of the *Piedra Pintada* at Caldera in its setting was the first ever done; see the plate between p. 326 and 327 of Seemann (1853b).

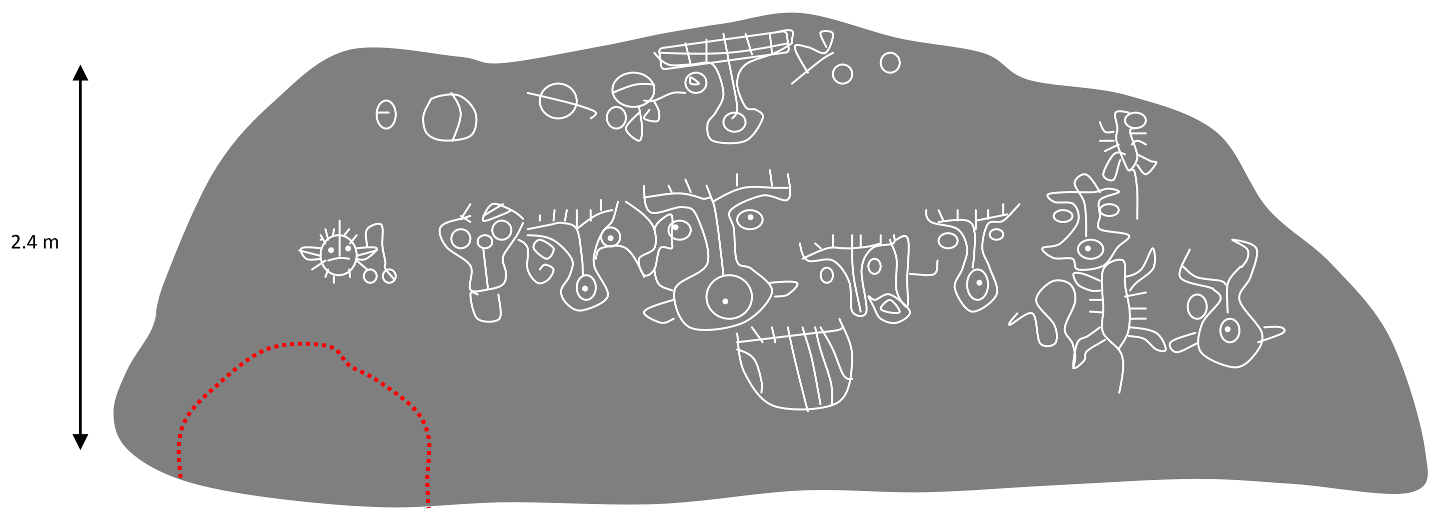


FIGURE 4-17: SCHEMATIC OF THE WEST PROFILE OF THE CALDERA *PIEDRA PINTADA*

Note: This is only a rough sketch based both on the drawing published in Mallery (1893: 144), which is a sketch by J. A. McNeil, and my own photographs. The creation of a detailed, accurate, and 3-dimensional representation of the petroglyph boulder that I would like to produce proved more difficult than I anticipated in the field and will require further experimentation.

The western face of the boulders receives more attention because the designs are more figurative and are easier to view. The designs on the eastern and upper surfaces of the rock are difficult to see and photograph due to the angle of the rock. They are also more eroded. I provide schematics of the east and north boulder faces that I made using a Haglöf clinometer, which allowed more accurate measurement of the faces and angle of the boulder (Figure 4-18). [163]

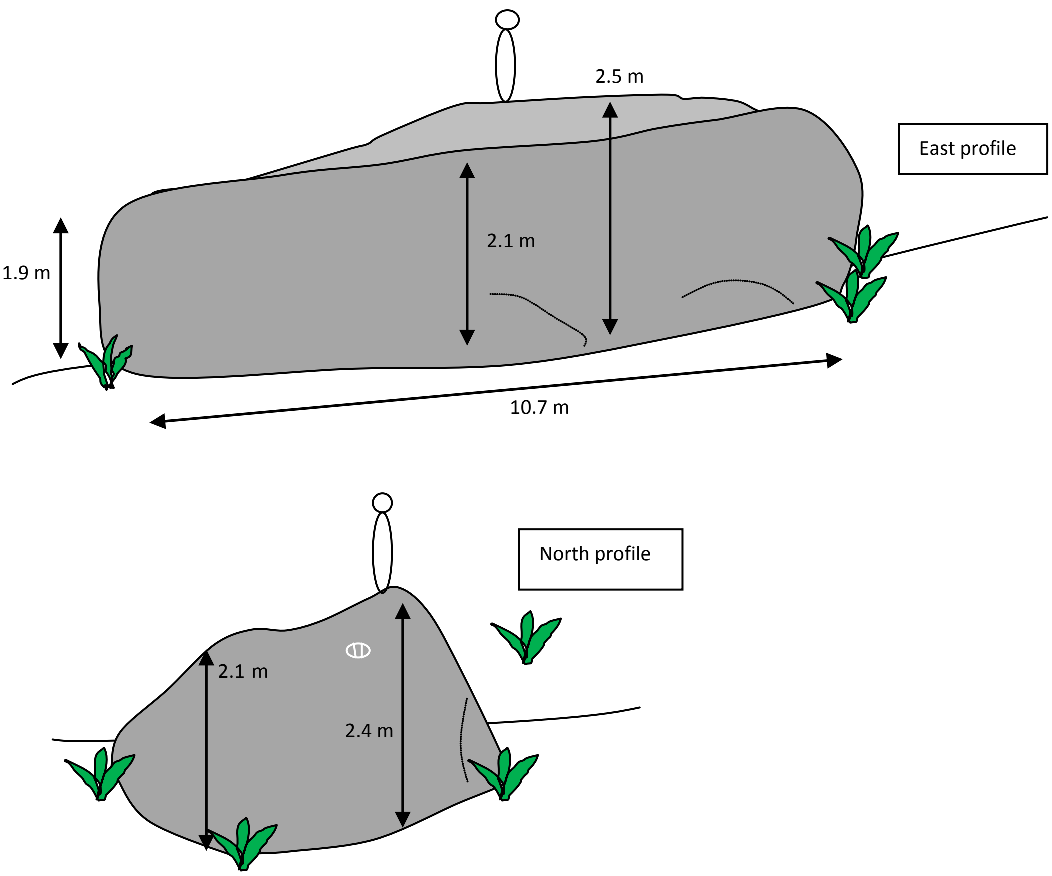


FIGURE 4-18: PROFILES OF THE CALDERA PIEDRA PINTADA WITH A SCHEMATIC OFA HUMAN FIGURE FOR SCALE

I assumed at the onset of my fieldwork that while the *Piedra Pintada* was clearly modified by petroglyphs, the shape of the boulder itself was 'natural'. The sketches of the boulder shape in conjunction with a very similarly shaped, modified boulder

[163] The clinometer accuracy is ±0.3 meters.

(Quilter 2004: 147, Figure 6.5) and modified basalt columns (Quilter and Frost 2007a: 50) in Costa Rica make me question, however, whether the *Piedra Pintada* was also shaped into a deliberate profile (Figures 4-19 and 4-20). I cannot offer any theory of why this shape would be significant, though the repeated motif is worth further consideration and examination both in the Boquete survey area and other areas of the Chiriquí region.

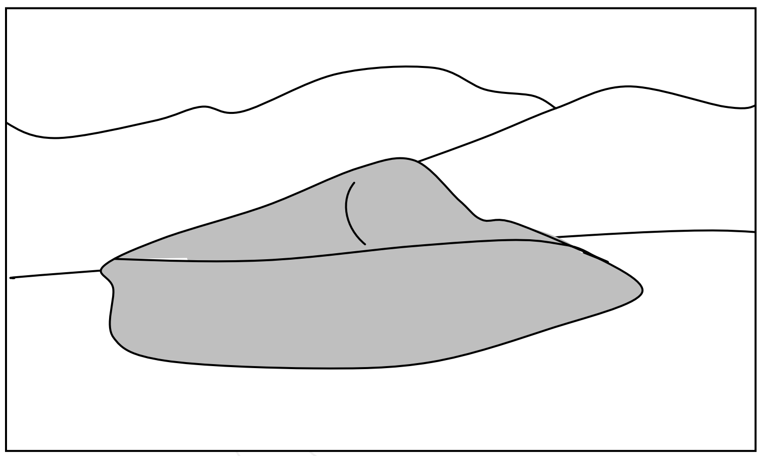


FIGURE 4-19: PROFILE SKETCH OF THE *PIEDRA DEL INDIO*, RIVAS SITE, COSTA RICA (FROM PHOTO IN QUILTER 2004: 147, FIGURE 6.5)

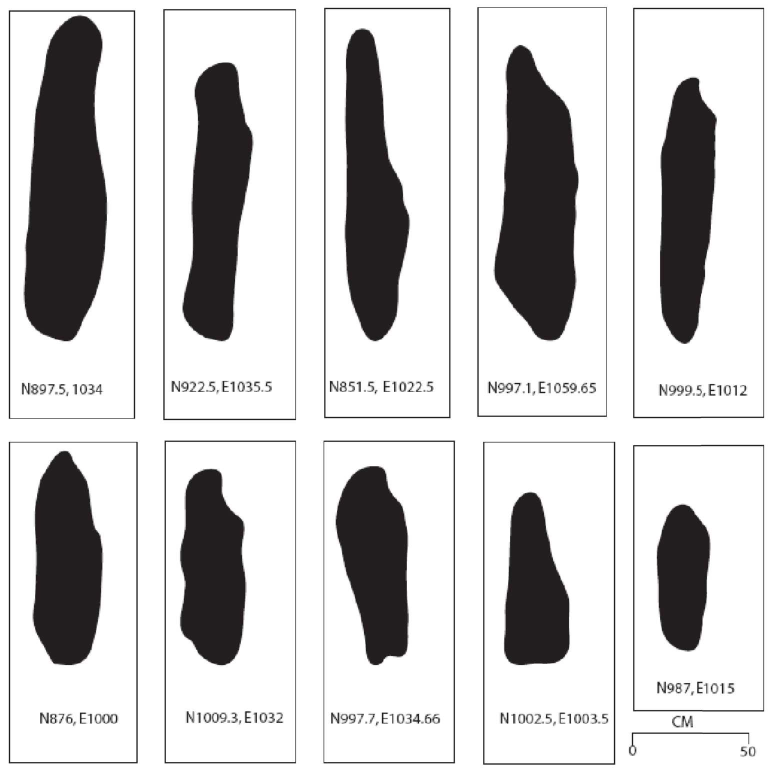


FIGURE 4-20: PROFILES OF THE BASALT COLUMNS (I.E., *LADRILLOS OR MOJONES)* FROM QUILTER AND FROST (2007: 50)

Quilter (2004: 147) notes that in the Costa Rican context, the modified but non-petroglyph marked boulder was shaped and 'sculpted' in order to mimic the view of the peaks behind it. This purposeful modification is a possibility at the Caldera *Piedra Pintada* as well. The size of the boulder, however, requires anyone wanting to view the repetition of the form to be actually standing or sitting on the top of the boulder (Figure 4-21).

FIGURE 4-21: THE TOP OF THE *PIEDRA PINTADA*, LOOKING NORTH WHILE SITTING ON THE SOUTH END OF THE BOULDER

Spanish chronicles support the idea that one role of rock art was to define boundaries between territorial groups; records made during the expeditions of Pedrarias Dávila in 1510, which describe how the territory under control of a particular *cacique* (chief) was marked by *mojones*, or 'cairns', to indicate where the territory of one *cacique* ended and another's began (Isaza Aizpurua 2007, Jopling 1994: 21). The Caldera *Piedra Pintada* boulder possibly indicated a boundary line between two stylistic regions; northwest of the site most petroglyphs are circles and spirals similar to those in Costa Rica and southwest a 'completely different formal language' appears that is more similar to that of Veraguas, Coclé, and Azuero in Panamá (Künne 2003: 206, 2008a: 244, Stone 1961). These differences in designs could indicate that the petroglyphs were created at different time periods. Künne (2003) notes the point that different iconographic languages can co-exist simultaneously so this differentiation cannot necessarily be equated to an indication of territory claimed by any particular political or cultural group if the designs are coeval. Clearly, identity cannot be read so discretely.

Like the unmarked rock in the midst of the *El Huacal* petroglyphs at BE-14-KH (GON), the *Piedra Pintada* site seems 'naturally' significant and likely held a vestige of power that the markings were intended to appropriate or accentuate rather than create. The *Piedra Pintada* is close to a volcanic hot spring. Contemporary indigenous groups in the area use the hot springs for health purposes and are thought to benefit female fertility.[164] Though it cannot be definitively inferred, the hot springs likely had some form of symbolic resonance in pre-Columbian life as well. The rock-art boulder is the largest rock in the midst of a field of volcanic boulders. Most of the other, much smaller rocks have been naturally sorted and are roughly coeval in size; hence the petroglyph boulder stands out as incrementally larger than the others.

The second largest stone in the field is a massive, split boulder, roughly 6 m long and 3 m tall that is situated between the seasonal stream and the petroglyph boulder (Figure 4-22). The viewer standing within the split boulder can see the crater of the Volcán Barú, 25 km distant. Split boulders can occur naturally through tree growth along softer mineral inclusions or can also be split by lightening, such as occurred at the Scottish megalith site of Brogar in 1980, or by using fire and water to create cleavage, such as was done at the site of Avebury in England in the seventeenth and eighteenth century to destroy their 'pagan' resonance.

[164] For example, a Ngöbe woman wanting to become pregnant is instructed to bathe in the hot springs at night time during the full moon (Luz Graciela Joly, personal communication). The Caldera thermal springs are particularly well-known for their ability to alleviate rheumatism, respiratory diseases, skin diseases, and increase circulation. Two other hot springs (Cotito and Los Posos) can be found near the town of Volcán on the western flanks of Barú. For descriptions of the health benefits of thermal springs see Bundschuh et al. (2007a).

FIGURE 4-22: THE SPLIT 'PASSAGE WAY' ROCK AT CALDERA (LEFT: PHOTO TAKEN WHILE LOOKING AT THE SPLIT BOULDER FROM THE *PIEDRA PINTADA*; RIGHT: PHOTO TAKEN FROM INSIDE THE SPLIT BOULDER, LOOKING AT THE *PIEDRA PINTADA*)

In the pre-Columbian context, fire-cracked rocks begin as 'natural', but if they are chosen according to form and volume and then used, they can be considered 'made' (Oyuela-Caycedo and Bonzani 2005: 87). Other boulders in the Caldera vicinity are also split (Figure 4-23). If the Caldera split boulder was intentionally formed, it most certainly provides an example of monumental material culture. No matter how it was created, however, the split stone is intimately and associatively linked with the rock-art and forms a hallway or 'passage way' for between the stream and the petroglyphs.

FIGURE 4-23: ANOTHER SPLIT BOULDER CLOSE TO THE CALDERA *PIEDRA PINTADA*

While it is well known that the great Mesoamerican cities erected buildings that aligned with or used to observe celestial bodies and movements, it is also possible that boulders and other natural or cultural landmarks in the isthmian area can be demonstrated to have had an astronomical relevance. The positioning of the *Piedra Pintada* in relation to the sun was potentially important in its past context and utilization. The sun plays an important role in Amerindian symbology and cultural life available through ethnography. The Bribrí, for example, locate their house entrances to the east in reflection of cosmological relationships (González Cháves and González Vásquez 1989: 87). The importance of stars is also evident in contemporary examples. A Ngöbe naming ceremony is conducted when a child is several months old. The ceremony occurs at 4:00 in the morning when Venus (called Jörrö in Ngöbe) rises; a female elder strikes the child with a calabash ladle and whispers a secret name in the child's ear (Luz Graciela Joly Adames, personal communication). Certainly, the *Piedra* Pintada appears to line up with prominent features of the landscape; i.e., the distinctive geodesic point of La Artilleria is directly north of the *Piedra Pintada*, while Barú is located to the west (Figure 4-24). The sun would rise and set with clear association to the Artilleria peak and disappear behind Barú.

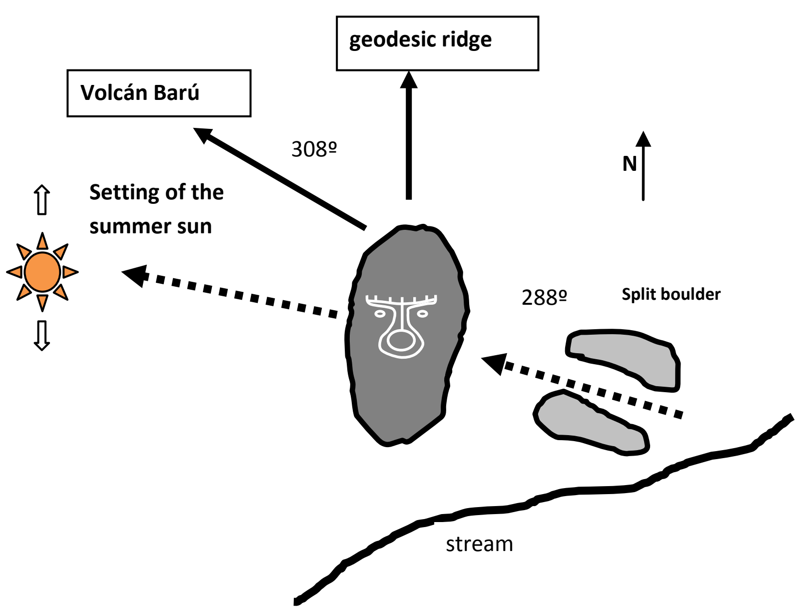


FIGURE 4-24: SCHEMATIC OF THE CALDERA *PIEDRA PINTADA*, THE SPLIT ROCK, AND THE PASSAGE OF THE SUN

My own considerations of the possible ‘use’ of the *Piedra Pintada* centered upon the split passageway rock and its relationship to the sun. In the current era, the sun sets in a range from 246°-294°. The setting sun therefore passes exactly through the midline of the split rock, angled at 288°, and over the top of the petroglyph boulder twice during the year. This occurs roughly May 14 and July 31 in the contemporary context. Since the crack in the boulder is wide, the sun of the summer solstice would presumably also shine through it, since it sets at 294° around June 21 (only 6° away from the midline of the split rock). These time periods all fall within the midway point of the rainy season (June-November), when the seasonal stream behind the passage rock and petroglyphs will be full of water (and potentially also full of freshwater fish such as *dajao [Agonostomus monticola]*), creating what conjecturally felt like a very auspicious series of conjunctions.

Though I am more interested in the positioning of the *Piedra* Pintada than an analysis of its designs for the purpose of this discussion, it is worth mentioning a series of evocative hypotheses of the intention and use of the figurative designs on the western face of the boulder. Panamanian engineer Roberto Perez-Franco interprets the designs and their positioning as representations of solar and lunar phases (Perez-Franco 2004, 2007). In this conceptualization, the repeated marking of a similar design reflects a multi-year trial and error of unsuccessful attempts to demarcate the locations of the solstice and equinox sun and 12 moon cycles of the solar year, finally culminating in one “correct” calendar. Perez-Franco proposes that the circle at the bottom of the design represents the sun and that the central line indicates the March and September equinoxes. The far left line, in this conceptualization, represents the June solstice, when the sun stops moving to the left of the design and begins moving again to the right. The far right mark interpreted as the December solstice, when the sun’s rays again change direction in reference to the petroglyph. The smaller lines within the boundaries of the design reflect, according to Perez-Franco, lunar cycles; within any equinox and solstice there are three lunar cycles.

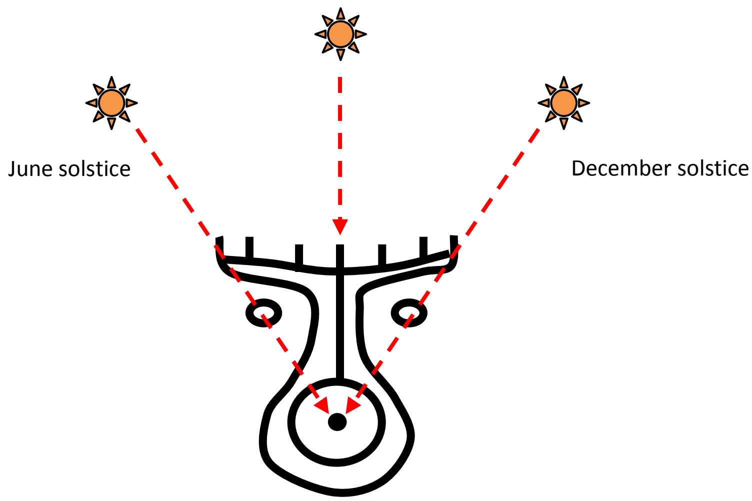


FIGURE 4-25: THE 'CORRECT' CALENDAR ON THE WEST FACE OF THE *PIEDRA PINTADA*, PER THE HYPOTHESIS OF ROBERTO PEREZ-FRANCO (REDRAWN FROM PEREZ-FRANCO 2004)

The timing of when grave materials were gathered and when graves themselves were actually constructed could have required a delicate balance of seasonality. Marking the passage of time throughout the year would be useful for agricultural cycles as well as ritual cycles such as the 'harvesting' of dacite slabs and basalt columns, assuming that seasonality was important to the gathering and transportation of the stones as with crops. The stones were prominently incorporated into Chiriquí period graves, and ostensibly would be very difficult to transport during the rainy season. The soil can be very dry and difficult to dig by the end of the dry season; however, hence grave digging would be far easier during the rainy season or in the beginning of the dry season. Routinized movement and the marking of seasons can be seen as ritual behavior. Perhaps more usefully, however, it should be viewed as an extension of the domestic sphere and a way in which activities such as farming, craft production, and occupation can be physically enacted (per Bradley 2005).

Quilter (2004: 123) discusses the possibility of multi-stage burials from evidence at the Rivas site in Costa Rica, where postholes in graves possibly show that a burial pit was opened and a first burial and set of offerings were interred and the spot was marked with poles as a temporary marker and then later filled more completely. Grave goods and stones used to construct graves in Costa Rica were not necessarily clearly aligned, possibly because the paving stones were put in place significantly later than the burial (Quilter and Frost 2008: 36). If death rituals and burial rites were conducted in more than one phase, this could explain why a great number of the artifacts from the BE-16-KH (KOT) grave site discussed in Chapter four could not be easily associated with a particular grave cavity. If grave offerings were interred at a different time than the actual burial, the precise location of the grave was possibly uncertain for the person leaving the offering resulting in a slight offset at times between offerings and burials. The re-use of graves, which is amply discussed in literature from the Gran Coclé region beginning with Lothrop (1942) could be another explanation as could multi-stage burial (see Cooke and Jiménez in press).

I recorded and photographed one additional petroglyph boulder in the Caldera area KHP-21 (Figure 4-26).[165]

[165] Note that I did not photograph this petroglyph with the same protocol as those listed in Figure 4-7 to 4-9. I did not use masking tape and a meter scale and did not take photos from cardinal directions. The designs, additionally, were chalked by local children and may include or exclude elements in the designs. In order to differentiate the schematics from the more standardized images earlier in the chapter, I am including a representation of the human figure used as the scale. My thanks to Feliciano Gonzalez for operating as scale in this case.

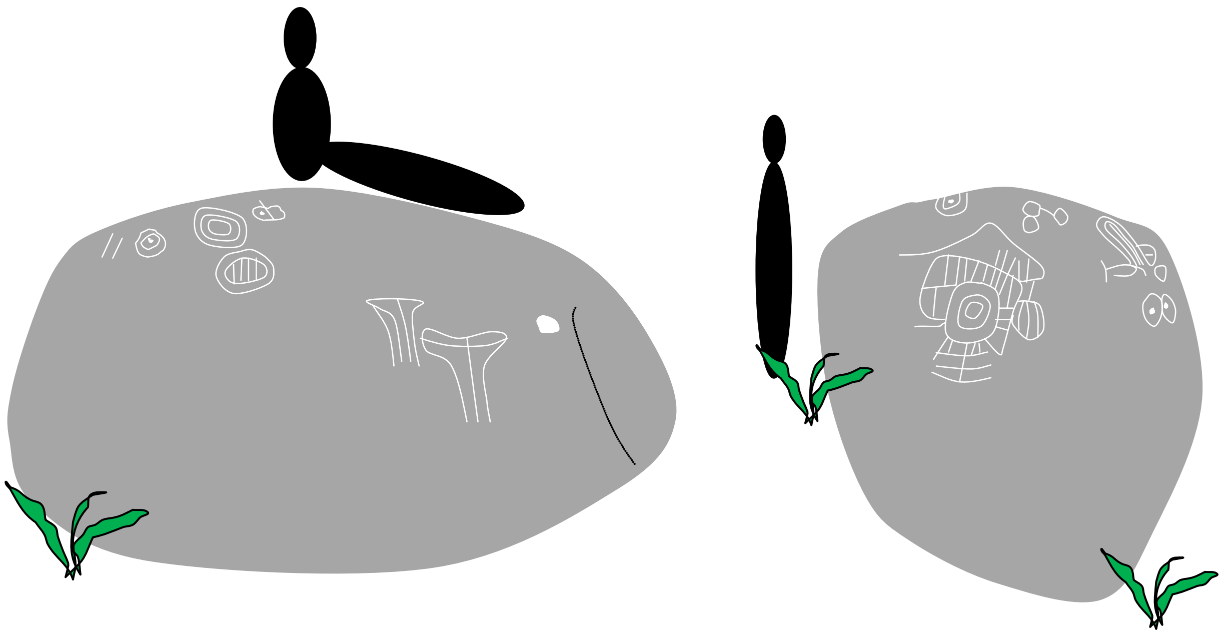


FIGURE 4-26: TWO ANGLES OF THE KHP-27 BOULDER (AT CALDERA) WITH A SCEMATIC OF A HUMAN FIGURE FOR SCALE

(HUMAN FIGURE IS TRACED FROM THE ORIGINAL PHOTO; NO SCALE ROD WAS USED IN THE PHOTO; IN THE LEFT IMAGE THE ADULT MAN SITS ON THE BOULDER AND IN THE RIGHT IMAGE HE STANDS SLIGHTLY BEHIND IT).

The purpose of rock art and the irritation of doubt

> The irritation of doubt causes a struggle to attain a state of belief. I shall term this struggle *inquiry*, though it must be admitted that this is sometimes not a very apt designation.
>
> Charles Peirce, *The Fixation of Belief* (1992 [1877]), p. 114

The material world and the phenomenal world are deeply linked. Drawing from the semiotic discussions of Charles Peirce, material signs can be seen as a form of thought (Bauer 2002, Lele 2006). If the rock art in the Boquete area can be seen as a materialization of thought and stories, however, the chance of determining the original 'sign' the designs conveyed at any particular time period are slim. The permanence of the rock art, like that of the Volcán Barú, ensures that the various uses, stories, purposes, and meanings attached to them shifted over time and was experienced differently at any given time.

The only reliable source of information that petroglyphs currently provide in the Boquete area is through their location. The Boquete area petroglyph designs can be potentially viewed as an *aide mémoire* with links to oral tradition that is now lost. This interpretation is applied to the Dreamtime 'Songlines', or routes taken by Ancestral Beings, which marked sacred, living, and mythological sites for Australian Aboriginals (Flood 2004: 183). These rendered tracks linked Dreaming sites, which were not necessarily marked in a materially discernible way. Their importance was derived and passed on through the oral tradition. The rock-art served in the Aboriginal context as memory anchors for the locations of ochre, food supplies, and permanent water. The Caldera, *Huacal*, and basalt column least cost path petroglyphs are strongly associated with nearby water sources, which could indicate their linkage to memory marking for essential resources.

Petroglyphs can also be seen as marks of ownership or territoriality, and as such would serve as permanent statements of place and identity. The menhirs, or standing megalithic stones erected in Neolithic through Bronze age Brittany, are seen in this context as a response to post-Mesolithic transformation and the transition to farming (Tilley 2004b: 33). In such a case, memories are not just attached to the objects but created through repeated social practices that have material residues (Mills and Walker 2008). The increasing importance of maize agriculture and developments of maize races adapted to cool, moist conditions is commonly thought to have allowed the first significant occupation of the Chiriquí highlands (Linares, Sheets, and Rosenthal 1975), which were prior to that transition (c. 2,000-3,000 BP) not inhabited by large populations. If that is the case, agricultural territory would have certainly been of key importance particularly in access to areas with richer soils or access to water. The marking of ownership of territory, or identification with that territory, could be seen as a viable purpose for marking the landscape.

The ways in which each of the above suggestions of meaning can work in tandem is apparent in the Andean context. The association of mytho-history and ritual practice in the Inka perception of landscape was deeply intertwined (Zuidema 1964, 1990). The 41 *ceque* lines that connected the 328 *wakas* of the Cuzco region combined both marked and unmarked elements of the landscape in to a cohesive whole. Unmarked *wakas* were no less potent than those that were marked, and strongly exemplify the element of hybridity of natural and cultural elements. *Ceque* lines often crossed canal intakes, springs, or important points along canal systems, and as such divided social spaces (Farrington 1992: 372, Sherbondy 1986: 85-92). Social groups' access to land and water was confirmed by rituals performed at the wakas belonging to them.

Lines of sight and site

A firmly established postprocessual critique in archaeology notes the inapplicability of post-Enlightenment, western emphases upon visual perception to many past contexts and strongly questions the dualism it creates between subject and object (e.g., Ashmore 2007: 261, Barrett 1994, Bender 1993, Edmonds 200, Gosden 1994, Lazzari 2003: 201, Shanks and Hodder 1995, Thomas 2001, 2004d: 178-80).[166] This critique, in part, stems from phenomenological discussions of the corporeal and social context of visuality (Merleau-Ponty 1962: 226) and is valid and insightful, but obviously cannot be cause to discard the examination of visual relationships in archaeological contexts when the data indicate their validity. [167]

What a person could and could not see seems deeply linked into some of the most evocative material traces of pre-Columbian isthmian life. At the site of Guayabo de Turrialba, Costa Rica, the site layout and way people were meant to move through it is

[166] The most graphic and commonly known metaphor and example for this relationship in the modern, western mind between vision, power, control, normalization, and the imperial gaze is Jeremy Bentham's Panopticon, as discussed by Foucault (1995 [1977]).

[167] Recent contributions highlight additional senses, such as sound, e.g., Loose (2008).

interpreted to be directly linked to a line of sight between mounds, structures and the volcano summit (Hurtado de Mendoza 2004; Michael Snarsksis, personal communication). Turrialba erupted at least three times between AD 700-1300 (Reagan et al. 2006), which prompts Alvarado and Soto (2008: 357) to suggest that the site layout indicates a symbolic linkage to the volcano and possibly the use of the site as an observatory. The authors (ibid.) propose that an artificial mound (Mound 1) was covered with a conical thatch roof. This thatch roofed structure mimetically referenced both the Turrialba volcano - visible directly behind it - and ethnographically known Bribrí and Cabécar structures in what became a recursive mimesis of building and the volcanic environment (ibid.). A mound between the volcano and the main mound is interpreted as a 'shaman's mound' (see Alvarado and Soto 2008: 3, Figure 2). Ostensibly, in times of eruption the cone of Turrialba would emit smoke while a similarly shaped structure in the foreground also had smoke coming from its 'summit' (Jeff Frost, personal communication).

Visuality may have been complexly symbolized, manipulated, and conceived in the pre-Columbian context. Wendy Ashmore described Maya site planning as a relational approach to space; rather than providing a passive map of the cosmos, settlement layouts can serve as political and propagandistic tools (Ashmore 1989: 272, Smith 2003: 76). What one could 'see' in the pre-Columbian past wasn't necessarily what it initially seemed, however, as is the case of the 'false cemetery' found at the base of a monumental staircase at the Rivas-Panteón de la Reina site in Costa Rica (Quilter 2004, Quilter and Frost 2007a). While the Costa Rican features appear to mimic stone lined graves, they don't seem to have ever held interments. Additionally, what one could 'see' could have been fleeting and situational, as in the case of the fires thought to have signaled people at night from the Rivas-Panteón site (Quilter and Frost 2007a: 42).

I argue that the locations of rock art indicate a linear layout to petroglyph locations and that this drew the petroglyphs into association through a 'line of site' (or place) rather than a line of 'sight'. The petroglyphs in the Boquete survey area seem to 'connect' to one another in a linear pattern (Figure 4-27). The only petroglyph slightly 'out of line' is the Caldera *Piedra Pintada*, though perhaps the 'specialness' of the Caldera boulder and its location set it aside concretely in space (and possibly in time) from the other, smaller petroglyph boulders. While it is impossible to assign some 'function' to this configuration, it does seem to incorporate some form of 'meaning'. The enigmatic, giant stone balls of the southern General Valley and Diquís region of Costa Rica are largely displaced now, but some also appear to have been located in groups or lines and placed where they are visible from a distance (Baudez et al. 1993, Fernandez Esquivel and Quintanilla 2003, Lothrop 1963, Quintanilla 2007, Stone 1943: 78, Figures 10 and 11). There is, however, no discernible pattern that explains the overall positioning or size of the Costa Rican stone balls (Stone 1943: 83). Similarly, I would not suggest that there is any uniform pattern applicable to the distribution of rock art throughout Greater Chiriquí. In the Boquete survey area, however, lines of connection - or figurative lines of sight - may have linked the petroglyphs and places into a unit or whole. Whether this 'line of site' connected the marked stones, such as the way Andean *ceque* lines connect *wakas*, is not possible to consider without further data.

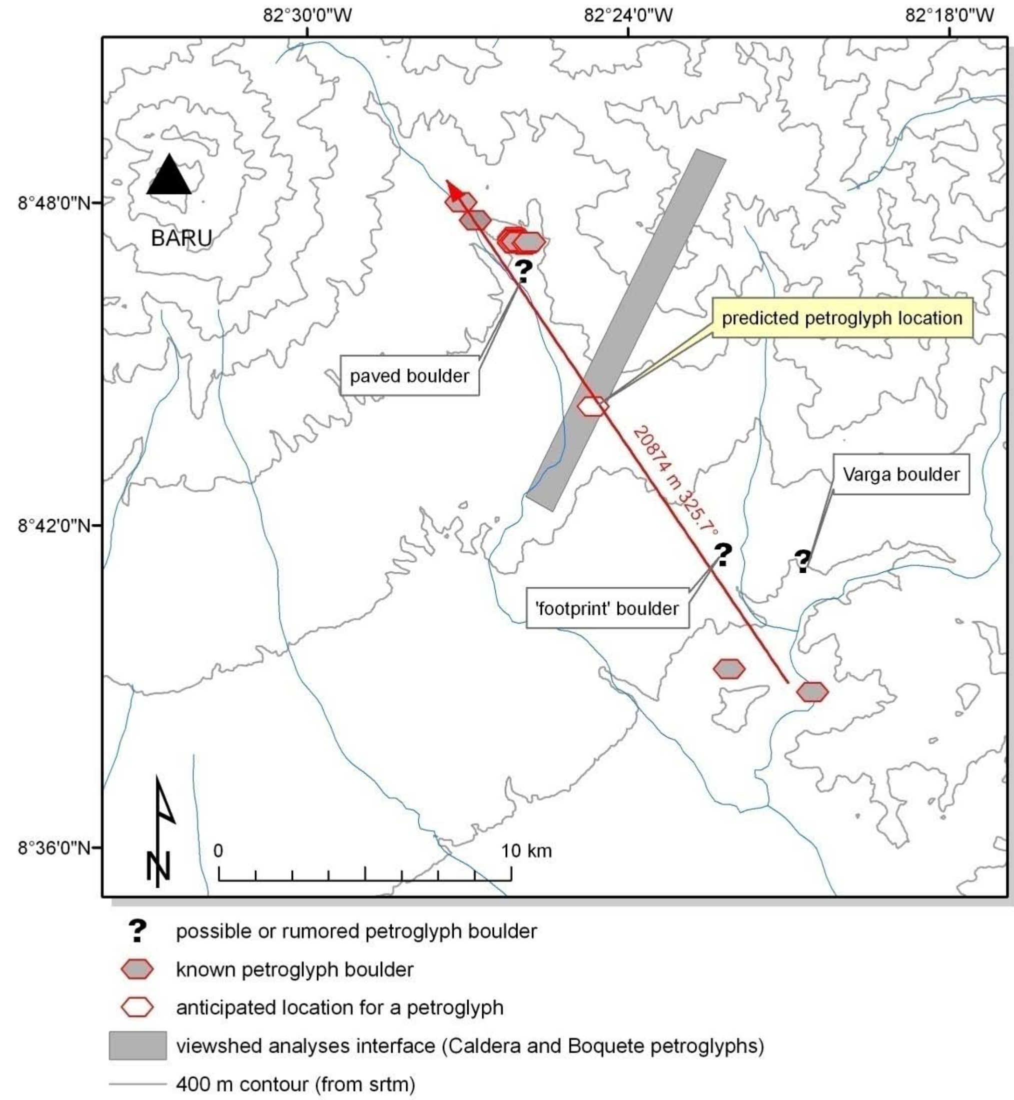


FIGURE 4-27: THE LINEAR PATTERN OF KNOWN PETROGLYPHS, 'RUMORED' PETROGLYPHS (DISPLAYED AS QUESTION MARKS), AND PREDICTION OF AN ANTICIPATED PETROGLYPH LOCATION

The 'line of site' incorporates two features that I had discarded from my analyses. The first of these was known commonly as a 'footprint' in a rock and in local lore this is seen as evidence of a pre-Columbian person who walked across molten lava. I took a GPS point for this boulder in 1999 and took photos of it, but could not determine whether the design was simply erosional and did not return in 2000 or 2004 as I was skeptical of the designation of the rock as 'cultural'. I did not believe that the mark was a footprint, but in retrospect it could be an eroded petroglyph. I would like to examine this boulder again in future fieldwork. The second feature is also a part of local lore, as local residents told me that an additional petroglyph boulder was buried under the paved road near the church in the center of the town of Boquete. Because I could not examine the petroglyph or record its designs, I excluded it from my study, though it is interesting that it falls within the line created by the other petroglyphs and merits further consideration.[168] One additional petroglyph location, labeled in Figure 4-27 as the 'Varga petroglyph', was provided to me by Martin Santamaria, who is a Caldera native currently living in Panamá City.[169] Photos of this boulder show multiple spirals.

The scale at which landscape is analyzed is extremely important in shaping the questions and interpretations produced (Crumley and Marquardt 1987) and it is important to note that my analyses were completed at a very localized scale. Rock art locations to the west of the Volcán Barú, for example, cluster into a group with no easily discernible patterning (see Brizuela 2007). The linear positioning of the petroglyphs may be an artificial artifact created by contemporary occupation patterns and the likelihood of not identifying petroglyphs in heavily forested areas. As is clear from the petroglyphs on the Gonzalez farm, most of which were unidentified despite 40 years of farming by the same family, the lack of artifactual or monetary value afforded to rock art can obscure their recognition. I anticipate that additional rock art boulders exist in the line created by the known petroglyphs and suggest that further survey be done to identify and record them. I have provided a location on the map in Figure 4-27 where rock art would likely be found if the concept of a linear alignment to the petroglyphs is accurate.

[168] The location of the church is 8.7792278 N/-82.4321639 W (8°46'45.22"/82°25'55.79"). Intact tombs were recovered roughly 50 meters from the location of this rumored petroglyph location in the 1990's, and local lore also recounts that stone figures similar to those at Barriles were recovered at this site in the 1960's, though I cannot verify this.

[169] The coordinates provided by Martin Santamaria on Google Earth are 8 41 21.10 N 82.20 40.16 W (8.689194N/-82.344489W), which is 2.5 km east of the 'footprint' and 4.5 km N of khp-27, ~4 km northeast of the Caldera *Piedra Pintada*.

I chose this predicted point as it corresponds to the overlap in the viewshed analyses I conducted from each of the three petroglyph locations (the GON cemetery site, the least-cost path for the possible transport of basalt columns, and the Caldera *Piedra Pintada*). Due to topography, vegetation cover, and the constant mists of the Boquete area the petroglyphs at the antipodal extremes of the line I suggest were certainly never visible to one another. If my theory of a linear alignment is accurate, however, it seems that at least one rock art location should visually 'join' the line. While I have provided an exact 'point' on the map for simplicity, I would anticipate rock art within roughly a 500 meter radius of the point, particularly skewed to the west or southwest direction of the river bank.

Throughout this thesis, I rely upon two-dimensional maps that place due north at the top of the view to convey information about my archaeological survey. In the past, however, the direction of the volcano and other distinctive ridges, movements of the sun, and the placements of the rivers and valleys were likely the way people envisioned their landscapes and referenced it. In Figure 4-28 I provide a three dimensional view of the line I propose connected the petroglyphs. The petroglyph boulders are clearly exaggerated in their three-dimensional forms and are seen from an angle that no pre-Columbian person could have seen them, though I propose that the imaginary line of sight it depicts was a consideration in the selection of rock art locations. Participation and incorporation into this line of 'site' could provide 'cultural' cohesion and connection, while associations to landscape markers such as the basalt column outcropping, *ojo de agua*, and hot spring tapped into a 'natural' specialness and power to the locations.

To sum, I suggest that the rock art in my Boquete survey sample fall into three categories of 'purpose'. Petroglyphs are associated with the least cost path that plausibly suggests the route by which basalt columns were taken to the BE-16-KH (KOT) graves on the Kotowa farm. Petroglyphs were also associated with the large, heavily looted graveyard of *El Huacal* and the large, monumental *Piedra Pintada* at Caldera that was potentially used to mark the passage of the year. This ritual movement, marking, and commemoration could be a part of building memory through the material world (Mills and Walker 2008), a way of domesticating ritual or ritualizing domestic life (per Bradley 2005), or some other purpose. The locations of the petroglyphs, however, place the different sets of boulders into apparent relation with one another.

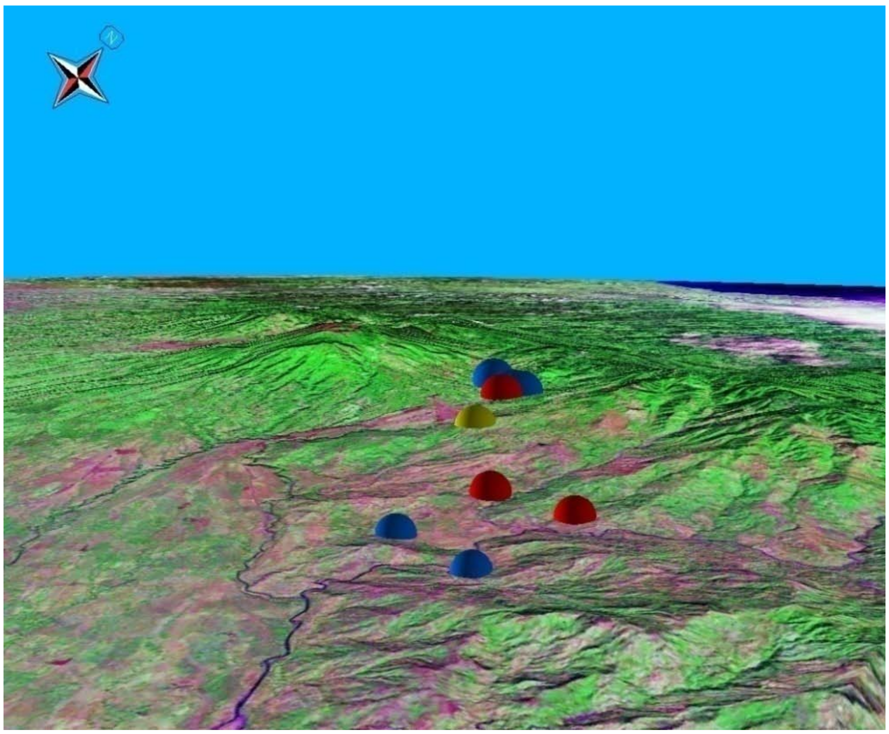


FIGURE 4-28: A 3-DIMENSIONAL LINE OF 'SITE' FOR THE BOQUETE PETROGLYPHS

Known petroglyphs discussed in this chapter are portrayed in blue, 'rumored' petroglyphs are portrayed in red, and the anticipated area of a petroglyph that would connect the viewshed between the Boquete petroglyph center and the Caldera petroglyph center is portrayed in yellow. The topography is derived from SRTM data over which I have draped Landsat imagery. The Landsat is classified so that fallow fields are shown in pink and forested or vegetated areas are green.

Landscape narratives

Mapping: a critique

I have proposed that the movement of dacite slabs and basalt columns, the marking of the landscape through rock art, and the placement and construction of graves are interlinked with one another in the Boquete survey area. In doing so, I am creating a narrative of the possible interlinking of artifact classes that were generally seen as separate or not even 'seen' at all as artifacts. My interpretation of the linear placement of the survey area rock art was not possible without GIS software that allowed me to map the natural and cultural features I chose to input and analyze.

There is very definitely a 'quirky paradox in the mimetics of cartography' (Raffles 2002: 167), as maps structure meaning and understanding yet still cannot translate to us how past landscapes were understood. Mapping, hence, is its own form of narrative and one that has its own languages that frequently do not translate easily in the isthmian area. In a well-known essay by Andreas Huyssen (1993), the history of postmodernism is figured in spatial terms and framed in terms of mapping. Huyssen's essay seems especially pertinent to the discussion of the Boquete area because basalt columns are centrally figured in his discussion, but more importantly Huyssen highlights how spatial interpretations of a time period or era can provide radically different ways to 'see' it.[170] Past contexts can also be understood spatially, but the meanings of those spaces can be difficult to understand.

A vast quantity and variety of literature now exists regarding the 'spatial turn' of the current academic literature and the importance of mapping in post-Enlightenment conceptions of order and control (e.g., see discussions in Bender 1999, Chapin, Lamb, and Threlkeld 2005, Cosgrove 1999, Cruikshank 2005b, Devi 1995, Golledge 2003, Harvey 1996, 1998, Ingold 2000, Layton and Ucko 1999, Pynchon 1997, Soja 1989, Winichakul 1994). I do not intend to provide an in depth discussion of these arguments but instead wish to touch specifically upon on the theoretical implications of the reliance my fieldwork and analyses had upon GIS.

[170] Huyssen is describing the work *7,000 Oaks* by German artist Joseph Beuys, who paired each basalt column with a tree and described it as a 'planting stone'. Beuys meant for the project to refer to 'the problems of nature and the problems of human beings'. See Cooke, Lynn. 7000 Oaks. http://www.diacenter.org/ltproj/7000/essay.html)

GIS was once termed the 'quantifier's revenge' on postmodernists (Oppenshaw 1991: 621). At the time period of that declaration, the technology was generally treated as the atheoretical focal point of any archaeological project that utilized it. While GIS is correctly stated to be the most sophisticated spatial technique currently used in archaeology (Preucel and Meskell 2007a: 12), recent studies incorporate it a mainstream technique that is a basic tool (e.g., Conolly and Lake 2006) and a standard component of field research. The technology and process of GIS is inherently 'sensuous and reflexive' (per Gillings and Goodrick 1996) and theory-laden due to its ability to create spatial relationships only between places and objects that we designate as having value (Aldenderfer 1996, Blake 2007: 233, Gaffney, Stancic, and Watson 1995: 213, Lock and Stancic 1995, Zubrow 1994).

It is incorrect to state that GIS provides a view of landscape that is divorced from human involvement (cf. Thomas 2004d: 200). Recent uses of GIS can incorporate massive data sets from multiple disciplines with interactive texts in order to examine alternate, overlapping, and highly social meanings attached to landscapes over time by different social groups and individuals (e.g., Given, Corley, and Sollars 2007). As virtually all landscapes are now viewed as anthropogenic (Head 2008), even the vegetation layers I incorporated and utilized in the maps in Chapter one of this thesis can be seen as 'cultural' and deeply imbricated with human experience and action.

In the Boquete context, rock art, dacite slabs, and basalt columns were given little archaeological value in past assessments. These same objects form the crux of my GIS analysis as I believe they also held an important social value in the past. Gaps in my understanding of how the past landscape was experienced, however, clearly will lead to gaps in the interpretations available from the spatial data. The least-cost path that I created to examine the route likely used to transport the basalt columns, for example, accounts only for cost surfaces based on topographic slope. Elements such as the presence of a hostile hamlet of neighbors, dangerous animals or insect colonies, or taboos regarding the area are not weighted into my analyses.[171] The missing 'costs' and meanings attached to the landscape are archaeologically difficult to determine as they frequently required narrative and memory for cohesion, even in the past contexts we try to study.

The inability to understand objects without the stories that gave them meaning was illustrated during my fieldwork by an informal encounter with local mapping. Augustine Marcusi is a Ngöbe man who was employed as a gardener in Boquete during my 2004 fieldwork. His employer sent him to the Caribbean coast to examine property owned by the employer on Macca Bite Island, southeast of Isla Colon. When he returned, Augustine brought a stone scratched with lines to create a map which would allow him to more carefully explain to his employer what he had seen in various parts of the property (Figure 4-29). He had not been told to create the map, and I was interested by Augustine's combined creation of modern 'rock art' and a very personal form of map making. Augustine chose the rock from the ground while on the island specifically because it seemed roughly shaped like the island itself. In this sense, he utilized the shape that was 'already in the rock' (Fonseca Zamora and Acúña Coto 1982-3: 252-3). He scratched the design using a nail that he also opportunistically found on the ground.

[171] In describing a path below a volcanic summit, for example, William Gabb describes how superstition determined the routes taken by nineteenth century indigenous people; see Gabb (1913 [1874]: 127).

FIGURE 4-29: AUGUSTINE AND HIS MAP

Augustine drew the map on paper for me to describe the designs in more detail (Figure 4-30). As I had never been to the island before, I required more information and explanation and Augustine drew the map in much greater detail. Other than the property boundary, the only other marks that Augustine made on the stone were for the multiple paths in the mangroves that allowed one to access the island by boat. Those details were then synecdochically meant to imply other aspects that he did not mark on the stone but did imply and that he used to describe to his employer what was happening on each part of the island. He described particular plants that were growing while pointing to their location on the stone and described issues occurring with each of the neighbors, whose locations were not denotatively inscribed on the stone but were implied. Without the narrative, the designs made no sense.

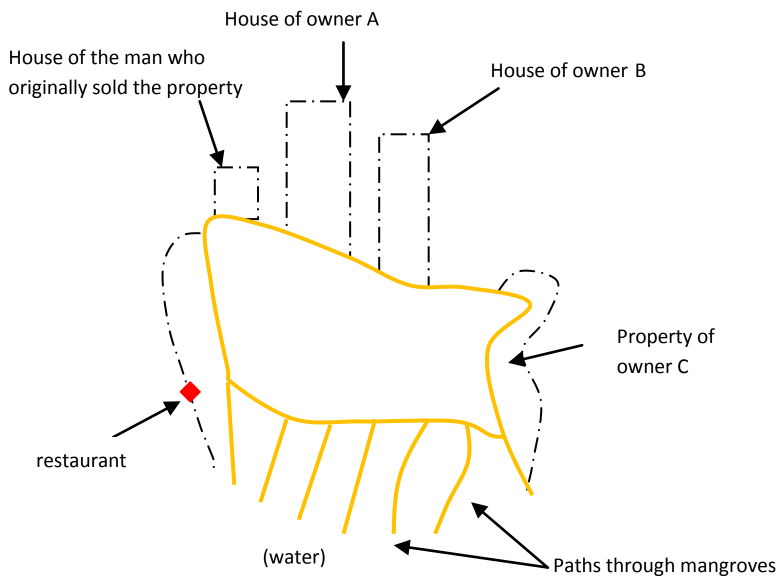


FIGURE 4-30: THE PHYSICAL AND THE IMPLIED ASPECTS OF AUGUSTINE'S MAP, WHICH WAS USED AS A MNEMONIC AND AID FOR ORAL TRANSMISSION OF INFORMATION

By no means do I mean to equate Augustine’s map making process to the pre-Columbian ‘use’ of rock art in the Boquete region. The Ngöbe are relatively recent inhabitants of the Barú area and Augustine is deeply removed both by time and religion (he is a devout Mormon) from the past inhabitants of the study area. I cannot speak to whether or not other people in Boquete make similar maps or if his act was uniquely inventive. The point I wish to make about the incident, however, is the deep impression the experience gave me regarding the amount of information and context I will never be able to access from the petroglyph designs in Boquete. Like *quipu* in the Andean context, the material form indicates a far larger amount of information that is largely inaccessible to anyone who is not able to use the object to trigger memory or knowledge. The valence of the material object depended upon imaginary, cognitive, or oral aspects that are no longer available, which severs the original meanings from the objects that were once explicitly intended to convey information.

To sum, the process of map making can be a highly individual one. While I do not parallel Augustine’s cobble stone map to rock art in the Barú area, I do use the example of his map to suggest that the determination of meaning for rock art designs could be challenging in a context without oral tradition that links the object to their meaning.

Oral tradition and the Barú landscape: three stories

Anthropological and archaeological discourses reflect a lack of consensus in how oral tradition fits within academic analysis. Malinowski (1948 [1926]) firmly placed myth and oral tradition as a form of consciousness that imposes present social values upon the past. This seems to constantly make 'past' oral tradition inaccessible as it is always modified to fit the present. Levi-Strauss (1966) divided human societies into 'hot' societies, which have 'history', and 'cold' societies, which have 'myth'. Cold societies' myths were (in theory) timeless and unchanging, while hot societies' histories were built upon discontinuities and progress. Archaeological data, however, clearly indicates that non-historical cultures and values were not unchanging nor can myth be seen as static. Levi-Strauss's conceptualization is too rigid, yet Malinowski's vantage overlooks the great time depth and continuity that myth can have.

Ethnographic discussions of landscapes and the oral traditions can provide rich descriptions of the indigenous perspectives in which memories and symbolism are constitutive of the 'natural' environment (e.g., Basso 1996, Cruikshank 2005a). The relevance of oral tradition to archaeology is receiving fresh attention in a number of recent discussions (Brumfiel 2003, Hbobat 2007, Preucel and Meskell 2007b: 219, Riley et al. 2005, Tilley 2006: 21, Whitely 2002) and has been very well integrated in incorporating the San ethnographic data with rock art (e.g., Lewis-Williams 2002a).

Whitely (2002) posits that the compatibility or commensurability of oral tradition with archaeological interpretation varies significantly between researchers who view archaeology as a science that should only test verifiable hypotheses (e.g., Mason 2000) and researchers who view archaeology as a humanities-focused endeavor that should produce multi-layered culture histories (e.g., Echo-Hawk 2000). The middle ground proposed by Whitely (2002) highlights the importance of epistemological rigor but is open to legitimate oral tradition that can enhance explanation of the past.[172] Very few contexts provide rich ethnographic and rock art traditions that interlink neatly.

The science-humanist schism that Whitely (2002) describes in the larger archaeological examination of oral tradition is not prominent in the examination of volcanic contexts. A wide range of volcanologists, hazards specialists, and social scientists who incorporate rigorous scientific methods or techniques are increasingly open to the serious discussion of myths and legends (e.g., Alvarado and Soto 2008, Builth et al. 2008, Chester and Duncan 2007a, b, Chester, Duncan, and Dibben 2008, Cronin and Cashman 2007, de Boer 2007, de Boer, Chanton, and Zeitlhöfler 2007, Le Pennec et al. 2008, Peraldo and Montero 1994, Piccardi and Masse 2007, Plunket and Uruñuela 2005a, 2008, Sigurdsson 1999). Memories, materials, and movements in the landscape can be fixed into relationships of meaning to one another that are archaeologically approachable (Mills and Walker 2008, Nieves Zedeño and Stoffle 2003).

While it is clear that archaeological interpretations cannot incorporate oral tradition uncritically, I suggest that the use of oral tradition can greatly accentuate the understanding of the pre-Columbian Barú context. I highlight three ethnographic narratives in the following discussion that relate to material culture and the volcanic landscape in the Barú region as indications of more experiential ways of viewing the rock art and the volcano and the way that they relate to one another. The three stories are from three different Chibchan linguistic traditions – Ngöbe, Doraz, and Bribrí – and are most correctly seen to contain multi-temporal agglomerations of natural and cultural landscape perspectives.[173] I am not encouraging a direct historical approach in

[172] Echo-Hawk (2000: 272) offers three tests of oral tradition in order to determine their viability for archaeological interpretation. The oral tradition should be a 'group account', rather than an individual one; it should describe presumably real events; and it should be supported by independent, non-verbal sources (archaeology, written records) in order to provide some bases for the consistency level of the story.

[173] I have translated and paraphrased the stories from the Spanish versions. Speakers of each of the three languages – Ngöbe, Doraz, and Bribri – were mutally unintelligible to one another though historical linguists believe they were phylogenetically connected (Costenla-Umaña 1991).

which a continuum is seen between current or recent indigenous groups and prehistoric groups in the Chiriquí context (cf. Holmes 1888, Joyce 1916b). Palaeoecological, genetic, and linguistic studies, however, *do* indicate that the Spanish conquest did not rupture pre-Columbian societies from their past but rather contributed to the creation of 'postcontact hybrids' (Cooke 2005: 134, Stier 1979). I suggest that the three stories offer ways to consider how the role of rock art and volcanism was intricately connected in the pre-Columbian context, but do not propose that any of the stories 'solve' or 'explain' the rock art. Rather, they offer examples of peoples' creative production of the world.

Ñaglon bata sö (The sun and the moon) – a Ngöbe story

The Sun and the Moon is a Ngöbe story recorded by a member of the Ngöbe indigenous group, Roger Séptimo, and Panamanian anthropologist Luz Graciela Joly (Séptimo and Joly 1998). The Ngöbe are the most populous indigenous group now living in the Boquete area, though they are likely relatively recent immigrants to the region and lived further east in the pre-Columbian period.[174] The story, though ostensibly an incest prohibition for women, centers upon the natural world and how petroglyphs intersect with it.

> A woman named Evia lived alone with her two small sons, who lived in squalor and whose only plaything was the wood burning stove, hence they were always naked and covered in ash. Evia, a singer, was always at parties and regularly left the sons alone at home. One night at a party she met two men; one dressed all in gold and one dressed all in silver. Evia stepped on the feet of the men to show that she liked them and tried to get their attention. People at the party told Evia to be aware that these were her sons and not to flirt with them, but Evia replied that her sons were at home, dirty in the ashes of the fire and that the handsome, richly dressed men could not possibly be them. She returned home to find her sons sleeping near the stove, which gave her confidence in her belief that the two men were not her sons. This happened two more times, and Evia refused to believe that the two men were her own children.

---

[174] The original occupation area of the Ngöbe was likely the area from Cricamola to the Coclé foothills.

> The fourth time, Evia hid along the road to the *chichería* after she left her house to be certain that her sons did not leave the home. The men passed her on the road on their way to the party. Evia returned to the house rather than going to the party and found that her sons were not in their customary spot beside the stove. She waited for her sons to return, and as she did she sorrowfully began to make random shapes and designs, which are the petroglyphs we see on stones today.
>
> Her sons did return, but not naked and dirty as she was used to seeing them but as the beautifully dressed men she had seen at the parties. Evia broke taboo and looked into a pot of red and white cacao they made as the sons bathed naked despite their warning to not do so. The sons did not want to see their mother again and threw Evia in the four cardinal directions, but she returned each time. Then they threw her below the earth. When there are earthquakes, it is because Evia is below the surface. Evia will return when the sun sets for the final evening at the end of time when the world ends. She is not dead, but simply waiting under the surface.

La Piedra Pintada de Caldera (The painted rock of Caldera) – a Doraz story

The Dorasques (or Doraces) have been extinct or 'reduced to reproductively unviable numbers' since the sixteenth century (Cooke and Ranere 1992b: 245-6, footnote 1).[175] Panamanian historian Beatriz Miranda de Cabal (1974) collected Doraz stories and vocabulary from one of the last Dorasque speakers of the language, María de Jesús Samudio de Ortega (Miranda de Cabal 1974, 1989).[176] The Doraz woman, who was elderly when Miranda de Cabal recorded the stories in the 1950's, called them 'remote stories' (*cuentos de la remotería*). The Dorasques were most likely the indigenous group who lived in the Boquete area during the pre-Columbian era. They are said to have emigrated due to a flood that filled the entire valley and killed many people, after which they moved to Costa Rica. There, they were known as *Dorasques Barú-go,* or Dorasques from Barú (Miranda de Cabal 1989: 29). The ethnographic Doraz

[175] A Panamanian *licenciatura* thesis on the Dorasques written by Maria del Carmen Gomez recounts stories from the author's grandmother, who was raised amongst Dorasque-speaking people. This indicates tha the language was still being spoken at the turn of the last century.

[176] I am grateful to the family of Beatriz Miranda de Cabal for their graciousness in sharing her work and their time with me.

word for the basalt column outcropping in Boquete was recorded as *Oyi-ig-sedé* suri (ibid.: 33), though no translation in Spanish is provided for this. Miranda de Cabal (ibid.: 32) quotes an un-cited historical text as stating that many isthmian place names are derived from the indigenous names, including the name for the Volcán Barú, stating that Barú meant 'mountain of fire' or 'house of fire'.

Several of the Doraz stories explicitly reference the Volcán Barú as the central landmark and reference point within the community (e.g., Miranda de Cabal 1974: 27, 28, 35, 46) in order to set the stage for the action of the story. The story I would like to focus upon, however, describes the Caldera *Piedra Pintada* (Miranda de Cabal 1974: 43).

> The *Piedra Pintada* at Caldera is an enormous stone and no one knows what Indian hands carved it. Time and erosion have worn away and erased the designs on the upper face, but those on the perpendicular face are clear. Some say that the stone was an altar that the Indians created for their old gods. Others say that the Dorasques left a message in the designs, which were used to communicate with others in the past. One other tradition is that under the enormous stone lies a buried treasure of gold that matches the designs that are drawn on the stone. No Dorasque can touch the treasure, but foreigners will come and take it. They will put 'earth of tremors and fire' (*Pondrán debajo* '*tierra de temblor y de fuego*') under the stone and it will shoot in pieces into the sky. The people who did this will flee in three directions. In the broken pieces of the black stone and the yellow stone that covers the deposit, the gold will be exposed. The treasure is guarded by a Dorasque spirit (*dago familiar*), and no Dorasque can touch it. The ancient Dorasque *dagos* have no power over the white foreigners. Meanwhile, the stone sits there with its enormous mass and mysterious designs as a memorial or message. The Indians today contemplate it melancholically as if it were the echo of an extinguished voice.

Kchabuckè, la ranita de achiote (Kchabuckè, the achiote frog)[177] *– a Bribrí story*

The Bribrí people are twentieth-century immigrants to Panamá (Cooke and Ranere 1992b: 248, Figure 1). Costa Rican anthropologist Maria Bozzoli (1979) recorded

[177] Achiote is also known as annatto or roucou; the seeds from the achiote tree produce a red dye and a flavoring used in cooking. It can also be used for body paint.

and published numerous Bribrí stories. One story, in particular, potentially records a specific eruption of the Volcán Barú.[178]

> The sea was a pregnant woman, and she was bitten by a snake and died. When it came time to bury her, two consecutive claps of thunder were heard, but it wasn't actually thunder as the sound came from the corpse. It sounded four more times. Then God called the tiny frog made of *achiote* and told her to sit on the woman/sea's body and by the mouth of her stomach, which is on her liver. They were about to bury the body when the corpse began making more loud sounds and the ground began to shake. God told the little frog not to move, and it was trapped there and hungry as it had not eaten anything. They buried the body under a mound of earth, but it began to make an incredible amount of noise. God told the little frog to stay on the burial mound over the stomach, but even still the noises continued. At noon on the fourth day the little frog still had not eaten, but then she saw a worm and decided to eat it. She had to move slightly off of the mound to catch the worm and was not able, no matter what she did, to jump on top of the body again. Because of this, the body swelled and burst and a tall tree grew exploded from it through the earth and continued to grow continually toward the sun.

Because of their permanence, both Barú and the rock art in the Barú area have provided material anchors for myths throughout human occupation in the area. In the three stories I have included in this discussion, the volcano and rock art are variously referenced.

In the Ngöbe story, Séptimo and Joly (1998) interpret Evia as an anthropomorphization of the earth itself and her sons are the sun (dressed in gold) and the moon (dressed in silver). The importance of fire and ash, attributions of earthquakes to a presence below the surface, and catastrophic connotation of Evia's return could possibly invoke narratives built around past volcanic eruptions. More concrete, however, is the evidence that the Ngöbe have incorporated the petroglyphs, which were likely made by other groups and in time periods that are now culturally disconnected from them, into their oral tradition. No function is given to the rock art but its presence is explained.

[178] My thanks to Guillermo Alvarado for sharing this with me.

In the Doraz story, similarly, no single ‘explanation’ is offered for the existence of the rock art. Like archaeologists, the Dorasques clearly acknowledge the loss of both designs and meaning to the petroglyphs over time. Like the Ngöbe story about Evia, volcanic eruption is potentially invoked through the description of earthquakes associated with fire and explosion and a catastrophic emergence of what is below the surface to the above ground world.

Like the Ngöbe story, the Bribi story was ostensibly a moralistic prohibition directed at women against incest (Bozzoli 1979). Volcanologists Giovanni Peraldo and Walter Montero (Peraldo and Montero 1994: 50), however, see the story as an accurate description of the phenomena of volcanic eruption and specifically state that they believe it describes an eruption of the Volcán Barú. Peraldo and Montero (ibid.) believe that the story describes the pre-eruptive processes of a volcano. The tremors, in this interpretation, were created by a magmatic mass that was opening new passages to the surface due to an obstruction in the main crater. The swelling represents the buildup of magma and the earthquakes accompanied its explosive release. The exaggerated description of the tree’s rapid and excessive growth could, according to Peraldo and Montero, easily represent the perception of the column of gases and ash that rises rapidly from the crater. If the story does describe a particular eruption of Barú, the recording of the story in Costa Rica indicates that the people who told the story emigrated from the Barú area or that the story was transferred from group to group until it reached there. Indigenous groups on the Pacific slopes placed importance upon rituals and legends invoking the sea, which could indicate a residue of migration (Bort 1980: 499). It could also, however, indicate the movement of stories separated from the people who first told them.

While the Bribrí story lacks the explicit connection to rock art that the Ngöbe and Doraz story contain, the description of the little frog as an important symbolic component in weighting the body in the burial and keeping it underground makes me query whether the very small petroglyph cobbles (such as the KHP-25 and KHP-26) could have served a similar role. Stones can have spirits and be representations of once live creatures (Pittier 1903: 4). If the marked rocks were considered animate, as is the case in many cross-cultural contexts (Stone-Miller 2002: 142), the stones were possibly seen as permanent guardians for (or from) the dead. Should burials have been multi-phased, as discussed earlier in this chapter perhaps the small, carved stones were meant to 'hold down' the body until more substantial grave building materials like dacite slabs and basalt columns were placed upon it. Seasonality and the difficulty of the rainy season transport of these materials could necessitate such a system, as could the ease of digging a grave during the rainy season but the difficulty of holding burial rites during it.[179] Possible support for this theory is provided by the fact that the smaller petroglyphs on the Gonzalez *finca* (BE-14-KH, GON) in *El Huacal* were closer to the area of the graves and farther from the larger boulders. As these marked cobbles were highly portable, however, it is difficult to determine how many of them existed in the past and where they were positioned.

The Ngöbe and Bribrí stories show a merging of bodies and the natural world; earthquakes are generated by Evia while she is trapped underground in the Doraz story, thunder is generated by the Bribrí corpse. These two stories also specify a female power that is under the earth and potentially dangerous. The Doraz story is less gender specific and seems to incorporate modern explosives and contemporary status differences linked to race, even if it evokes similarities to volcanic eruptions. The power of destruction is shifted to humans in the Doraz story of the *Piedra Pintada.*

How can stories from oral traditions inform our archaeological interpretations? In each of the three stories I have highlighted, stone clearly had a value in the past that does not translate to the modern era. Myth and the landscape are both heavily grounded in sensory awareness and knowledge of the world and are tightly bound to

[179] Though note that the belief that rites could not easily be held in heavy downpour may be a Eurocentrism on my part; Richard Cooke (personal communication) notes that he witnessed a four-day *balseria* in Bocas del Toro that took place without interruption despite heavy and non-stop rains.

one another (Tilley 2006: 21). If oral tradition is a way of characterizing knowledge of landscapes, stories 'encode mechanisms for coping with the different scales of environmental variation' (Minc 1986, Minc and Smith 1989, Rockman 2003: 6). Ritual stories often prescribe the action to be taken in the face of cyclical landscape events, with the most extreme prescription being that of abandonment (Rockman 2003: 6). These mechanisms/stories can be integral to a group's sense of place and is important to archaeology (ibid.: 7). I propose that one of the ways that the Doraz story of the *Piedra Pintada* differs most from the Ngöbe and Doraz stories is that it prescribes a certain form of abandonment of the landscape; without actually leaving the physical space, the Doraz in the story have let go of the meanings indicated by the petroglyph designs as well as any claim to the treasure rumored to exist beneath it. There is a sense of separation indicated in time and in access to meaning that is quite parallel to the archaeological experience of studying the same petroglyphs.

Discussion: oral traditions, volcanic landscapes, and exceptional events

> I speak of stones…. Human beings envy their durability, their hardness, their intransigence and their brightness, the fact that they are smooth and impenetrable, and entire even when broken. They are fire and water in the same immortal transparency.
>
> Roger Caillois, *Extracts from Stones* (2005 [1966]), p. 89-90

At the beginning of this chapter I noted that landscape can be seen as a collection of actions and happenings that help form social identities. I propose that the transportation of dacite slabs and basalt columns, making and viewing of petroglyphs, and burying of the dead were linked to a sense of belonging and group cohesion in the survey area during the pre-Columbian period. The shape of lightly modified basalt columns from Costa Rican Chiriquí and the shape of the Caldera *Piedra Pintada* suggest that the rock art and basalt columns were possibly drawn into association through their form in Chiriquí, while petroglyphs lining the least cost path suggest that basalt columns were transported to the BE-16-KH (KOT) cemetery draw associations through their location. Paths are important not only as a way of channeling movement, but also as a way of providing perspective and scale to a place in order to structure ideas and stories. This was evident in the contemporary map that Augustine sketched onto the stone to describe his trip to the island; the paths provided both the literal and metaphorical conduit for the narrative he provided of his trip, while the remainder of the map was oral rather than inscribed.

If the ceramics found near the rock art in the Boquete survey area (Figure 3-10; BE-14-KH [GON] and BE-16-KH [KOT]) were used coevally with the rock art and provide a date for the construction of the graves with volcanic materials, this suggests a potential concatenation of the volcanic materials and the rock art by the early second millennium AD. The use of new materials and new symbolic media can reflect social changes and in turn cause new changes in tasks and movements (Thomas 2007: 424). Rather than sterile construction supplies, dacite slabs and basalt columns likely were symbolically laden and purposefully sought. While individual imaginaries, movements, and motives are important, I propose that the petroglyphs provide a trace of shared imaginaries and the circulation of people and objects attached to ideas.

A large body of rock art literature links petroglyphs to shamanism (see discussions in Lewis-Williams 2002a, b, Lewis-Williams and Pearse 2005, Stone 2007, Whitley 2005, 2008). The spiral – which is one of the predominant designs in the Boquete petroglyphs - is a common, transcultural phosphene in hallucinations (Reichel-Dolmatoff 1975: figure 39, Stone 2007: 18) and can be an important part of a visionary experience, hence potentially the Boquete petroglyphs can be interpreted as locations of shamanistic ritual or visions.[180] The KHP-23, KHP-24, and *Huacal* (BE-14-KH GON)

[180] Note that spirals are linked more strongly to water rather than hallucinatory visions in the interpretations (Fonseca Zamora and Acúña Coto 1986: 36). Also note that there are many kinds of spirals; the double spiral is a frequent motif of petroglyphs in Panamá and also is found in goldwork and pottery (see Sánchez H., Alberto, and Cooke 1997).

petroglyphs' location in association to the least-cost path used to possibly transport basalt column and in a highly utilized pre-Columbian area of the Boquete valley, however, indicate that the rock art was not a place for contemplation in solitude as part of shamanistic rites. The rock art boulders are not located in a 'marginal' or out-of-the-way spaces that are generally sought as destinations for fasting and reflection (Dove 2007: 32, Tsing 1993).

Potentially, the petroglyphs that are found along the least-cost path for transporting the basalt columns and in association with graves and the focus upon calendrics seemingly indicated by the Caldera *Piedra Pintada* could indicate a possible *departure* from shamanism and the rise of a more institutionalized religion. This possibility is in line with the provocative argument by Augusto Oyuela-Caycedo (2001), who proposes that religious routinization is absent in pre-Columbian shamanism. Ideology is a process that operates above the level of political, economic, and language units (ibid.: 6). Oyuela-Caycedo suggests that ideological routinization in the Andes and Mesoamerica resulted from successful prophetic movements. A shaman would rise to the level of prophet in periods of crisis, be it political, economic, social, environmental, or of 'values' in relation to the 'other' (Oyuela-Caycedo 2001: 5).[181]

Oyuela-Caycedo's concept of a charismatic shaman draws upon the conceptions of Max Weber (1993) and the role that charismatic individuals can have in culture change. I suggest that this conceptualization can be combined with the ideas proposed by Beck et al (2007) in their discussion of an 'eventful archaeology' in which contingent events produce ruptures in material culture and create opportunities for re-articulation within new frames of reference. This parallels, to some extent, the discussions by French Marxist philosopher Alain Badiou (2005) noted in the introduction to this thesis, in

[181] The past is necessarily Other and exotic to those in the present. It is important, however, to avoid an Orientalism-tinged narrative that projects past people as more religious, irrational, or ritualistic in the absence of data that support that interpretation. For a recent discussion of this archaeological tendency see Scham (2009).

which unlike the normal contingencies of life, an *event* creates rupture in the established order.

If a volcanic eruption provided the *event* that allowed for a charismatic individual to rise in influence and rock art is the material residue of the religious routinization that resulted from these changes, then the petroglyphs can be viewed as monuments that resulted from this radical change. Heritage studies attempt to classify monuments that are put up in time periods 'conflict, contradiction, or deep contestation' that such a post-eruption period could provoke through the terms of *dissonant heritage*, or the heritage of atrocities evident in war memorials, and *negative heritage*, which are meant to be didactic, such as memorials at Hiroshima or Auschwitz (Meskell 2002). The Boquete area petroglyphs do not fall into either category very easily and the Barú context is more ambiguous.

Some kinds of imagery transcend the narrow boundaries of 'culture areas' as we envision them as archaeologists. Publications on Coclé province artifacts address the slipperiness of assuming that shared symbolism evidenced in artifacts indicates a shared culture (e.g., Bray 1992, 2003, Cooke 1998). The identification of difficult to decipher elements of material culture as religious or ritually linked is certainly problematic. It is possible, however, as Oyuela-Caycedo (ibid.: 6) states, that archaeologists have a tendency misidentified distributions of 'religious motifs' in time and space and erroneously designated them as 'cultural areas' or 'cultural periods' rather than as the spatial and temporal reach of cults. Should the creation of rock art denote a cultic shift, the teasing apart of the prompting factors for the shift and the means by which cultic traits were adopted would provide fascinating new research foci.

Shared imaginaries cross one another and can be diverted by *exceptional events* that transform ideological beliefs, leading in essence to a 'divinicide' of former beliefs (Straight 2008). In the case of a shaman-prophet or post-shamanism leader as discussed by Oyuela-Caycedo, perhaps the old beliefs were not 'killed', but existing beliefs were transmogriphied, accelerated, exaggerated, or diverted in new directions. The concept of circulation is most frequently applied to material objects, but can also apply to ideas, opinion, and beliefs (Habermas 1989), and the spread of religious beliefs would entail a circulation of intangible ideas that may or may not have material correlates in the archaeological record. The circulation of people, ideas, media, technology, and value create matrices of “imaginary worlds” (Appadurai 1996). Circulation is not just a movement of people, commodities, ideas, or objects from one place to another, but instead is a cultural process that is temporally constructed (Gaonkar and Povinelli 2003: 391, Lee and LiPuma 2002: 192).

Once a former belief system is ruptured, performance of the new belief system is required to solidify its existence. Daily routines are linked to a properly maintained and performed sacredness to the non-quotidian (Comaroff and Comaroff 1991, Straight 2008: 851). One way to perform and channel peoples’ activities into a shared pattern is through movement. Rosemary Joyce (2003: 112), for example, describes how memory in the Classic Maya world was strengthened by channeled movements along marked routes that were linked to ritual calendars. People can perform identity in order to connect individuals to ‘multiplicities’ or transcend the real and physical and enter the ephemeral and communal (Deleuze and Guattari 1977, 1987). Carrying basalt columns along a set path to construct a grave lined with petroglyphs can possibly represent an example of this identity performance of the individual within the group. The positioning of rock art centers in a linear pattern which was not necessarily visible at any given time, barring the use of smoke signals or other methods we cannot easily detect archaeologically, created what I termed a ‘line of site’. Places were linked to one another socially in order to create a cohesive unit.

The creation and maintenance of social identity is linked strongly to people’s senses of place and movement within the landscape (Edmonds 2006). In agreement with earlier discussions of isthmian rock art sites, I feel that petroglyph centers potentially can be viewed as ‘identity complexes’ that formed at some point during the

Aguas Buenas or San Lorenzo periods (mid to late-first century AD) and were fully expressed by the Chiriquí period (second century AD through contact) (per Fonseca Zamora and Chávez Chávez 2003: 31, Zilberg 1986: 340). This is *not* to say that petroglyphs were not created long prior to this period, but that petroglyphs served new roles and represented different elements in the later periods due to a shift in practices or beliefs.

The role of oral tradition cannot be overstated in the transition and transmission of new beliefs. As Victor Turner (1968: 576) states,

> Myths treat of origins but derive from transitions…Myths are liminal phenomena; they are frequently told at a time or in a site that is 'betwixt and between'. [182]

Many of the materials that I have discussed in this thesis – tephra, dacite slabs*,* basalt columns, and rock art - are themselves betwixt and between and represent examples of 'cultured natures' to use the words of Latour. Cultural transitions and changes represent concepts of *innovation, creativity, and invention* that can leave overt archaeological traces in the landscape (Robinson, Korisettar, and Koshy 2008): 356); these currently popular terms are perhaps less loaded than the older terms of *adaptation* and *adoption* in referring to culture change, yet in practice seem to imply the exact same archaeological questions. Like myth, which is associated with periods of transition and which can be seen as a form of both creativity and adaptation in the face of newness, rock art is generally reflective of transitions and changes between periods rather than particular 'culture' periods (Whittle and Cummings 2007). Rock art is directly linked to oral tradition as both reflect cultural narratives and help invent new ones (Bradley 2002, Chippendale 2001, Chippindale and Nash 2004b, Robinson, Korisettar, and Koshy 2008).

The creation of both oral traditions and permanent landmarks can be a reaction to change as well as a source of change. This returns us to the vibrating string analogy of

[182] 'Betwixt and between' is, memorably, how the isthmian area itself is described in terms of its relative lack of archaeological study and interpretations that compare it to Mesoamerica or Andean cultures rather than in its own light; see Drennan (1996).

the thesis introduction: it can perhaps be difficult to determine a 'before' or an 'after' effect when the flow of time is constantly linking memories to stories that are then linked to events which link to new memories. While myths and stories often do not survive over the *longue durée*, more permanent artifacts can provide a material trace to the past experience of inexplicable landscape changes. Mesolithic peoples in western Europe, for example, watched as their old landmarks, resources, and favorite places for settlement were erased by 16 meters of post-glacial sea level rise (Tilley 2004b). Fresh water was polluted, fields became rivers, and social relationships and memories that were linked to the places were lost along with them. The menhirs erected after this period served as new landmarks and were possibly intended to act as guardians of fresh water and the overall sense of place (Tilley 2004b: 84). Though the stories that were linked to the time period do not survive, the menhirs provide a fossil of them.

My explicit focus in this chapter was on the time periods between Barú eruptions, though I do not intend to downplay the importance of eruptions. I propose that the role of an eruption could have been more important in memory and retrospect than in its actual physical impact. Stories and myths of eruptions would not be important during an eruption or immediately after, when survival and mitigation would have been the priorities. Oral traditions would only become potent once the event itself was over. One possible scenario is that the non-catastrophic eruptions that Anchukaitis and Horn (2005) place at roughly AD 570 and AD 870 left the Boquete area largely unscathed physically, but generated stories that incorporated descriptions and memories of the events.

Inexplicable, extreme geological and climatological phenomena can create narratives of fear and judgment (Grattan and Brayshay 1995, Hulme 2008). Pre-Columbian cults were closely linked to observations of nature, which prompted ritual intended to control observed natural phenomena (Plunket and Uruñuela 2005a: 109). The role of volcanic eruption – and the fear of eruptions passed down through stories – was prominent in better studied areas of the pre-Columbian world. Volcanic eruption is suggested as the cause for a new cult at Teotihuacan and linked to the building of the Pyramid of the Sun, one of the largest structures ever built, as a collaborative effort to placate the angry volcano in the first century AD (Barba 1995, Plunket and Uruñuela 2005a: 112). A central Mexican creation myth recorded in the *Codex Chimalpopoca* unequivocally references volcanic eruption in the description of five mythical cycles of creation and destruction:

> In this sun it occurred that it rained fire
> And the people were consumed by fire…
> It rained stones.
> They now say that this was when the stones we now see fell,
> And the lava rock boiled up.
> And also, it was when the great rocks formed into masses, and became red.
> (Plunket and Uruñuela 2005a: 112-13, Sullivan and Knab 1994: 113).

In the introduction to this thesis I noted the volcano shrines found at the site of Tetimpa, México. Plunket and Uruñuela (ibid.: 121-22) propose that these shrines represent a period of increasing volcanic activity that eventually – but not immediately - led to cultic activity. These cults ostensibly sought to stabilize an unpredictable volcanic landscape. The Doraces, the most likely pre-Columbian inhabitants of the Barú area, were led by an elder male who was in turn led by a higher leader given the title of *Balú* (Miranda de Cabal 1974). If a *Balú* figure incorporated fears and stories of eruptions at time periods of actual eruptions, this could provide a potent means of radically transforming beliefs and ways of thinking that were in turn represented in and shaped by material culture.

This concept of landscape unpredictability and fear brings me to my final point regarding the Caldera *Piedra Pintada* and its possible role as a means to chart the passage of the solar year. The desire to track the seasons could have practical, social, and spiritual impetus but more likely combined to a complex merging of all of those elements. Agricultural cycles would obviously benefit from a firm grasp of seasonality in order to sow and harvest at proper times. As I noted, seasonality was potentially also a factor in the various time periods that were best suited for 'harvesting' of volcanic materials for grave construction, digging the burials, and conducting burial rites. I have suggested that these time periods were potentially staggered from one another, which could help explain why grave offerings and graves do not always seem to line up in the Chiriquí context.

One other possible reason to place an emphasis upon calendrics is that volcanic eruptions can be seasonal (Mason et al. 2004). Eruptions tend to cluster in particular periods of the year during local or regional surface changes (ibid.). This perceptual linkage between volcanic events and particular timing in local memory, whether seasonal or hourly, is noted by William Hamilton in the *Campi Phlegraei* when he states that the oldest people in the Vesuvius area say that eruptions occur either at midnight or noon (Hamilton 1776: 16). Conventional wisdom in the contemporary Boquete area states that earthquakes generally occur in the very early morning in the rainy season. As I write this chapter, the Rio Caldera is in the midst of its catastrophic '30 year flood' (which occurs every few decades, not necessarily every 30 years). These floods are caused by large low-pressure moisture systems that stagnate in the Caribbean at the end of the rainy season. If oral traditions recorded particularly 'dangerous' time periods in the year in terms of eruption, earthquake, and floods, this could provide an added impetus to chart the cycle of the calendar year in order to provide some form of knowability and predictability to the destabilizing events in order to mediate the risk.

In modern, western terms a volcano in eruption can be seen as the epitome of the *sublime* as described by Burke or Kant, and the sounds, smells, sight, and vibrations from it would not have been something one would easily forget. Changes in metaphysical belief systems and the shaping of shared imaginaries occur in moments of exceptional events that are then overcome by a shared habitus (Straight 2008). Villages on central Java, Indonesia in the 1980's described the threat of volcanic eruption as a feeling of being confused (*bingung*) and lost (*kesasar*) (Dove 2007: 16). The Javanese villages feared being lured from their homes and into the crater by spirits masquerading as friends and saw the volcanic hazard as a loss of home and identity (ibid.). A Merapi eruption in 1994 became incorporated into millenarian fears of identity loss and societal transformation and the eruption was seen as a message of challenge to the current culture and linked to moral behavior (ibid.). Though not catastrophic, particularly on the Boquete side, the experiential aspect of first millennium Barú eruptions could have certainly provided a deep sense of insecurity to pre-Columbian residents. If similar feelings were prompted in the Barú region to those in the contemporary Merapi example, this could provide ideal conditions for a charismatic leader. Oyuela-Caycedo (2001) describes the pivotal moments in which shaman-prophets led charismatic movements as linked to eschatology, or the doctrine of last things. The shaman-prophet reestablishes temporal and spatial order in response to a crisis through alternative explanation or revelation. When successful, the routinization of new system of belief is emplaced.

In describing the central region of Panamá during the pre-Columbian period, Cooke and Ranere (1992b: 287) propose that the social system was destabilized by 'population growth, deforestation, an increasingly unstable productive base, and the repercussions of polygyny and endogamic marriage rules on the availability of women'. The Chiriquí area was populated by a culturally different group, but if social dynamics were even nominally similar to those described in central Panamá, the *exceptional event* of volcanic eruption could cause significant disruption to established thoughts and beliefs. While much archaeological attention is placed upon the imposition and coercion of people into hierarchical situations, I would point out that hierarchical situations and cultic following of religious tenets are not necessarily something that people are coerced into, but also something that people choose for a sense of 'belonging' and identity in times of instability.

In sum, eruptions of the Volcán Barú occurred every few centuries in the pre-Columbian context. Catastrophic floods are likely occurred every few decades, if past cycles are similar to present ones. Earthquakes occurred every few months. In relative terms, the volcano provided more 'stability' within the landscape than the rivers and ground beneath people. Barú eruptions may have been more important in memory and myth through much of the pre-Columbian period than in their actual physical impact. In the Amerindian story of the Revolt of Objects mentioned in the introduction to this thesis, the normal order of things reversed, the sky became dark and rocks 'banged against one another' (Quilter 1990: 46). The loss of stability that an eruption of Barú, normally the most stable portion of the Boquete area landscape, could arguably fit very easily into a Revolt of Objects feeling of world-turned-upside-down. Rock art in the Boquete area was potentially created between eruptions of the Volcán Barú. Experience of non-catastrophic but highly phenomenologically impactive eruptions, stories of those experiences, and fears of an unstable world possibly prompted the rise of a charismatic cult leader and the routinization of ideology as a way of creating order. I offer these theories more as a provocation and exercise to prompt fresh ways of thinking through the Chiriquí material, though I suggest that they can and should be tested by future survey and fieldwork.

In this chapter I have considered the rock art of the Boquete survey area. Like the volcano itself, the rock art along with the volcanic materials of dacite slabs and basalt columns comprise the most persistent component of the pre-Columbian landscape. What we lack, however, is the ethnographic data that could help provide more context to some of the past meanings attached to the materials. I suggested that the rock art in the study area served three 'uses': petroglyphs lined the least cost path that was a probable route between the source of basalt columns and the BE-16-KH (KOT) graves where they were used in construction; a heavy concentration of rock art marked the cemetery area of BE-14-KH (GON); finally, the monumental *Piedra Pintada* at Caldera was used for calendrical marking of the year. This desire to know the seasons could have important links to farming, burials and transportation of grave materials, and even volcanic eruption if memory of eruptions were incorporated into oral traditions that described a particular time of year prone to the eruptions.

Chapter 5 • HERITAGE AND HAZARD OF THE VOLCANIC LANDSCAPE

The role of the individual in the context of multi-scalar engagements with the world is a key element of the current interest in cosmopolitan anthropology and archaeology (e.g., Meskell 2009, Rapport 2007) [183] Through such a lens, the contemporary Barú landscape can be seen as a complex context in which individuals are continually negotiating their individual and shared conceptualizations of culture, nature, and the past. The way that these concepts are invoked differentially impact the lives of indigenous people, land owners, retirees, locals, ecotourists, and other cross-cutting categorizations.

The study of modern life is generally assessed through methods of sociocultural anthropology while early complex societies are generally studied through anthropological archaeology, though this elides the interconnection of the past and

[183] Cosmopolitanism, in broad strokes, is a conceptual unifying ethic in the contemporary period during which nation-states have declined in power, authority, and identity and globalization is creating new political, economic, and cultural structures. It is less a 'school of thought' than an acknowledgment of the larger historical forces that are changing modern life. For a broad overviews of cosmopolitanism see Harvey (2000) and Held (1995).

present contexts (Smith 2003: 22). The promiscuousness of temporal and spatial relationships and associations is especially prominent in human senses of *place* (Bender 2001: 6, Hirsch 2006: 151). As a spatial term, the concept of place inherent to landscape implies a physicality as well as a lived and experienced quality; this association of identities and meanings attached to physical areas is well-matched to the methods of archaeological investigation (Preucel and Meskell 2007b: 215).

In the previous chapters of this thesis I focused upon the past volcanic landscapes of the Barú area. In this chapter I shift the focus to the contemporary context in order to query the modern roles of the volcano and of the past itself in creating senses of place in Boquete. In the contemporary context, the Volcán Barú and the archaeological past are strongly drawn together by ecotourism and hazards studies. Each seeks to use the past to serve the future; ecotourism by commodifying the authenticity of an indigenous and more 'natural' past for financial benefit and hazards studies by examining past eruptions in order to understand what future eruptions may be like.

The place of the Volcán Barú in Chiriquí identity

Landscape, place, heritage, and identity are overlapping and linked elements (Bender, Hamilton, and Tilley 2007, Schama 1995, Tilley 2006). The Panamá Canal arguably provides the best known symbol of Panamanian national identity. The canal, which made Panamá a strategic route in global shipping in the twentieth century, draws considerable income through shipping fees and tourist revenue. The colorfully dressed Kuna people and the tropical white sand beaches of the San Blas islands where they live provide another commonly held image of Panamá that is propagated in post cards and guide books. The highlands of western Chiriquí, Panamá have a regional identity that is quite distinct from the national one. The cool climate of the highland agricultural communities produces award-winning and highly commodified coffees.[184] Crops such as potatoes, strawberries, cabbage, celery, and orchids are also important parts of the local economy and are shipped throughout Panamá. Navel oranges provided a more important crop base than coffee in the early twentieth century, and paintings and photographs of the Boquete area in the early twentieth century tend to portray orange trees.[185] These images are ubiquitously backed by the distinctive shape of the Volcán Barú in order to evoke the regional sense of place.[186]

Representations of volcanoes have long been prominent in national flags and symbols throughout Central America (Hall and Pérez Brignoli 2003: 50, Heckadon-Moreno 1997: 177).[187] The geological study by Terry (1956: 10) that I cited earlier in this thesis points out that:

> El Barú, which dominates the landscape from almost any point in the province of Chiriquí, is for that reason usually known as the Volcán de Chiriquí.

The volcano is provided, in this description, a very active role in creating a distinctive and cohesive Chiriquí vantage. This parallels the position of Tilley (2004a) in *The Materiality of Stone* that landscapes should be seen as agents that are capable of producing identity rather than reflections or signs of social identity. In this sense the

---

[184] The *geisha* Arabica coffee varietal from Finca Esmerelda, owned by the Peterson family, sold at a record price of $130/lb in online auctions on May 29, 2007. For comparison, non-premium coffee closed at an average of $1.10/lb that day on the NYMEX Coffee, Sugar, and Cocoa Exchange. The Coffee C contract is the world benchmark for Arabica coffee and per the March 2009 coffee futures contract the average price of coffee closed at $1.20/lb, which highlights the significant price obtained by the *geisha* beans in 2007.

[185] The navel oranges grown in Boquete were originally propagated in Bahia, Brazil. They were introduced to southern California in 1873 and then brought to Boquete in 1894; see Grigore (1992).

[186] The painter Marco Ernesto, though originally Ecuadorian, is closely associated with Chiriquí after moving to David in the 1950's; he frequently painted Barú to evoke the landscape of the area. Ernesto murals that prominently feature the volcano can be found on the walls of the Bistro Boquete, Pension Virginia, and the public school in Boquete.

[187] One example of many that could be offered is the coat of arms for the short-lived (1823-1840) Federal Republic of Central America (*República Federal de Centro América),* which was a confederation of Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica. The design portrayed a line of triangular volcanoes within a larger triangle. See p 50 of Hall and Pérez Brignoli (2003: 50).

volcano, though 'natural', can be viewed through terms of agency - rather than meaning - much in the way that material culture is viewed in influential current discussions (e.g., Gell 1998, Latour 1991, Miller 2005). The agency of the volcano in times of eruption is of course quite clear, though it also has a great deal of agency throughout the long time periods between eruptions.

I have noted elsewhere (Holmberg 2005: 197-8, 2007a: 288-90) the frequent use of Barú representations in local business signs, logos, and community buildings and will not duplicate the same discussion here. The volcano is central to both material representations of the region as well as less tangible cultural aspects such as poems and songs. Like a frequently used Chiriquí slang term, *meto* (roughly glossed as 'buddy', 'friend', or 'fellow Chiricano'), the volcano provides a marker of place and community identity.[188] The link between landscape and local identity can be exceptionally strong (Tilley 2006: 18), which is illustrated graphically in the example of a series of 1949 stamps showing Barú as a synecdoche for the Chiriquí province (Figure 5-1).

FIGURE 5-1: PANAMANIAN STAMPS FROM 1949 SHOWING BARÚ IN ORDER TO DENOTE THE PROVINCE OF CHIRIQUÍ. IMAGES USED WITH PERMISSION FROM THE COLLECTION OF J.L. WHITFORD-STARK (WHITFORD-STARK 2007)

The local perception of Barú illustrates a strong attachment to place, or 'topophilia', which is a common component of human societies (Thompson 1990: 113, Tuan 1990). In state level societies this attachment is tinged by ethnicity and nationalism, and globalization does not erase such 'local' concerns so much as redefine them (Descola

[188] For a discussion of the possible indigenous etymology for the word *meto*, stemming from the Ngöbe term for a person belonging to the Metobo group, see Joly Adames (2005: 11); see also Séptimo and Joly (1986: 60).

and Pálsson 1996: 15). While links between territory and identity are rarely straightforward (Blake 2007: 234), Barú provides an important aspect of modern Chiricano identity. Amongst many of the local people with whom I spoke, particularly males, the six-hour hike to the top of Barú was considered a rite of passage. This hike is often completed in the late teen years, before work and family responsibilities make it less practical, with a pre-dawn departure in order to see sunrise at the summit. The summit is spiked with communication towers that are visible from Boquete, though the highest point is marked with a small Christian cross where many people have their picture taken as evidence and trophy that they made it to the top (Figure 5-2).

FIGURE 5-2: COMMUNICATION TOWERS AND A CROSS AT THE HIGHEST POINT OF THE MAIN CRATER SUMMIT OF BARÚ

While imagery of Barú remains a constant in portrayals of Chiriquí, the representation of orange trees prevalent throughout much of the twentieth century is now frequently replaced by images of coffee. Coffee trees, beans, flowers, and cups are frequently represented in conjunction with images of Barú. Coffee became a more important cash crop than oranges by the end of the twentieth century. Per the 2000 census, Boquete contained 10 million of the 28 million mature coffee plants in Chiriquí and the 2000 census crop was worth an estimated $7.4 million US (Contraloria General de la República 2003: 6, Reid and Hanily 2003). The number of smaller coffee crops in Boquete that can be described as organic, shade-grown, or environmentally conscious is growing steadily and can be highly lucrative. The market for these specialty Boquete coffees stems in part from commodification by North Americans of 'fantasies of pure, untouched nature and romantic portrayals of small coffee farmers as natural conservationists, eager to protect birds, biodiversity and natural resources' (Lyon 2006: 378). [189] Local coffee growers, who do frequently have genuine interest in conservation issues, also play savvily upon this commodification in their packaging and marketing. The Volcán Barú is frequently noted or imaged in this packaging, as are indigenous references. Several coffee farms and roasting facilities offer tours to paying visitors, many of whom are ecotourists or adventure tourists.[190]

Ecotourism and ecoretirement: nature, the past, and desirability

Despite the strategic and economic importance of the canal, Panamá's gross domestic product (GDP) was outpaced by that of Costa Rica by the turn of this millennium due to Costa Rica's highly successful development of ecotourism (Bundschuh et al. 2007a: 1076). Though clearly the dynamics are very complex, the cessation of armed conflict in Guatemala, El Salvador, and Nicaragua and improvements in transportation were partial contributors to a massive increase in tourism in Central

---

[189] The geisha varietal, which is originally from Ethiopia, was brought to the isthmus in the 1930's (see http://www.haciendaesmeralda.com/Thegeisha.htm). Geisha coffee sold at a Vancouver café for $270/ lb in bean form, or $15/8-ounce cup (Ramsey 2007).

[190] It is not a coincidence that two of the most important sites in my survey project were on property owned by two of the coffee farms/roasters with the best developed tourist facilities. The BE-16-KH (KOT) site and the intact graves I excavated are located on the Kotowa *finca*. The BE-14-KH (GON) site and the concentration of petroglyphs is primarily on the private coffee and orange *finca* owned by the Gonzalez family, though the commonly known petroglyph that first brought me to the site is on the property of the Café Ruiz roasting facility. The Ruíz family was very supportive of my work and interested in learning more about the petroglyphs in order to pass on correct information to tourists. Both Kotowa and Café Ruiz have well-developed tours in both English and Spanish that allow visitors to learn about and participate in coffee picking, roasting, and tasting (or 'cupping') processes. The owners of both facilities are genuinely interested in the pre-Columbian evidence on their property but also aware of the value and interest of the material culture to tourists. 'Patrimony', in this sense, is shifted from its original meaning to imply a heritage that can be used as a tourist draw (per Lowenthal 1998: 4). This overlap in their interest and my own need to conduct archaeological survey and collect data were extremely helpful and symbiotic in this context.

America between 1990-2000 (Bundschuh et al. 2007a: 1076). The presence of inexpensive coffee from southeast Asia on the global market and overall decrease in cash crop prices has lowered the viability of agriculture as an economic base. This, in part, has encouraged the aggressive marketing of Central America's tropical rain forests, biodiversity, and volcanoes to ecotourists and adventure tourists as a way to compensate for the lower viability of cash crops (ibid.: 1073).[191]

The Volcán Barú was clearly seen as a potential commodity in the geothermal study completed by Stewart (1978), which was written following the discovery of copper deposits in eastern Chiriquí requiring large amounts of electricity to process. The volcano, however, is more recently viewed as a useful ecotourism commodity. Roughly 19.5% of national territory in Panamá is protected in 14 national parks, over a dozen forest reserves, and 10 wildlife refuges, and the Volcán Barú is itself protected as a national park (Bundschuh et al. 2007a: 1038).

I was initially surprised when a seminar that I taught during my fieldwork period for the *Universidad Autónoma de Chiriquí (*UNACHI) in David was offered as a course in the 'tourism studies' program.[192] I did not touch directly upon tourism in my lectures, which focused upon the archaeological and volcanological understanding of the Barú area. The course drew some history and education majors, though the majority of students in the seminar were a part of the first tourism degree offered by the university.[193] In essence, both the past and the volcano were bracketed by the university classification as tourism commodities. The designation of the environment as *capital* or commodified object is tightly bound into the modern conception of nature upon which ecotourism and conservation are based (Costanza and Daley 1992, Ogden

[191] Bird-watching is one exceptionally important element of Barú area tourism; rare birds such as quetzals, the Volcano Junco, and Timberline Wren draw a particularly large number of ecotourists to the area.

[192] This course was offered with the encouragement and help of Dra. Luz Graciela Joly Adames at UNACHI.

[193] The seminar was also open to members of the local community. A second seminar was later held in English for members of the expatriate community.

2008, West and Carrier 2004: 484). The past, particularly an indigenous past, is frequently packaged along with the natural environment as part of a more pristine interaction of nature and culture; in essence this is a naturalization *of* culture (Braun 2002, Raffles 2002: 152, Wilson 1992).

The linkage between archaeology, conservation, and tourism is increasingly prevalent in the overall Panamanian context. Recent work in the Pearl Islands of Panamá was undertaken with explicit awareness of the tourism potential of the finds (see Cooke et al. 2007), though the report of the work also notes the concomitant destruction caused by tourism on islands like Contadora, where extensive pre-Columbian occupation evidence was erased by the steady development of the island since the 1970's. The same report notes that the concept of 'TCI' (Tourism, Conservation, and Investigation) can link the efforts and goals of archaeologists, government officials, and business people in Panamá (ibid.: 4). This highlights the need to provide an incentive or desirability for archaeological investigation both to allow funds to engage in survey and excavation and to encourage the protection of archaeological remains.

Biodiversity and nature are commodified in neoliberal conservation agendas and peoples and cultures can additionally be swept into the marketing of ecotourism ventures (Igoe 2004: 257, Paterson 2006, West 2005, West, Igoe, and Brockington 2006). This commodification process is in a nascent period of development in the Barú area and is linked more to the natural environment than the archaeological past.[194] The inaugural 2005 issue of a magazine targeted to the tourist community in Boquete

[194] This is due in part to emulation of Costa Rica's successful ecotourism sector; roughly 420,000 tourists visit Costa Rican volcanoes each year (in order of popularity: Poás, Irazú, Arenal, and Pacaya). For further statistics see (Alvarado et al. 2007: 1166). In eastern Panamá a strong Kuna cultural heritage is avidly marketed to ecotourists who pay to visit the San Blas islands of Kuna Yala. The Kuna self-monitor this identity and marketing closely and an angry debate broke out during my fieldwork period when non-Kuna Costa Ricans began selling cheap replicas of the colorful cloth *molas* for which the Kuna are known. The anger that was expressed was not only for the financial benefit to non-Kuna for Kuna cultural items but also that the *molas* were poorly made and cheapened the 'brand', in a sense, though they did not use that terminology.

showed young local women posing seductively in bikinis in various areas of Boquete on its cover and throughout the inner pages of advertising and articles. This ostensibly was an attempt to create an aura of desirability, premised on the female body in contexts of natural beauty (at a stream, in front of flowers, at a waterfall, foregrounding the volcano), though was quite forced in the sense that it is generally quite chilly in Boquete throughout the year and the girls in the photos in fact look uncomfortably cold and ill at ease. Another magazine targeted to tourists, *Focus Panamá*, published an issue entitled 'The Magnetism of the Mighty Volcán Barú'. The magazine labels Barú as 'extinct', hence less threatening than the geological reality of being dormant rather than dead, and shows a colorful cover illustration of the volcano as the hub of activity.

The focus of the tourist gaze in the magazine examples is upon natural rather than cultural commodities, though the petroglyphs of the area provided an earlier tourist draw to the area. The Caldera *Piedra Pintada* discussed in the prior chapter is frequently visited by tourists who combine the trip with a visit to the nearby hot springs. The Caldera petroglyph boulder has drawn western visitors beginning at least with the accounts of Berthold Seemann (1853a). The Boquete area petroglyphs have provided less of a tourist draw, though were notably visited by Charles Lindbergh (Figure 5-3) as part of his Latin American good will tour in 1927-1928 (Lindbergh 1928).

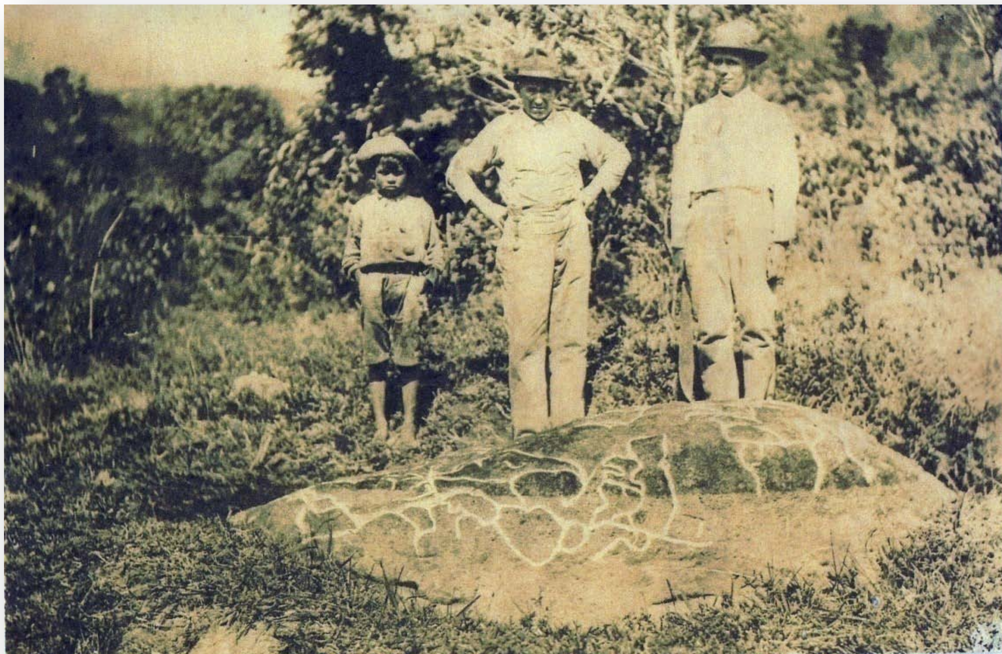


FIGURE 5-3: CHARLES LINDBERGH (CENTER) VISITING A PETROGLYPH IN BOQUETE IN JANUARY 1928

This petroglyph appears to be the rock art boulder that I designated as KHP-9. The photo is used with permission from the Wren Grigore Panamá Canal and Panamá Memorabilia collection. [195]

The possibility of future tourist potential of the petroglyphs was explored during my fieldwork period by a local artisan, Cecilio Enoy González Tejeira, who created a ceramic paperweight with the shape and design of the KHP-11 petroglyph from the BE-14-KH (GON) site (Figure 5-4). The object was designed to be iconic, easily portable, and inexpensive hence attractive for tourist consumption as a Boquete souvenir. Ostensibly, a tourist to Boquete who purchased the petroglyph paperweight would also see the petroglyphs, perhaps tour a coffee farm and roasting facility, and likely hike either on the Quetzal Trail between Boquete and Cerro Punta or climb to the top of Barú.

[195] The man to the right of Lindbergh is Pop Wright, the owner of the Panamonte Hotel at the time. The child to the left is unidentified.

FIGURE 5-4: A CERAMIC PAPERWEIGHT OF THE KHP-11 PETROGLYPH WHICH IS DESIGNED TO APPEAL TO ECOTOURISTS

The petroglyph paperweight utilizes the shape and designs found on a petroglyph recorded by Boquete survey (KHP-11).

The combined packaging of nature and an indigenous past for tourism consumption is illustrated in the advertising of a 'canopy tour' that was developed during my fieldwork period on Kotowa coffee farm property. The endeavor, called Boquete Tree Trek, allows tourists to use harnesses and a series of cables between tree top platforms to descend a forested valley. An advertising pamphlet for the tour promotes that you can:

> Glide through the treetops of century-old forests, high above the pristine rivers and waterfalls that make up the incredible collection of natural landscapes bordering the National Park La Amistad and the famous Barú volcano.
>
> Tarzan, 21st century! Who would have thought that a technology utilized hundreds of years ago by our indigenous people and later perfected by botanists and naturalists to observe and study the behaviors of wild creatures in their natural habitat, would be transformed into one of the most revered extreme sports
>
> A harness, an ultra-resistant steel cable and gravity are the only elements necessary to suspend and propel the "fearless rider" in this incredible "adrenaline rush".

This description of what is, in actuality, a rather tame and highly controlled activity promotes it as a rugged and adventurous sport that puts one in contact with a 'pristine' environment that is linked to a pre-Columbian past that never was. No evidence exists that pre-Columbian people in the Barú area ever thought to visit the canopy, much less use it as a form of transportation, and it is unclear to which indigenous technology the pamphlet is referring. Simultaneously, most animals will of course avoid the area of the cables and the loud groups of tourists on the platforms; any that don't will be fully aware of the human presence, hence the voyeuristic promise of viewing fauna in their natural habitat is quite false. This form of tourism is dependent upon the production and reproduction of 'new things to discover and experience, and the exoticism of experiencing other supposedly more authentic and less corrupted' worlds (Tilley 2006: 17). The canopy tour and its description create a context of *virtualism*, in the sense described by West and Carrier (2004), as the environment is produced in a way to meet the expectations of North American consumers (see also Carrier and Miller 1998). This essentially transforms 'nature' for economic development.

'Panamá is a paradise for foreigners'

Another form of virtualism can be seen in the rapid growth of the market for retirement and second homes in Boquete over the past decade. Boquete, like Cerro Punta and other communities near Barú, is becoming well known as a retirement center for North Americans and Europeans (Reid and Hanily 2003). Frequent mentions in North American newspapers (e.g., Anon. 1930, Brass 2007, Gunderson 2007, Koyen 2007, Kraul 2007, Markels 2005, McLane 2001, Tedeschi 2006) following the 2001 declaration by *Modern Maturity* magazine that Boquete was one of the best places in the world to retire have brought a rapid influx of expatriates and exponential increase in property prices. While this brings opportunity for employment to many people in the Boquete area, it also provides conflict as established communities are displaced by development and land prices rise out of the reach of most locals. The successful advertising and public relations campaigns that promote Panamá as a 'paradise' for North Americans and Europeans rankle some Panamanians, who see the influx as undermining their own patterns of life (Figure 5-5).

FIGURE 5-5: THE FIRST PANE OF THE CARTOON SHOWS THE NEWSPAPER HEADLINE, "PANAMÁ IS A PARADISE FOR FOREIGNERS"; IN THE SECOND PANE THE PANAMANIAN READER QUIPS "NO WONDER IT'S GOING SO BADLY FOR ME". © LA PRENSA, DEC 26, 2006

While many of the North American newspaper articles that extol retirement in Panamá describe what they interpret as a new phenomenon of expatriate 'destination' retirement, the 'fine climate and beautiful scenery' are noted to have attracted American retirees over half a century ago by Stirling (1950) and the process is more realistically seen as an extension of trends that were in place by the late nineteenth century.[196] What is new, however, is the rampant marketing of the Boquete area as a place of 'eternal spring' (a frequently re-used phrase) to denote the cool climate but also connote a place where aging retirees needn't necessarily feel that they are in the winter of their life.

Many of these retirees are actively environmentally conscious and have been instrumental in developing recycling campaigns that benefit local schools, animal clinics to spay and neuter stray cats and dogs, and construction techniques utilizing solar panels and ecologically friendly materials and designs. Social projects include charities

[196] Many of the nineteenth-century accounts of the 'gold rush' on sites like Bugaba, for example, note the presence of European immigrant in highland Chiriquí.

to benefit orphans and poor families and free birth control clinics for indigenous women. Unlike ecotourists who visit for several days, these retirees plan to spend the remainder of their lives in Boquete, though from my experience with the retiree community they are drawn to similar elements of adventure and difference as ecotourists. Tourist perceptions may be shaped by 'a preoccupation with harmonious social relations' and ideas about community (Selwyn 1996: 3, Tilley 2006: 16), though so are those of the expatriate retirees, who are in one sense simply long-term tourists. As Tilley (ibid.) points out, however, tourists can over time become locals and locals become tourists, hence the identities of insider and outsider can be quite complex.

Narratives of ownership, property, and commodification are applied to natural and non-renewable resources and heritage (Meskell and Preucel 2007b: 317). Barú is, in essence, positioned as a primary source of heritage in the Boquete area. As I already mentioned in this chapter, Barú is central in early twentieth-century representations of the Boquete area and is repeatedly symbolized throughout the local community. The recently constructed expatriate community of *Valle Escondido* can be seen as accessing or appropriating the greater 'authenticity' of the earlier portrayals of the volcano by painting a large, vivid mural of Barú in the Christian chapel of the upscale, gated community.[197] This repetition of what is already an established mode of representing the Boquete landscape through reference to Barú ostensibly draws the gated expatriate residents into the larger community framework. As Cosgrove (2006: 63) states,

> It is easy to criticize the exurban, gated community, with its exclusionary restrictions, 'master-planned' picturesque design conceits and contingent connections with the history and physical geography of its location as inauthentic and placeless, an unhomely (*unheimlich*), pastiche landscape that utterly fails to pull together earth, sky, the divinities and other humans into true dwelling (Heidegger 1978). But it is more accurate to see it as one expression of the characteristic modern sensibility of nostalgia…"

The Barú mural in the gated community links to the community to the natural and social environment around it; if nostalgia is in fact entailed, it is to the earlier and more

[197] The tourist magazine, Focus (2005, vol. 31: 29) describes the mural of Barú in the Valle Escondido chapel as a representation of the 'ferocity' and fertility of the volcano.

'natural' agricultural communities that formed the prior identity of the area and regularly referenced Barú. In this sense, an indexical slippage between the natural environment, the traditional farming communities, and the imposed order of the carefully zoned and groomed community exists similar to that noted by Buchli (2007: 190-1) in the painted traditional yurt elements incorporated into prefabricated concrete Soviet buildings. In one sense, the gated community's relationship to the local Boquete community can be seen as a context in which local pasts are turned into a playground for rich non-locals (per Bernbeck and Pollock 2007: 347, MacCannell 1976). This consumerist relationship is less straightforward in practice, however, as many residents within the gated community work diligently to join and contribute to the outside community while local residents outside the community can be just as capable of treating the local past – particularly the indigenous and 'natural' past – as a recreational commodity.

The Volcán Barú is notably and repeatedly referenced as 'extinct' by real estate ad campaigns targeting expatriate retirees. Upon discussion of Barú's state of dormancy, not extinction, one real estate developer with whom I spoke excitedly asked whether there was a chance that Barú could possibly begin erupting soon and be harnessed as a tourist draw like the active volcanoes of Costa Rica, where hotels built specifically as viewing stations offer services such as night time wake-up calls in the event of a lava flow.[198] The 1995 eruption of Soufrière Hills volcano on the island of Montserrat graphically illustrated how volcanic eruption can unexpectedly and violently disrupt North American retirement communities. The developer with whom I spoke, however, perceived the volcano not as a possible hazard or threat to real estate and tourism in the area but as an economic boon to be harnessed. The developer ostensibly viewed the volcano as an entity that could be tamed or domesticated for profit, which is

[198] A US example of marketing a volcano can be seen at Mt. St. Helens in Washington State. In 1981-2 a permit was required to enter the park, making access to the area of the 1980 eruption difficult. In 1983 a parking lot, interpretive panels, and toilets were installed. By 1984 one could buy a 'volcano burger' or a 'dome dog'; by 2004, during renewed eruption, tourists flocked to the volcano to engage in sight-seeing and new age rituals.

clearly a perspective that overlooks the genuine threats and dangers that renewed activity of Barú would create. As was the case on the Caribbean island of Dominica, increased settlement around the volcano creates a dilemma in the sense that land-use planning and regulation could reduce volcanic hazard risk, though the competition for tourism money is fierce and local authorities do not want to detour investors by highlighting business risks (Kreimer 2003: 21). In the case of Dominica, little awareness of volcanic hazards in the government, business, or local communities existed prior to the arrival of refugees from nearby Montserrat.

Learning from the past and a de-moralized nature

The hazards of the volcanic landscape

> When I arrived in Central America, I thought that a complete and thorough study of seismic and volcanic activity could provide data that, if not capable of predicting catastrophe, then at least would be able to estimate the frequency of those horrible disasters that have elevated to first place that part of the active volcanic chain located between the isthmuses of Panamá and Tehuantepec.
>
> Fernand comte de Montessus de Ballore, *Temblores y Erupciones Volcánicas en Centro-América* (1884)[199]

Discourses of how humans and the natural world intersect have changed markedly in the past century. The Enlightenment and colonial era brought an emphasis upon male domination of a 'nature' that needed to be tamed. This stance has gradually shifted in the post-colonial era and by the 1972 Stockholm Conference discussions of human dependence upon a fragile 'environment' became more dominant (Argyrou 2005). The concept of sustainable development that became prominent beginning in the late 1980's is a product of the conception that mastery and custodianship are both entailed in our inhabitation of the planet (ibid.). The underlying basis of both elements

[199] As cited by Lindholm et al. (2007: 1099).

is an awareness that our natural surroundings can change in threatening and dangerous ways. This concept of human vulnerability became increasingly 'de-moralized', or separated from the conception of 'malign Acts of God' in modernist thought (Chester, Duncan, and Dibben 2008: 216).[200] 'Natural disasters' are seen as explicable and predictable events, and many archaeological studies that examine them explicitly state that we should learn from past environmental events in order to prepare for future ones.

While this belief adds helpful gravitas and pertinence to grant proposals that seek to show the applicability of archaeological data to contemporary issues, the actual fit between climate change in the Little Ice Age versus global, anthropogenic climate change in the twenty-first century (to cite one commonly used example) is yet to be clearly established. In the context of volcanic eruptions, in fact, the study of past eruptive events does not necessarily provide a clear template for future eruptions. The eruptions of Santa María (1902, Guatemala), Arenal (1968, Costa Rica), and San Cristóbal (1971, Nicaragua) volcanoes, for example, proved entirely distinct in type, duration, and the area affected from previous, pre-Columbian eruptions according to the physical eruption evidence (Alvarado et al. 2007: 1160).

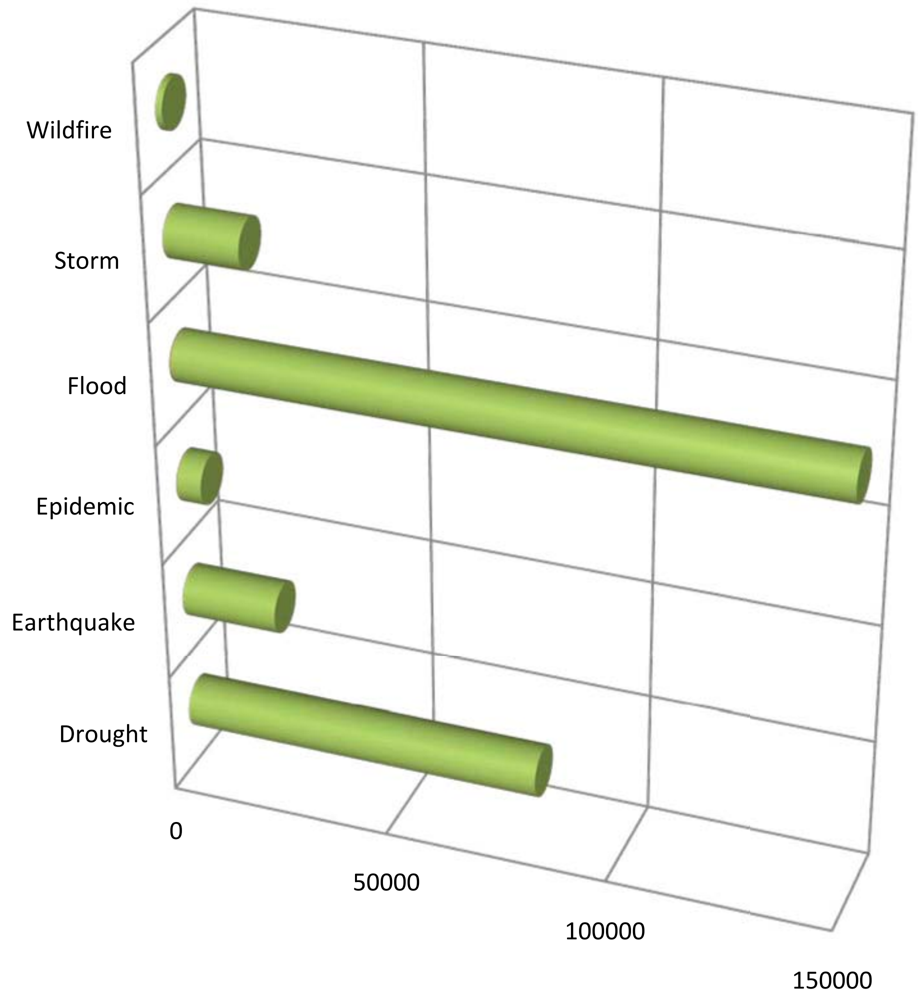
Data for natural disasters in Panamá have only been collected since 1900, hence volcanism is not registered in the International Disaster Database (EM-DAT) due to the lack of twentieth-century eruptions in Panamá.[201] This database divides disasters into 'complex' (famine), 'natural' (drought, earthquakes, floods), and 'technological' (building collapse, transportation accidents) events. For Panamá, the category of 'natural' disasters comprises 97% of the overall tally of 283,316 people considered

[200] Though religious frameworks to explain disasters are very much a prominent part of modern disaster contexts and cannot be assigned to a pre-industrial past; see Chester and Duncan (2007a).

[201] EM-DAT: The OFDA/CRED International Disaster Database (www.emdat.be), Université Catholique de Louvain, Brussels, Belgium).

affected by disasters between 1900 and 2008.[202] By far, the most impactive natural disaster in Panamá since 1900 is flooding (Figure 5-6). Drought provides the second-most disastrous natural event. The absence of volcanic eruption in the EM-DAT data, as no eruption has occurred since 1900, deemphasizes the catastrophic potential held by Barú.

[202] These data were provided to me by EM-DAT in December 2008, yet do not yet reflect the catastrophic flooding that occurred in Chiriquí in late November 2008. My thanks to Jean-Michel Scheuren from the World Health Organization Collaborating Centre for Research on the Epidemiology of Disasters (CRED) for making these data available to me before they were accessible on the internet.



	Drought	Earthquake	Epidemic	Flood	Storm	Wildfire
Occurrence	1	4	5	25	4	1
People killed	0	32	101	165	46	0
People affected	81000	21511	5554	147828	16800	1436

Natural Disaster data for Panama, 1900-2008

FIGURE 5-6: NATURAL DISASTER DATA FOR PANAMÁ BETWEEN THE PERIOD OF 1900-2008, AS REPORTED BY EM-DAT

These tallies are accurate per the collected data as of December 19, 2008, though do not yet reflect the catastrophic November 2008 floods in Chiriquí.

Over 400 recorded volcanic eruptions have occurred in Central America since AD 1500. Frequently, the volcanoes dormant the longest and with no prior historical record of eruption provide the most explosive and dangerous eruptions (Bundschuh et al. 2007b: 43). While volcanic eruptions rarely occur without significant precursor events spread over a series of days or even years, some of the greatest catastrophes occur when early signs for eruptions are unrecognized or ignored (Alvarado et al. 2007: 1181). Very few volcanoes in Central America are currently being monitored, and of roughly 70 stratovolcanoes only 17 currently have monitoring systems (Bundschuh et al. 2007b: 43).[203] The 'seismic crisis' (as it was termed in Panamanian newspapers) or series of low-grade earthquakes that occurred at Barú in May 2006 prompted the most thorough examination of the volcano to date and resulted in the USGS Open-File report by Sherrod et al. (2007). The report included archaeological data and interpretations from the Linares and Ranere (1980a) edited volume in their report, highlighting the connection between past and future impacts of Barú eruptions on human occupation. Eight monitoring stations are currently emplaced around the periphery of Barú in order to monitor seismic activity that could indicate a pending eruption (Figure 5-7).[204]

While past eruptions do not provide a clear template for the size and form of future eruptions, it can accurately be assumed that Barú's past eruption history indicates that the volcano will erupt again (see Sherrod et al. 2007: 2). It can also be assumed that, as in past eruptions, Barú will explode violently and will be highly dangerous to anyone on its flanks during an eruption (ibid.). Sherrod et al. (2007) state that future eruptions, if they follow the pattern of past eruptions, will include multiple-year episodes of tephra fallout, pyroclastic flows, and lahars; the exact zones where these hazards will impact, however, can only be generally defined in advance. The most dangerous hazard, pyroclastic flows, would likely flow to the west of the crater (to Nuevo Bambito and Volcán) if an eruption occurs at the main summit dome; should the eruption originate only slightly east of the main dome Boquete could receive the flows

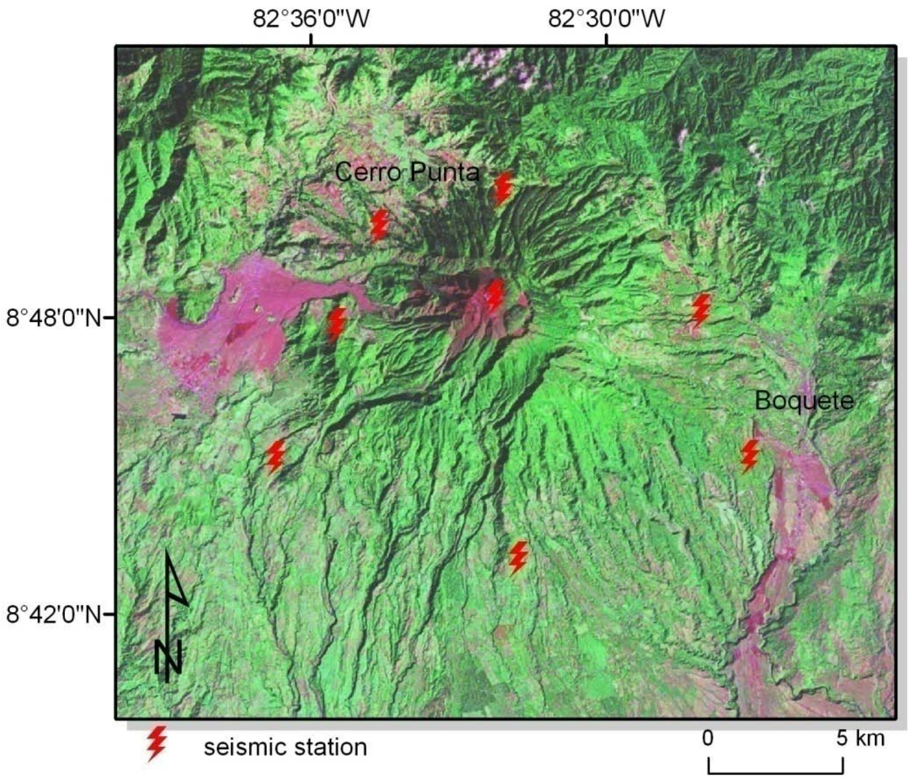
[203] A stratovolcano is composed of many layers of lava, tephra, and volcanic ash ejected during multiple eruptions. Stratovolcanoes tend to have steep, conical profiles and explosive eruptions due to viscous magma.

[204] For specifications of the Barú monitoring system per 2004, see Lesage et al. (2007: 1197, Table 39.1).

(ibid.). Lahars, or flows of wet volcanic materials, would travel down the many Boquete river and stream channels, making valley floors the most dangerous locations.[205]

Chapters two and three of this thesis discussed the presence of tephra from past Barú eruptions. The distribution of this tephra would have been highly affected by wind currents for which we have no direct data. Using wind direction data gathered between 1997 and 2006, however, Sherrod et al. (2007: 22, Figure 14) created useful diagrams for contemporary Barú wind distribution in dry (March) and wet (November) seasons. The time of year in which a future eruption occurs will determine the location and distance of tephra dispersal. The cited impacts of the future Barú tephra fall include reduced visibility, midday darkness, water contamination, crop ruination, short-circuiting of transformers and breakage of power lines, and engine malfunctions (ibid.: 5).

[205] The Sherrod et al. (2007) report uses the LAHARZ computer program to model possible lahar inundation areas (see their Plate 1).



Station Name	Altitude (m asl)	Longitude*	Latitude*
ALB2	1221	-82.4505	8.7531345
BRU3	3359	-82.5367	8.8067302
RES2	2557	-82.5344	8.8428355
CDA2	1402	-82.6109	8.7520428
ALP2	2234	-82.5762	8.8302837
BCO2	1429	-82.5286	8.7184938
ALQ2	1537	-82.4671	8.8021888
AGC2	2101	-82.5904	8.7969225

*WGS84

FIGURE 5-7: MAP AND CHART OF SEISMIC STATIONS CURRENTLY MONITORING THE VOLCÁN BARÚ (LONGITUDE AND LATITUDE WERE PROVIDED BY EDUARDO COMACHO, GEOSCIENCE INSTITUTE, UNIVERSITY OF PANAMÁ, NOVEMBER 2007)

While uncertainty exists regarding the future eruption date of Barú, both scientifically and locally a strong sense exists of the tectonic liveness of the area.[206] Seismic swarms, or a series of earthquakes over a short period of time and limited area, occurred at Barú in September 1930, June-August 1963, November 1985, and May 2006 (Sherrod et al. 2007: 10).[207] The 1963 event is interpreted by some researchers as a harmonic tremor, or continuous and low-level earthquake caused by the movement of magma underground (de Boer et al. 1988: 278, Morell, Fisher, and Gardner 2008: 85). These events often precede volcanic eruption, though Sherrod et al. (2007: 10) question the definition of the 1963 event as indicative of magma movement. An additional series of seismic swarms was cited from local memory in Boquete throughout the entire month of June 1934.[208] A Ngöbe family described to me how they felt the volcano shake slightly at least once a week and described how, during the 1970's, they could smell sulphur in the stream that comes from the volcano following an earthquake. More recently, the same family described digging a seven meter deep latrine and noting two very distinct layers of volcanic material covering dark, fertile soil they interpreted as farm land impacted by eruptions.[209]

Protecting the volcano

Discourses of the natural environment are increasingly fused with conceptions of danger, disquiet, and risk in recent decades (Mühlhäusler and Peace 2006). The USGS hazards study of Barú highlights the risk posed by the volcano and the 2006 seismic swarms did heighten considerable local tensions regarding possible dangers they faced

---

[206] This is despite the repeatedly stated real estate mantra that Barú is 'extinct'.

[207] Based on written communication from Eduardo Comacho (Universidad de Panama) to the USGS researchers in 2007 and written communication from Randall White (USGS) in 2007.

[208] This was related to me by Clavdia Gonzalez, whose grandfather remembered the event.

[209] These stories were from discussions with the family of Demetrio Miranda, who live on the *finca* owned by Guillermo Bell and Niviavde Bell Arce.

in the Barú landscape. Overall, however, the stronger perception of the Barú environment places the volcano as an entity that itself needs to be *protected*. Parallel to the underlying tenets of ecotourism, a prominent local environmentalist presence in the Barú area relates to the natural environment as one that is fragile rather than threatening.

As already noted in this chapter, the Volcán Barú is contained within a conservation area. The Volcán Barú National Park was created on June 24, 1976 and contains 14,522 hectares of highlands, 6,000 hectares of which are forested (Reid and Hanily 2003). This park connects to La Amistad International Park in Costa Rica and together form part of the UNESCO Man and the Biosphere site known as PILA (*Parque Internacional La Amistad)*. The Volcán Barú National Park is also part of the Nature Conservancy's prioritized conservation areas.

The recent global increase in protected areas is part of a specific way of viewing, understanding, producing, and reproducing the world (West, Igoe, and Brockington 2006). During my fieldwork period in 2004, a very active grassroots movement began in opposition to a proposed road through the Volcán Barú National Park. The road project at the center of the protest was, ironically, proposed as an 'eco-road' (*camino ecológico*). It was defined as ecologically 'friendly' for the following reasons: it was only one lane of 4.5 meters width to minimize the impact of a normal 10 meter wide, two lane road; three parking areas were planned (3x40 meters) to allow drivers to stop and appreciate the natural beauty; a weight limit of 10 tons was suggested to bar large buses and trucks from the route; and rustic wood informational signs would provide information along the route (Constructora Urbana 2002).

Opponents of the road project pointed out that the construction of the road inside the protected park was illegal until the law was changed to accommodate it.[210] While a very few wealthy individuals stood to benefit from the road, a vast number of

[210] One of the primary financial beneficiaries of the proposed road was at the time also the president of the country.

people felt that they stood to suffer from it if the construction and traffic disrupted the wildlife and natural beauty of the park. The anti-road groups noted that it would cross the Quetzal Trail, a hiking route through a major nesting area of the quetzal bird, and endanger both the birds and a top tourist attraction of the area (Reid and Hanily 2003), hence a possible economic detriment was perceived as well as an ecological one. Rallies, parades, signs, and letters to the newspapers provided mainstream outlets for objection to the project, while a successful campaign of selling inexpensive ($1) flags that people could put on their car or truck proved a highly visible way to show affiliation with the anti-road protest (Figure 5-8). More individual forms of protest took the form of sabotage to the heavy equipment used in the preliminary stages of road clearing and removal of the spray painted survey marks on trees along the proposed road path by stripping the bark from the trees.

While North American and European environmental groups were in communication with some of the leaders of the anti-road movement, the organization and funding of the movement was very much a local activity. As several of the local residents expressed to me, their concern was that the park and natural environment should be protected for their children and for the future. The t-shirts that were sold against the road project stated in Spanish ‘No to the Cerro Punta-Boquete road: oxygen or cement’ (*No a la carretera Cerro Punta – Boquete: Oxigeno o cemento*). This stance removes any question of ‘sustainable development’ in the concept of the road, dichotomizing oxygen/non-development and cement/development as the only possibilities. This concept puts a great value upon the future and material nature; local value upon the past and material culture, as I discuss below, is also present. In the end, the road was never built and the protesters and environmental groups considered their actions successful.

FIGURE 5-8: FLAGS ON CAR WINDOWS (LEFT) AND SALES OF T-SHIRTS, CALENDARS, AND BUTTONS (RIGHT) WERE USED TO PROMOTE THE ANTI-ROAD MOVEMENT

The local 'afterlife' of the past

Descendant communities and appropriating heritage

William Henry Holmes (1888: 15) stated that the indigenous people of Chiriquí have no interest or awareness in the interpretation of the prehistory of the region and feel no connection to the pre-Columbian artifacts found in the area.[211] While I cannot speak to the nineteenth-century context that Holmes described, his statement is highly inaccurate in the contemporary context. A number of recent archaeological discussions note the need for archaeological work to be relevant and responsive to 'descendant communities' of the people whose material culture we excavate (Ardren 2002, Ferguson 1996, Gosden 2001, Kehoe 1998, Patterson 1995, Stone and MacKenzie 1990, Swidler et al. 1997). The definition of who should be included as a descendent group in western

[211] The exact quote from Holmes (1888: 15) is, 'At the present time this district is inhabited chiefly by Indians and natives of mixed blood….These peoples are generally thought to have no knowledge or trustworthy tradition of the ancient inhabitants and are said to care nothing for the curious cemeteries among which they dwell, except as a source of revenue'. Holmes (ibid.) did note, however, that Pinart (1885) found that some traditional groups considered the individuals represented in the graves to be ancestral.

Panamá, however, is not easy. The pre-Columbian inhabitants of the Barú area are either displaced or decimated and the Ngöbe groups that form the largest indigenous presence in the area are relatively recent immigrants to the region. A firm sense of ancestral heritage, however, is invested in the indigenous past of the Barú area by many of the Ngöbe with whom I spoke.

I would attribute this sense of or desire for connection to the past in part to the rise of *indigenismo* in Panamá, which mirrors similar indigenous movements in many areas of North and South America in recent decades.[212] Many of these movements cite globalization as a direct risk to indigenous economic and social rights as nation-states, corporations, and financial institutions encroach upon resources and consider globalization and neoliberal processes to be 'euphemism for a second colonialism' (Houghton and Bell 2004). Indigenous movements are often transnational and incorporate multiple cultural groups, and hence can be seen as practicing their own form of cosmopolitanism. In the Amazon River Basin, for example, nine national Amazonian indigenous organizations from various nations are linked by the transnational organization of COICA (Coordinator of Indigenous Organizations of the Amazon River Basin). Similarly, while a great deal of cultural and linguistic heterogeneity exists within the Maya culture, cultural activists utilize organizations such as the International Maya League to promote a pan-Maya ethnic identity (see Magnoni, Ardren, and Hutson 2007). These movements emphasize an indigenous cohesion and unity in the face of the pressures organizers interpret from the outside forces of the dominant cultures. This elision of the very marked cultural differences and animosities

[212] Examples of the indigenous organizations active in Panamá in recent years include: *Coordinadora Nacional de los Pueblos Indígenas de Panama* (COONAPIP; National Coordination of Indigenous Peoples of Panama); *Congreso General de la Cultura Kuna* (CGCK ; General Congress of Kuna Culture); *Instituto Para El Desarrollo Integral De Kuna Yala, adscrito al Congreso General Kuna* (IDIKY; Institute for the Integral Development of Kuna Yala, Kuna General Congress) , *Movimiento de la Juventud Kuna, Miembro del Congreso General Kuna* (Movement of Kuna Youth (of the General Kuna Congress) , and the *Congreso General Ngobe-Bugle* (Ngöbe-Bugle General Congress). Contact information for these groups is available from http://www.globalpolicy.org/globaliz/special/2004/1011indigenousresources.pdf.

that often existed in the pre-Columbian past had led to a degree of appropriation of the pre-Columbian material culture in the Barú area as a source of identity by contemporary groups such as the Ngöbe, who did not live in the Barú area during the pre-Columbian period.

Archaeology can play a fundamental role in defining national identities (Benavides 2004). Archaeological materials, however, can also play more individual roles in providing a sense of identity or cultural belonging. This appropriation of the past for a contemporary sense of identity can be very tangible, as is the case with a ceramic vessel collected by the Jiminez family, who are Ngöbe and live on the Gonzalez *finca* where the BE-14-KH (GON) site is located.[213] The vessel was recovered during farm work and was likely part of a grave offering as it is intact. The family members, who proudly keep and display several other artifacts from the property, chose to carefully color the miniature vessel with the distinctive zigzag designs found on the intricately sewn dresses worn by Ngöbe women (Figure 5-9). When I asked José Jiminez about the artifacts, he emphasized that their importance stemmed from their handmade quality and the fact that they were made long ago by 'pure' Ngöbe people (José Jiminez, personal communication March 25, 2005). Contra the statement by Holmes (1888: 15) regarding the lack of any value other than monetary afforded to artifacts by indigenous groups in Chiriquí, José Jiminez stated that he considers the pieces to be without price and will keep them in the family. As he considers them well made, he shows them to his children as a source of pride in Ngöbe culture. Though removed temporally, spatially, and culturally from the people who made and used the objects in the collection, in this example both metaphorically and literally the miniature vessel was incorporated by the family into the Ngöbe cultural context.

[213] Vidal Guerra, who also lives on the Gonzalez *finca*, provided information about objects he collected on the property and I am indebted to him for his help.

FIGURE 5-9: A MINIATURE CERAMIC VESSEL RECOVERED AT THE BE-14-KH (GON) SITE. THE PRE-COLUMBIAN VESSEL HAS BEEN DECORATED WITH TRADITIONAL NGÖBE DESIGNS

A similar appropriation occurs with the petroglyphs in the Boquete area, particularly in the case of the Caldera *Piedra Pintada*. As noted in the prior chapter of this thesis, ethnohistoric and ethnographic stories invoke both the enigmatic character of the petroglyph meanings and the linkage the stone provides to an indigenous past that is somewhat out of reach. During the many visits I made to the *Piedra Pintada* since first visiting it in 1999, I regularly encountered Ngöbe families or groups of children at the boulder. Like school groups and tourists who visit the site, they sometimes brought chalk to trace and emphasize the designs, though they differed from Latino or tourist visitors in that they often expressed a feeling of connection to the site as part of their own culture. As part of a seminar that I taught for UNACHI, Dra. Luz Graciela Joly Adams arranged for a Ngöbe group to perform a dramatic interpretation of *Ñaglon bata sö* (Sol y Luna/ The Sun and the Moon) story discussed in the prior chapter at the *Piedra Pintada*. The story recounts how all of the petroglyphs of the area were made by one Ngöbe woman as she waited for her sons to appear. The interpretation was followed by a Ngöbe dance in which dancers formed a line or a 'snake' and circled around the petroglyph (Figure 5-10). As in the case of the miniature vessel which the Jiminez family painted with Ngöbe designs, both metaphorically and literally the Ngöbe dance participants circumscribed the material culture of past groups in the area into their contemporary culture.

FIGURE 5-10: NGÖBE DANCERS AT THE CALDERA *PIEDRA PINTADA.* PHOTO IS BY HOWARD HILL

Re-using and living with the past

My archaeological fieldwork emphasized the use of volcanic materials in the Barú landscape in the past. Durable materials such as the dacite slabs from pre-

Columbian graves are commonly re-used or piled out of the way of agricultural fields. Dacite slabs are generally not transported far from the grave locations, but are utilized as common components in paths, over ditches to form small bridges, and in one example I found as surfaces for washing clothing (Figure 5-11). In the photos in Figure 5-11, the top two photos are from the BE-14-KH (GON) site in the area known as *el Huacal* for the large number of graves that were opened there. The bottom photo is from the *La Panaderia* area of Boquete, where several isolated and looted graves were found at the top of a steep ridge. While some of the dacite slabs from *La Panaderia* were brought down from the ridge to create the washing area, the remainder of the grave materials were left in place and used to support bee hives.

FIGURE 5-11: RE-USES OF DACITE SLABS FROM LOOTED GRAVES

This incorporation of the past materials in new contemporary contexts is also present in the case of the Rovira (KHP-23) petroglyph discussed in Chapter four. As the boulder is located in the back yard of the Rovira household, it is both within the yard used as a chicken coop and useful as a rack for washing and drying dishes.

Local interest in the pre-Columbian past cannot simply be defined as economic in the terms used by Holmes 1888 or in conceptions of their ecotourism draw. As noted earlier in this thesis (as well as by Corrales 2000: 31), the high school organization led by Dr. Roberto de la Guardia published the results of informal archaeological excavations from 1965-1968 in the *Boletín del Museo Chiricano*. Though not rigorous in their method, the activity produced awareness of and interest in the archaeological past for the students involved and the larger community. Currently, one of the most active proponents of archaeological information to local communities in Chiriquí is *Culturama*, a weekly magazine that is widely distributed to school children. The magazine includes a wide variety of topics ranging from history, literature, physical sciences, and social sciences. The first issue of *Culturama* was distributed in August of 1988. At the time of my fieldwork in 2004 over 5,000 copies of the bulletin were distributed each week (Milagros Sánchez Pinzón, personal communication).[214] By including archaeological information in this context, the data and discussions are positioned as part of a package of cultural literacy that school children and the local community are encouraged to embrace. This is quite different from the sense of identity that the Ngöbe family felt through the archaeological materials and is linked more to conceptions of interest and knowledge as a tangible commodity for the entire community.

This same aspect of interest can be seen in the reaction of the Kotowa coffee farm owner, Ricardo Koyner, upon the discovery that the new house he was building for his family was to be built directly upon a pre-Columbian cemetery (Figure 5-12).[215]

---

[214] *Culturama* was developed by businessman Roger Patiño, engineer Jacques Chevigné, and painter Manuel Montilla. Online versions of the magazine can be found at www.semanarioculturama.com .
[215] Ricardo Koyner is a second generation Boquete native with Dutch and Canadian ancestry.

Rather than a sense of discomfort or inauspiciouness at the prospect of living over a graveyard, Koyner found the juxtaposition of the past and present use of the land to be interesting and thought provoking. The presence of the family dining room and living room directly over the grave locations seemed, in essence, to bind the house into a tighter sense of belonging in the landscape. This sense of identity or belonging is quite different from that felt by the Ngöbe family who marked the pre-Columbian ceramic with Ngöbe designs, yet achieves similar goals of bringing material evidence of the past and present occupation of the land into a narrative that provides a role to the present inhabitants.

FIGURE 5-12: THE OWNER OF FINCA KOTOWA, RICARDO KOYNER, STANDS OVER THE LOCATION OF THE EXCAVATED GRAVES AT THE BE-16-KH (KOT) SITE IN MARCH 2005

A recent trend in attempts to convey academic information to the non-academic community, particularly children, entails the creation of coloring books. Examples include books that promote knowledge of traditional forest garden practices in the Maya world (Ford 2007), Maya design motifs (Turner 1999), the process of contract archaeology (Shepard 2002), Harappan civilization (Kenoyer 2004), and human evolution

(Zihlman 2001). In this vein, Panamanian anthropologist Luz Graciela Joly Adames created a rock art coloring book for children in Chiriquí (Joly Adames 2007). The rock art coloring book incorporated information from my fieldwork as well as that of German archaeologist, Martin Künne, in discussions from a wide array of perspectives from artisans, tourism officials, and Ngöbe ethnohistory and is intended to aid in the identification and appreciation of Chiriquí petroglyphs.

Notions of authenticity cannot be seen as an absolute or unchanging value (Lindholm 2008). While I do not suggest that the many painted boulders in the Boquete area intentionally mimic pre-Columbian petroglyphs, I would point out that the modern stones fulfill similar interpretive roles as pre-Columbian petroglyphs (Figure 5-13). Both modern and pre-Columbian boulders were marked to convey information and act as visible markers. The major differences between the pre-Columbia petroglyphs examined in the previous chapter of this thesis and these contemporary versions, obviously, is the capitalist basis to the messages they advertise as well as the use of written language.

FIGURE 5-13: CONTEMPORARY ‘PETROGLYPHS’ ? PAINTED BOULDERS FROM THE BOQUETE AREA. LEFT: ADVERTISING FOR A BRAND OF BEER; RIGHT: ADVERTISING FOR TOURIST SERVICES

The past and future landscape

Landscape studies can provide the problematic impression that the present is some form of achieved terminus (Massey 2006: 42). The contemporary Barú landscape counters this tendency quite strongly through the strong connection between the past and the future that is seen both in the desire to develop ecotourism that draws upon the volcanic landscape and hazards studies that seek to understand the future eruption potential of Barú from its past behavior. Both ecotourism and hazards conceptions place the Barú landscape in a very active process of change and non-stasis.

Tourism fuses the spatialized experience of place and the practice of consumption (Blake 2007: 242). The present and archaeological landscape of the Barú area is seen as a font of untapped potential that can be developed for future benefit in emulation of financially successful ecotourism development in Costa Rica. The archaeological past is swept into this conception and is viewed as a resource that can be commodified in the same ways that the volcano, forests, or biodiversity can be. Expatriate retirees in the Barú area bring a very specific conceptual package of ideas regarding social and environmental order. I have argued in this chapter that these retirees share common goals and motivations as ecotourists despite the different time frame of their intended stay in the Boquete area. Like ecotourists, many retirees seek to be non-destructive to the 'natural' element of the area and to 'improve' or repair environmental or social contexts that they find to be wanting in their conceptualization of social and natural order.

Hazards studies flip the gaze from the possible harm to the environment to the harm that can come from it. While ecotourism looks to the cultural past and a source of heritage that can be commodified, hazards studies look to the natural past as a source of information that can possibly predict future threats to lives and resources. Hazards researchers, though cognizant that past eruptions do not indicate perfect models for future eruptions, seek information regarding the volcano's general eruption tendencies from its past behavior. The recent USGS hazard report by Sherrod et al. (2007) makes explicit mention of the very real danger and economic threat posed by the likelihood of a Barú eruption. This sense of threat, however, is only a very small part of the sense of place created by the volcano.

The contemporary role of the Volcán Barú is deeply entwined with conceptions of identity and commodification. The volcano is a monument and symbol that is prevalent in the national imaginary, local business logos, and community buildings. I would include the desire by environmentalists to 'protect' the volcano as part of this intricate weft of identity and commodification. As Cosgrove (2006: 57) notes, the terms of preservation, protection, conservation, and sustainability all parse similar intentions of slowing or negotiating social and environmental changes with values inherited from the past. The threat, in the case of the anti-road protesters discussed in this chapter, was *to* the volcano and 'natural' volcanic landscape and its biodiversity rather than *from* the volcano and its potential to erupt. A sense of identity and patrimony was invoked by anti-road protestors, though formal complaints against the road project, as recorded in Reid and Hanily (2003) also cited the economic destruction of the project and linked the negative financial and ecological impacts into a unit.

The development and commodification of 'heritage' can take very divergent forms that are determined by historical traditions and views of development and social order (Breidenbach and Nyíri 2007). The development of Barú area ecotourism is still in a nascent state. Costa Rica is held as the model of the economic possibilities of ecotourism, though the way that tourism will develop in Chiriquí is not fully established or predictable at this stage. One of the least established aspects of the tourist development is the market division between state and local agencies or individuals. In the Peruvian context, for example, the friction between these divisions and the competing claims of authenticity and authority between the neoliberal state policies and the more local or indigenous claims of Andean mysticism or Inka patrimony has proven difficult (Hill 2007). The lack of a clearly defined descendent community in the

Boquete area does not negate the feeling of affiliation or *indigenismo* connection that indigenous groups feel for the pre-Columbian past of the area, and future archaeological work should take careful consideration of these issues. Archaeological work can also seek to further elucidate the past experience with volcanic eruption, which is part of the intricate admixing of natural and cultural heritage in the Barú region.

Afterword • MATERIAL NATURE: THE VOLCANO AS A THINKABLE WILDNESS

E Pluribus Unum.

Virgil, *Moretum* (70-19 BC) [216]

The formative question with which I began this research was 'how does one *think* the volcano?' [217] The possible answers to this question are determined by how one first thinks *nature*. A variety of different facets of nature are provided in this thesis. In Chapter one I portrayed nature as a mix of scientific measurements and descriptions. In Chapter two, nature was a physical residue of events. In Chapter three, nature was a body of raw materials and their immaterial associations; in Chapter four, nature was a space that was filled with stories and inscrutable signs. In the final chapter, nature was a

[216] This Latin phrase ['out of many, one'] is from a poem that describes *moretum*, or a cheese and garlic paste. While Virgil is associated with the poem, he did not originate it and *moretum* was a popular inclusion in ancient Roman poetry. The full phrase describes the colors of the varied ingredients blending into a new and unified whole that cannot be created without all of the component parts.

[217] The opening photo was taken by Howard Hill, a US expatriate resident of Boquete. The photo shows a Ngöbe woman in traditional dress with the Volcán Barú in the background. The photo was taken at the Caldera *Piedra Pintada* during an enactment of the Ngöbe story, *Ñaglon bata sö* (The sun and the moon), as part of a seminar I taught on the archaeology of Boquete.

source of both identity and danger that was itself, in turn, endangered. Each chapter drew upon its own specific body of vocabulary and literature yet described the same volcano and comprised part of the same research project. I argue that each component is important in the overall study of the volcano and that they are inextricably connected. The goal of the project was to examine volcanic phenomena, which I argue are not limited to eruptive time periods; the volcano is a phenomenologically rich presence in non-eruptive phases as well.

The pioneering nineteenth-century German naturalist, Alexander von Humboldt, believed that 'volcanic phenomena…considered in the totality of their relations, are among the most important topics' if we as humans seek to broaden our understanding of how people and the environment intersect (Humboldt 1831: 1-4). The examination of volcanic rocks and landscapes, from Humboldt's perspective, allow one to consider the 'intimate connection between so many diverse phenomena' (ibid.).[218] This, perhaps, would eventually permit one 'to recognize unity in the vast diversity of phenomena' (Humboldt, as quoted by Goetzmann 1995: 59, see also Sachs 2006: 42). These considerations go well beyond volcanic regions and invoke Humboldt's deep curiosity with the natural world as a whole and how people fit into it; the statements also are apt to archaeological investigations in general.

Humboldt's work resonates with my own research interests due to his personal belief in the wonder and importance of volcanoes, his studies of Latin American volcanism, and his strong belief that national, disciplinary, and dogmatic borders are inappropriate research barriers. Social and natural realms are deeply connected and inextricably linked. My archaeological project was not possible without the combination of a highly multi-disciplinary set of data, methods, and theory. I drew from geophysics, volcanology, palaeoecology, and ethnography as ways of situating my archaeological data. As I noted in the introduction to this thesis, culture history, processual

[218] The quotation in this sentence and the sentence prior were translated from the French by Aaron Sachs; see Sachs (2006: 42, 387, Note 2).

archaeology, and postprocessual archaeology are not exclusionary. I have incorporated elements of each of these approaches in some form or another during my research.

I hold that this interweaving of different data and theory sets is disciplinarily appropriate; archaeology is itself betwixt and between as an academic endeavor. Archaeological work is poised at the interstices of the humanities and the sciences. While archaeological approaches can be more strongly skewed to one or the other end of the continuum it is artificial to separate science (*nature*) from the humanities (*culture*) as elements of study.

The idea of nature

> The idea of nature contains, though often unnoticed, an extraordinary amount of human history.
>
> Raymond Williams, *Problems in Materialism and Culture* (1980), p. 68

The 'idea of nature' has received a great deal of notice in academic literature in recent decades. This attention is warranted, as the dichotomy between nature and culture 'is not just another analytical category belonging to the intellectual tool-kit of the social sciences; it is the key foundation of modernist epistemology' (Descola and Pálsson 1996: 12).

Nature was used throughout the Enlightenment as a way to place racial and sexual identity that was established by science (Harvey 1984: 3-4, 2000: 533, Morton 2007: 16). The social sciences, as a product of this context, incorporated embedded constructs of a Cartesian division between nature and culture. Viewing nature as a basic determinant of human action and importing models of causal explanation from the natural sciences allowed materialist vantages to attempt a wider scope for the social sciences (Descola and Pálsson 1996: 2), albeit a highly deterministic one. Structuralists and symbolic anthropologists utilized the nature-culture binary as an analytical device to make sense of social life. Recent conceptualizations, however, acknowledge that nature is a highly slippery concept and that the explicit definition of nature is a formidable task.

As Marilyn Strathern (1980: 177) wrote,

> there is no such thing as nature or culture. Each is a highly relativised concept whose ultimate signification must be derived from its place within a specific metaphysics.

One can consider n*ature* to be a physical substance or an abstract essence and principle (Morton 2007: 16). Nature is not simply a construct that is culturally mediated, however; it is also a very physical, tangible entity (Hinchliffe 2003: 207, Massey 2006: 36). To obfuscate this fact falls into what literary theorist and ecocritic Louise Economides (2005: 99) describes as, 'anthropocentric hubris that would sanction the complete erasure of nature as material outside of culture'.

Terms used by various authors to incorporate the physical aspect of the natural world as well as the social construction of nature include *surroundings* (Carrier 2004: 1, West, Igoe, and Brockington 2006: 252) and *natureculture* (Haraway 2003, Morton 2007: 21) as well as innumerable and varied uses of Nature (capital N) or a parenthetical 'nature' to imply the author's awareness of the difficulty inherent to the language. Conceptions of 'material nature' that parallel long-standing archaeological conceptions of material culture can mediate the theorization of a pristine nature and a more extreme postmodern vantage that sees nature as only a social construct (Haraway 1991: 8, West 2006: 30). Material nature is neither the opposite of culture nor a static or epiphenomenal base for culture, but instead is a highly active and underlying basis of human life that should be understood in terms of its dynamic forces and fields of transformation and upheaval (Grosz 2005). I personally like this concept of a 'material nature' and feel that it fits comfortably in the volcanic context. I suggest that the added concepts of *wild* and *socialized* can further nuance discussions of the eruptive and non-eruptive volcanic landscape.

Thinking the wildness of the volcano

> In the New World, man and his productions almost disappear amidst the stupendous display of wild and gigantic nature.
>
> Alexander von Humboldt, *Personal Narrative of Travels* (1852-3), vol. I, p. xxi

The volcano was memorably termed 'the ultimate and hitherto unthinkable wildness' and viewed as the embodiment of the post-Enlightenment sublime in its incorporation into eighteenth-century British and American landscape gardens (Thacker 1984: 74). In the discussion that follows, I try to consider how to define the nature of the volcano and to 'think' its wildness. The conceptualization of *wild* and *socialized* landscapes provides a view of volcanic contexts that is less rigid than the Cartesian division of nature and culture.

It is first important to distinguish that wildness is an entirely different concept from that of *wilderness*. Environmental historian William Cronon (1995a) believes that wilderness takes us to the 'wrong nature' in that it presupposes a nature-culture dualism. The concept of wilderness is historically contextual and laden with political and social over tones (Smith 1990: 15, West 2006: 30).[219] Early progenitors of the modern environmentalist movement such as Henry David Thoreau and John Muir used the term wilderness as a cultural framing and as something that would 'cure' industrial society (Schama 1995: 7). In the sense that Thoreau and Muir implied the word, as with the use

---

[219] Ethnography is largely the cause of the crumbling of the nature-culture binary's analytical strength (Descola 1996). Brazilian anthropologist Eduardo Vivieros de Castro (1996: 191) goes as far as to call the nature-culture division a 'shopworn antinomy' that has no relevance to indigenous perspectives. Archaeologist Augusto Oyuela-Caycedo (2004: 56), whose ideas I utilized in my Chapter four discussion of rock art in the Barú area, points out that our archaeological imposition of the very western Enlightenment-derived division between nature and culture is itself 'exotic to most indigenous societies' (see also Descola 1996: 82-3). Oyuela-Caycedo cites the *communalism* discussed by Gisli Pálsson (1996), in which the separation of nature and society is dissolved and rejected, as a more accurate way of conceiving the environment in many indigenous consciousness.[219] The imposition of a western Cartesian vantage of nature as separate from culture is also in contemporary western life. French sociologist Bruno Latour (1993) cites nature/culture hybrids such as the ozone hole, mad cows, test tube babies and genetically modified crops as examples of how the spheres of nature and culture elide in the modern context (see also Žižek 2008).

of the word and concept in nineteenth-century landscape painting, wilderness was more of an aesthetic category than an organizing concept. The artificiality of this wilderness is underscored by Mark Leone's (1984) classic discussion of the carefully cultivated 'wilderness' and use of vanishing perspectives in the William Paca garden in Annapolis, Maryland. The concept of wilderness inherently draws upon perceptions of control and order as its antithesis (Balée 2006: 77, Hirsch 1995).

Wildness, in opposition, is a more fluid and adaptable consideration of the environment. Philippe Descola and Gísli Pálsson (1996: 9-10) point out that a consideration of wildness may be a more appropriate suggestion for non-western imaginings of what we semantically try to distill into nature versus culture (see also Oelschlaeger 1991).[220] One example that supports this switch in conception and terminology is that offered by Roy Ellen (1996) in which the Nuaulu people of eastern Indonesia have a distinction between wild and socialized, yet they are highly dependent on context and hence are extremely promiscuous categories. At times, uncut primary forest can travel between categories of human, non-human, antagonistic, nurturing, male, and female and either 'wild' or 'socialized' for the Nuaulu depending on the situation.

This categorical fluidity seems particularly appropriate in discussions of the volcano, as it shifts between categories of object, subject, animate, and inanimate throughout periods of eruption and non-eruption. The wild-socialized continuum is not a non-western parallel for the binary of nature-culture, but instead is more of a sliding scale, per the discussion by Edvard Hviding (1996) from his work in the Marovo area of the Solomon Islands. Wildness, as a concept, is also applicable in contemporary contexts. As William Cronon (1995b: 89) states:

[220] Though Descola and Pálsson (1996: 2) also warn against a full-scale return to an early medieval European perspective.

> *Wild*ness (as opposed to wilderness) can be found anywhere; in the seemingly tame fields and woodlots of Massachusetts, in the cracks of a Manhattan sidewalk, even in the cells of our own bodies.

I propose that the Barú landscape, both past and present, can be viewed as more socialized in non-eruptive periods and as more wild in eruptive periods. Mountain ranges, volcanoes, and the land that surround them are physical, discursive, and imaginative landscapes into which multiple academic disciplines are drawn that invoke the past, present, and future of that landscape (West 2006: 5). To date, most research of volcanic regions over-weights the role and event of eruption - or its wildness - which precludes considerations of the non-eruptive contexts. As I noted in the introduction to this thesis, this eruptive focus is almost entirely viewed in negative terms of disaster. The archaeological framing of past eruptions as disasters is inherently problematic; it is not possible to write about a disaster one has not experienced as 'the disaster describes' and exists at the limit of writing's capability (Blanchot 1995: 7).

A diseased and imbalanced nature: the event of eruption

> Diseased Nature often times breaks forth
> In strange eruptions.
>
> William Shakespeare, Hotspur in *Henry IV, Part I, Act III, Scene I*

Western scientific discussions of volcanism tend to largely focus only on the destructive rather than creative aspect of eruption (de Boer and Sanders 2002: xii, Frierson 1991: 69), and this opinion is well encapsulated by Shakespeare's character of Hotspur when he describes a 'diseased nature' in eruption.[221] Volcanic eruption is commonly viewed in social science literature as a 'natural disaster' (e.g., Bawden and

[221] This western tendency exists despite the efforts of British diplomat and early volcanologist William Hamilton, who wrote in 1786 that 'Volcanoes should be considered in a creative rather than a destructive light' (per Sigurdsson 1999: 126).

Reycraft 2000, Oliver-Smith and Hoffman 1999, Torrence and Grattan 2002). As I have suggested, this preferences the wildness of the volcano and obscures its socialization during non-eruptive periods.

The framing of environmental change as a disaster – or an anomalous event - is both temporally and spatially situated in contemporary western discourse (Hulme 2008). The term 'natural disaster' is meant to differentiate a hurricane or earthquake from a chemical plant spill or nuclear reactor meltdown, though one rarely if ever uses the term 'cultural disaster'. A massive volcanic eruption in an unoccupied portion of Kamchatka is simply a natural event while a moderate sized eruption in Washington State near large US cities is seen as a major natural disaster. While the shorthand of the term is clearly understandable, it also reinforces a false separation of nature as distinct from culture and defines events by their relationship to people. In the context of volcanic eruption as a natural disaster in the archaeological past, the event is sandwiched between a before and after 'culture' that is temporarily interrupted by 'nature ' (e.g., Sheets 2002). An overemphasis on 'impacts' or responses to a natural event 'positions humans as *outside* the system under analysis' and 'assumes a stable natural baseline and experimental method in which only one variable is changed' (Head 2008: 374).

The over-population and fear of impending environmental catastrophe is very much a part of a very specific 'risk culture' in which we live (Adam, Beck, and van Loon 2000, Beck 1992, Douglas and Wildavsky 1982). Past interpretations of what we now see as a disaster or a hazard could have radically differed. British geographer and theologian David Chester (2005: 320), for example, highlights a well known ethnographic example from Papua New Guinea in which frequent falls of volcanic ash were viewed as so beneficial to agriculture that people engaged in elaborate rituals to encourage eruption reoccurrence (see Blong 1982, 1984: 320). Similarly, while early missionaries to Hawaii found volcanism to be a literal vision of hell, indigenous

Hawaiians viewed the volcano as a sacred source of spiritual energy and viewed eruption as part of a cycle of the continuingly procreative cosmos (Frierson 1991).

Roy Wagner's book, *The Invention of Culture* (1975), examined the relationship of modern western culture to a constantly destabilized nature. Marilyn Strathern (1992: 190) draws on Wagner's conceptions when she cites that 'An epoch is experienced as a *now* that gathers perceptions of the past into itself. An epoch will thus always be what I have called post-eventual, that is, on the brink of collapse'. The envisioning of a nature-in-balance prior to human intrusion exists simultaneously in the human mind with an idea of nature as turbulent and out of equilibrium (Massey 2006).

One problematic issue with conceptions of nature as out-of-balance is the implicit assumption that balance once existed; this implies a 'First Nature' or harmonious balance prior to human intervention (Demeritt 1994, Hinchliffe 2003: 207, Massey 2006: 37-9). The opposite view, however, that nature is always 'turbulent, troubled, indeed destructive as well as creative' prevents easy evaluation of the role of human intervention and impact on the planet and hence is problematic in an era of anthropogenic global climate change debates that require political and ethical stances (Massey 2006: 39). Like hazards studies – and archaeology conducted in volcanically active regions - these political debates frequently invoke words such as catastrophe, danger, and collapse. Climate-as-catastrophe, like overall visions of nature and culture, are deeply linked to concepts of control and mastery that are embraced differently by different cultures (Hulme 2008).

Reversed orders: the beginning of nature

The positioning of nature as both font and recipient of harm is a common element of the modern perception of nature as destabilized, disordered, or out of balance. Post-Marxist philosopher Slavoj Žižek (2008: 435) states,

> Nature is no longer 'natural', the reliable 'dense' background of our lives; it now appears as a fragile mechanism which, at any point, can explode in a catastrophic manner.

Žižek's words can be easily applied to the modern Volcán Barú context. Though certainly not a static background due to the very active anthropomorphization and mythologizing and that volcanoes receive in most if not all human cultures, Barú was considered 'reliable' as a landscape fixture, reference point, and source of local identity. That reliability was shattered by the very recent realization that Barú could explode catastrophically as well as a growing acknowledgment that the Chiriquí environment is endangered by human mismanagement.

Žižek (2008: 435) proposes that the contemporary period is leading humans into a time when 'it is simply *nature itself* which melts into air'.[222] Žižek (ibid.) further states that scientific breakthroughs are leading to the 'end of nature', which invokes influential discussions of the contemporary period as one that is 'after' nature (per McKibben 1989, Sebald 1988, Strathern 1992). Rather than physical nature itself, the implication is that an essentialized view of a pristine nature is increasingly eroded by the human ability to create, sustain, and alter life (Strathern 1992).

I propose that the human hubris implicit in the concept of nature 'ending' is reversed entirely in active volcanic contexts; socialized landscapes transform to dramatically wild ones. If the 'end of nature', in the terms of Strathern (1992), is marked by the 'artificial' human ability to begin and end life then the volcano returns that agency directly to the natural world. The active volcano, in essence, is the beginning of nature.[223] By this I mean that while humans can harness the volcano

---

[222] Žižek's phrasing draws upon the lyrically poetic statement by Karl Marx that, 'All fixed, fast-frozen relations, with their train of ancient and venerable prejudices and opinions, are swept away, all new-formed ones become antiquated before they can ossify. All that is solid melts into air' (Marx 1969 [1848]: 98).

[223] This can be said quite literally in the sense that deep sea volcanic vents are thought to be the source of the primordial, single-celled life called *archaea* that formed 3.5 billion years ago.

through geothermal projects and can benefit from it through the fertile soils and stones that it provides; humans cannot 'tame' or 'domesticate' the volcano. Hazards studies seek only to mitigate the risk of the volcano and the loss of life and property that can result from living near an 'active' volcano when it 'awakens' from dormancy. In this role of both provider and destroyer the volcano embodies the well-known statement by Karl Marx that 'everything is pregnant with its contrary' (Marx 1969 [1856]: 500). In non-eruptive periods the fertile soils of volcanic regions make the regions highly socialized, ordered, and nurturing; eruption returns the environment to one that is again wild, unpredictable, and dangerous.

An active volcano forces one to 'experience a radical reversal of human dominance over the natural environment' (Sachs 2006: 43). I don't believe that this is only a modern perception; or, perhaps as Latour (1991) describes, we have never truly been modern. I propose that this concept of a reversal of the *status quo* and human surprise at the reversal of the accepted order is implicit to the common Amerindian Revolt of Objects myth I discussed in the introduction to this thesis. If the volcano is viewed as an object or *thing*, the Revolt of Objects myth could easily adapt to the reaction pre-Columbian residents had when the familiar, quotidian presence of the volcano that made their landscape unique suddenly became a source of unusual and unexpected danger.

The Linares and Ranere (1980a) edited volume, *Adaptive Radiations in Prehistoric Panamá*, theorizes that human populations were unable to live in the Barú area until the adoption of maize agriculture. If this is correct and agriculture is viewed as a taming or socialization of nature, the Barú eruptions that occurred every several hundred years firmly returned the locus of power to the wildness of the landscape. The Revolt of Objects describes mice chasing cats or llamas driving humans. This is not so different an imagination and encapsulation of a world-turned-upside-down than contemporary stories of cyborgs or computers that think for themselves and no longer obey the humans that created them. If there is one commonality in the human experience in the past and the present I suggest that it is a discomfort with changes to accepted orders and a need to frame unfamiliar contexts using analogies to familiar ones.

In sum: inalienable material

The Revolt of Objects myth was common throughout the volcanically active Americas. I do not propose that the myth is definitively derived from volcanic activity, but simply point out that similar pre-existing myths likely offered one way for pre-Columbian people to explain the phenomena of volcanic activity. In the introduction to this thesis I noted the vibrating string analogy that volcanologists Jelle de Boer and Donald Sanders (2002: xiii) used to illustrate the very long-term impacts – both natural and social - of a volcanic eruption. I suggest that the Revolt of Objects myth or similar stories and myths were told in the interstices of Barú eruptions and helped to frame and provide meaning and explanation to those eruptions. As I discussed in this thesis, at least three and possibly four eruptions occurred during the main periods of pre-Columbian human occupation of highland Chiriquí. The stories would not necessarily encapsulate a direct memory of the eruptions that occurred every several generations so much as provide a way to understand or 'think' them. In this sense, the myths are little different from our own conceptions of plate tectonics: partial explanations that are adjusted gradually as additional information becomes available.

Stories and myths are immaterial culture and we will never excavate them archaeologically. Material correlates to events and experiences in the volcanic context do exist, and in the introduction to this thesis I noted the very evocative Amerindian examples of the Terminal Preclassic volcano effigies at the site of Tetimpa in México, the Sunset Crater 'corn rocks' created when corn cobs were placed in eleventh-century flows of lava in the southwest US, and the Koniag memory box showing a volcanic tsunami in Alaska. These types of unusually clear evidence of human involvement with active volcanic contexts are extremely rare. Such direct material links to the active volcano are *not* present in the Volcán Barú context. I argue, however, that objects like the tephra sculptures or the volcanic bomb that seems to have been transported kilometers from its original location provide potential evidence for socialization of the volcanic landscape following eruptions. This evidence is tantalizing but ambiguous. Similarly, the pre-Columbian associative link of the volcanic dacite slabs and basalt columns favored in Chiriquí grave construction to the volcano cannot be assumed. Were the volcanic materials valued only due to their unique and distinctive shapes and practical forms or were they also associated with the telluric presence and power of the volcano? These are questions my data cannot answer and I do not presume to provide more meaning to the materials than the data permit.

What I do wish to do, however, is to draw renewed focus to the highland Chiriquí area and the objects that have evaded archaeological attention to date. Many stones, literally, remain unturned in the investigation of pre-Columbian highland Chiriquí. The heavy amount of looting spawned by the 1859 discovery of gold in Chiriquí graves is regrettable but not a sufficient deterrent for future study of the region. In this call I return again to the example of Humboldt, who looked to the marginalia in his own fieldwork; marginalized people, places and topics and the genuine attempt to make connections with differentness characterized Humboldt's work (Sachs 2006: 339). The Linares-Ranere project and *Adaptive Radiations in Prehistoric Panamá* (Linares and Ranere 1980a) volume provided an important foundation for the reinterpretation of the Barú area and received far less follow-up fieldwork and research than it merits.

The overall isthmian area is undeservedly marginalized in archaeological conception in part due to its ambiguous positioning as neither a part of the Central American nor the Andean spheres despite its obvious connection and importance to both. The lack of monumental architecture also contributes to the archaeological marginalization of Chiriquí as a study area. This archaeological emphasis upon built monuments and architecture, however, overlooks the monumentality inherent to the volcano itself. While pyramids or other forms of monumental architecture can be important signifiers of elite control and authority in many contexts, the appropriation of a natural monument can serve the same function. While we may never know if large-scale organic structures from Chiriquí approached levels one could consider monumental, perhaps we should consider whether monumentality was even required in a region in which it would be inherently redundant or dwarfed by the natural monumentality of the volcano. If the pre-Columbian cultures shared anything in common with contemporary ones, the volcano could have been a very highly acculturated and socialized form of nature.

My discussion throughout this thesis has focused on what could be termed inalienable objects. This term stems from earlier discussions used in important studies by Annette Weiner (1992), Maurice Godelier (1996), and Barbara Mills (2004) to denote artifacts that are affiliated with their owners even when not in their possession. The inalienability that I suggest, however, is quite physical in the sense that it refers to the landscape itself. I have redefined material culture for the Barú study area to include objects that are ambiguously located in the nature-culture continuum and have studied tephra from volcanic eruptions and the distinctive volcanic forms of dacite slabs and basalt columns. These are inalienable in the sense that they are inextricably, associatively linked to the volcano and additionally have not been removed from their archaeological contexts. Even in areas of heavy looting, such as the BE-14-KH (GON) section of the *Huacal* neighborhood of Boquete, the dacite slabs and basalt columns that were used in grave construction remain in close proximity to the graves even if the gold they contained was melted and the ceramics were smashed, sold, or sent to collections in Europe or the US. The volcanic materials, as they were not classified as artifacts or given social value by looters, remain intact and provide data that can add to our understanding of pre-Columbian life.

The archaeology of an anti-Pompeii

The site of Pompeii is fetishized for what Charles Dickens termed the preternaturally 'fresh traces' of the past it provides. As a volcanic archaeological context, highland Chiriquí can be seen as an anti-Pompeii. Subjects (bodies) and objects (things) from the pre-Columbian past seemingly disappeared from the archaeological record. Vast amounts of material culture were removed in the nineteenth and twentieth centuries from pre-Columbian cemeteries in Chiriquí. These objects did literally 'melt into air' – or at least into their base components - as many of the abundant gold figures in Chiriquí graves were smelted for the commodity of their metal rather than retained for any value as cultural objects. Low levels of organic preservation removed much of the remaining material culture and the human bodies from archaeological study. My intention in this thesis has been to query what forms of overlooked data remain.

Pompeii is popularly celebrated for its high-level of preservation. Archaeologically, however, we should remember that the most evocative and experience-filled sources of information took the form of voids and absences. Novel techniques and new ways of seeing data were required; the injection of dental plaster into empty cavities created material representations of the immaterial spaces. New techniques and sources of data need to be developed to examine overlooked or unseen materials in the Chiriquí context, where many voids and absences exist as well.

In this thesis I laid the foundation for an examination of tephra, dacite slabs, and basalt columns as complimentary sources of information when used in conjunction with traditional archaeological materials of ceramics and lithics and palaeoecological data. I approached issues of objects, subjects, nature, and culture that evade easy categorization or definition. At its most basic level, my discussion focused upon material culture in the volcanic context. There is, however, a great deal of material nature entailed in these discussions and there is no easy dividing line between them. In trying to understand the material nature of volcanic landscapes, I encourage a greater archaeological emphasis on human experience as well as longer spans of time. As indicated by the vibrating string analogy that I utilized in the introduction to this thesis, there are multiple places at which researchers can truncate analyses and that decision strongly impacts whether the event of eruption and non-eruptive periods are viewed separately or as conjoined units.

The Volcán Barú is the living southern base of the volcanically extinct Talamanca Cordillera. This Cordillera provides the spine of the Greater Chiriquí region. Humboldt purposefully provided the name 'cordillera' for these mountains as a reference to cords, lines of linkage, and chains of connection (King 1878: 5, Sachs 2006: 252). The chains of connection require both social and natural science methods to understand and are not fully grasped by any one existing archaeological theory set. Rather than the exceptional events of eruptions, I focused upon the exceptional, lived experience of the overall volcanic landscape in both eruptive and non-eruptive phases. These landscapes were full of material culture, material nature, human experiences and stories. They are worth studying in their emblematic encapsulation of environmental change, which is a pressing topic for present and future people to consider deeply. I encourage the plumbing of further meaning and impacts volcanism has in human life; volcanic landscapes provide a challenging but thinkable wildness.

Glossary

adorno	A decorative ceramic element which sometimes also functions as a handle
AVHRR	Advanced Very High Resolution Radiometer instruments measure five bands of reflection from the Earth and monitor clouds and thermal emissions of the Earth. The sensors are part of the National Oceanic and Atmospheric Administration (NOAA) polar orbiting platforms
basalt column	Vertical columnar jointing created when volcanic lava cools into a polygonal formation. Locally termed a *ladrillo* ('brick') in the Boquete area
biostratigraphy	A sub-discipline of stratigraphy that correlates and assigns relative ages of rock strata through the fossils contained in them
caldera	A large depression formed when a volcano cone collapses; this can occur after an explosive eruption empties the magma chamber
chemostratigraphy	A sub-discipline of stratigraphy that examines chemical variation within stratigraphic sequences
chronostratigraphy	A sub-discipline of stratigraphy that interprets the age of rock strata to form theories of geologic history
clinometer	A survey instrument that measures angles of elevation, slope, or incline
dacite slab	Stone slabs used in the pre-Columbian period to construct graves; these are often recycled in the contemporary period to line paths or form work tables. Locally termed a *laja* in the Boquete area
EM-DAT	The International Emergency Disasters Database; the database was created in 1988 by the World Health Organization and the Belgian government and seeks to serve national and international disaster planning
finca	A farm
fumarole	A vent from which steam and hot gases escape
Holocene	A geological epoch that began approximately 11,700 years ago (10,000 ^{14}C years ago) and continues to the present.

huaca/waka	A *huaca*, in Panamá, refers both to an artifact (generally a gold figure or a ceramic vessel) or to a grave. A *waka* (or *guaca)* in the Andean context was a sacred monument and could be natural or built
huaquero	A looter
hummocks	Mounds of earth and rock that tend to be found in groups or fields; they can form by debris avalanches when large volumes of rock collapse from volcano flanks in blocks
isothickness	Areas of equal sediment thickness
juvenile clasts	Pyroclastic material formed from magma that reaches the earth surface; these materials are described as young or fresh to contrast them to older rocks and materials that may also be ejected during an eruption
lacustrine	Of or pertaining to a lake
lahar	a mudflow or landslide composed of pyroclastic material (superheated clouds of ash, lava fragments, and vapor carried through the air) and water that flows from a volcano, typically through river valleys
lapilli	A size classification term for tephra to denote particles that range from 2-64 mm; particles that are larger than 64 mm are considered bombs when molten or blocks when solid at ejection
lithology	The mineral composition, grain size, texture, and other physical properties of soil, sediment, or rock
lithostratigraphy	A sub-discipline of stratigraphy that interprets the physical and petrographic properties of rock layers
mano	A hand-held stone or roller for grinding maize or other grains on a *metate*
metate	A stone block or base with a shallow, concave surface used to grind maize or other grains with a *metate*

Neogene	A geological period and system that began 23.03 ± 0.05 million years ago and lasted either until 2.588 million years ago (at the beginning of the Quaternary) or today. The debate of where to end the period stems from disagreements between marine and terrestrial data
ñumi	Replicas of valuable objects that were placed in burials in order for the living to retain the object it represented
petrography	The description and classification of rocks
phreatomagmatic	Phreatomagmatic eruptions contain juvenile clasts (unlike phreatic eruptions) and are the result of interaction between magma and water.
SRTM	The Shuttle Radar Topography Mission was an 11-day NASA mission of the Space Shuttle Endeavor in February 2000 that obtained elevation data from most of the earth’s surface. The resolution is 90 meters.
stratovolcano	A volcano composed of many layers of lava, tephra, and volcanic ash; stratovolcanoes generally have steep, conical profiles and explosive eruptions due to their viscous magma.
tephra	Solid material that is ejected into the air by a volcanic eruption; the term does not indicate composition or size
tephrochronology	A geochronological technique that uses layers of tephra to create a chronological framework in which palaeoenvironmental or archaeological records can be placed
volcano	an accumulation of volcanic deposits around a source vent

References

Abel-Vidor, S. 1981. *Between Continents/Between Seas: Precolumbian Art of Costa Rica*. New York: Harry N. Abrams, in association with Detroit Institute of Arts.

Abratis, M., and G. Wörner. 2001. Ridge collision, slab-window formation, and the flux of Pacific aestenosphere into the Caribbean realm. *Geology* 29.

Acuña, V. J. 1983. La Florencia-1, un sitio precerámico en la vertiente atlántica central de Costa Rica. *Vínculos* 9:1-14.

—. 2000. Cronología y tecnología lítica en el valle Turrialba. *Vínculos* 25:41-76.

Adam, B., U. Beck, and J. van Loon. Editors. 2000. *The Risk Society and Beyond*. London: Sage.

Alba, M. M. 1929. *Volcanes de Panamá*. Vol. 1, Geografía de Panamá.

Aldenderfer, M. 1996. "Anthropology, Space, and Geographic Information Systems." Edited by M. Aldenderfer and H. Maschner. New York: Oxford University Press.

Allison, P. 2002. "Recurring tremors: The continuing impact of the AD 79 eruption of Mt Vesuvius," in *Natural Disasters and Cultural Change*. Edited by R. Torrence and J. Grattan, pp. 107-125. London and New York: Routledge.

Almelda-Lenero, L., H. Hooghiemstra, A. M. Cleef, and B. van Geel. 2005. Holocene climatic and environmental change from pollen records of lakes Zempoala and Quila, central Mexican highlands. *Review of Palaeobotany and Palynology* 136: 63-92.

Alvarado, G. 2000. *Les Volcanes de Costa Rica: Geología, Historia y Riqueza Natural*. San Jose: Editorial Universidad Estatal a Distancia.

Alvarado, G., and G. Soto. 2008. Volcanoes in the pre-Columbian life, legend, and archaeology of Costa Rica (Central America). *Journal of Volcanology and Geothermal Research* 3(1):356-362.

Alvarado, G., G. Soto, C. Pullinger, R. Escobar, S. Bonis, D. Escobar, and M. Navarro. 2007. "Volcanic activity, hazards, and monitoring," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 1155-1188. London: Taylor & Francis.

Alvarado, G. E., S. Kussmaul, S. Chiesa, P. Y. Gillot, H. Appel, G. Wörner, and C. Rundle. 1993. Resumen cronoestratigráfico de las rocas ígneas de Costa Rica basado en dataciones radiométricas. *Journal of South American Earth Sciences* 6:151-168.

Alvarado, G. E., G. J. Soto, H. U. Schmincke, L. L. Bolge, and M. Sumita. 2006. The 1968 andesitic lateral blast eruption at Arenal volcano, Costa Rica. *Journal of Volcanology and Geothermal Research* 157:9-33.

Anchukaitis, K., and S. Horn. 2005. A 2000-year reconstruction of forest disturbance from southern Pacific Costa Rica. *Palaeogeography, Palaeoclimatology, Palaeoecology* 221 (1-2):35-54.

Andagoya, P. d. 1548 [1865]. *Narrative of the proceedings of Pedrarias Dávila in Provinces of Tierra Firma or Castilla de Oro and of what happened in the discovery of the South Sea and the coasts of Peru and Nicaragua, translated and edited by Clements Markham*. Vol. 1 (34). London: The Hakluyt Society.

Andree, R. 1878. *Ethnographische Parallelen und Vergleiche*. Stuttgart: I.J. Maier.

Anon. 1859a. "From the isthmus of Panama: The Chiriquí gold fields - intense excitement at Panama - fresh discoveries - Pincards at Panama (from a letter written Friday, July 22, 1859)," in *The New York Times, August 1*. New York.

—. 1859b. "Gold images found in the graves at Chiriqui, now in the possession of Tiffany and Co., and from sketches taken by M.S.W.G. Overend, U.S.N. Marshall H. Saville Collection, Museum of the American Indian - Heye Foundation," in *Frank Leslie's Illustrated Newspaper*.

—. 1930. "Mountain health station: Boquete, 4,000 feet up in Panama, overlooks Pacific Ocean," in *The New York Times, July 20, 1930*. New York

Anschuetz, K., R. Wilshusen, and C. Scheick. 2001. An archaeology of landscapes: Perspectives and directions. *Journal of Archaeological Research* 9:157-211.

Appadurai, A. 1986. *The Social Life of Things*. Cambridge: Cambridge University Press.

—. 1990. "Disjuncture and difference in the global cultural economy," in *Global Culture: Nationalism, Globalization and Modernity*. Edited by M. Featherstone, pp. 295-310. London: Sage.

—. 1996. *Modernity at Large: Cultural Dimensions of Globalization*. Vol. 1. *Public Worlds*. Minneapolis: University of Minnesota.

Arce, J. L., K. E. Cervantes, J. L. Macias, and J. C. Mora. 2005. The 12.1 ka Middle Toluca Pumice: A dacitic Plinian-subplinian eruption of Nevado de Toluca in Central Mexico *Journal of Volcanology and Geothermal Research* 147:125-143

Ardren, T. 2002. Conversations about the production of archaeological knowledge and community museums at Chunchucmil and Kochol, Yucatán, México. *World Archaeology* 34 (2):379-400.

Arford, M., and S. Horn. 2004. Pollen evidence of the earliest maize agriculture in Costa Rica. *Journal of Latin American Geography* 3 (1):108-115.

Argyrou, V. 2005. *The Logic of Environmentalism: Anthropology, Ecology and Postcoloniality*. Oxford: Berghahn.

Arvidsson, R., J. Toral Boutet, and O. Kulhanek. 2004. Foreshocks and aftershocks of the Mw = 7.1, 1992, earthquake in the Atrato region, Colombia. *Journal of Seismology* 6 (1):1-11.

Ascher, R. 1962. Ethnography for archaeology: a case from the Seri Indians. *Ethnology* 1:360-69.

Ashmore, W. 1989. "Peten cosmology in the Maya southeast: An analysis of architecture and settlement patterns at Classic Quirigua," in *The Southeast Maya Periphery*. Edited by P. A. Urban and E. M. Schortman, pp. 35-49. Austin: University of Texas Press.

—. 2007. "Archaeologies of Landscape," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 255-271. Malden, MA, Oxford: Blackwell Publishing.

Attfield, J. 2000. *Wild Things: Material Culture of Everyday Life*. New York: Berg.

Bacon, C. R., and M. A. Lanphere. 2006. Eruptive history and geochronology of Mount Mazama and the Crater Lake region, Oregon *Geological Society of America Bulletin* 118:1331-1359

Badiou, A. 2005. *Being and Event*. London: Continuum.

Bailey, G. 2007. Time perspectives, palimpsests and the archaeology of time. *Journal of Anthropological Archaeology* 26:198-223.

Bailey, G., A. Whittle, and V. Cummings. Editors. 2005. *(Un)settling the Neolithic*. Oxford: Oxbow.

Baldi, N. 2001. Black Creek (Cat U.C.R. N0 467): Primeras interpretaciones arqueologicas de un modo de vida costero en el caribe sur de Costa Rica. Tesis de licenciatura, Universidad de Costa Rica.

Balée, W. 2006. The Research Program of Historical Ecology. *Annual Review of Anthropology* 35:75-98.

Balmuth, M. S., D. K. Chester, and P. Johnston. Editors. 2005. *Cultural Responses to Volcanic Landscape: The Mediterranean and Beyond*. *AIA Colloquia and Conference Papers, 8*. Boston: David Brown.

Banning, E. B. 2002. *Archaeological Survey*. *Manuals in Archaeological Method, Theory, and Technique*. New York: Kluwer Academic/Plenum Press.

Barba, L. 1995. El impacto human en la paleogeografia de Teotihuacan. Unpublised Ph.D. dissertation, Universidad Nacional Autonoma de Mexico.

Barber, K. 2007. "Improvisation and the art of making things stick," in *Creativity and Cultural Improvisation*. Edited by E. Hallam and T. Ingold, pp. 25-41. Oxford; New York: Berg.

Barber, K. E., P. G. Langdon, and A. Blundell. 2008. Dating the Glen Garry tephra - a widespread late-Holocene marker horizon in the peatlands of Northern Britain. *The Holocene* 18:31-43.

Barillas, E. 1982. *Proyecto Rescate Arqueológico Oleoducto Chiriquí-Bocas del Toro*. Instituto Nacional de Cultura, Dirección de Patrimonio Histórico.

Barrett, J. 1994. *Fragments from Antiquity*. Oxford: Blackwell.

Bartlett, A., and E. Barghoom. 1973. "Phytogeographic history of the isthmus of Panama during the past 12,000 years (a history of vegetation, climate, and sea-level change)," in *Vegetation and Vegetational History of Northern Latin America*. Edited by A. Graham, pp. 87-103.

Bartlett, A., E. Barghoorn, and R. Berger. 1969. Fossil maize from Panama. *Science* 165 (3891):389-90.

Bassie, K. 2002. *The Jolja' cave project, final report.* www.famsi.org/reports/00017/index.html. Foundation for the Advancement of Mesoamerican Studies (FAMSI).

Basso, K. 1996. *Wisdom Sits in Places*. Albuquerque: University of New Mexico Press.

Bataille, G. 1988. *The Accursed Share: An Essay on General Economy*. New York: Zone Books.

Bateman, J. 1860. An account of a visit to the huacas, or ancient grave yards of Chiriqui. *Bulletin of the American Ethnological Society* 1:28-33.

Baudez, C., N. Borgnino, S. Lalignant, and V. Lauthelin. 1993. *Investigationes Arqueológicas en el Delta del Diquís*. *Delegation Regionale de Cooperation Scientifique et Technique en Amerique Centrale*. Mexico City: Centre d'Études Mexicaines et Centraméricaines and Délegation Régionale de Coopération Scientifique et Technique en Amérique Centrale.

Bauer, A. 2002. Is what you see all you get? Recognizing meaning in archaeology. *Journal of Social Archaeology* 2 (1):37-52.

Bawden, G., and R. M. Reycraft. Editors. 2000. *Environmental Disaster and the Archaeology of Human Response*. Vol. 7. *Anthropological Papers (Maxwell Museum of Anthropology)*. Albuquerque, NM: Maxwell Museum of Anthropology.

Bayman, J. 2002. Hohokam Craft Economies andthe Materialization of Power *Journal of Archaeological MethodandTheory* 9 (1):69-95.

Beck, R., D. Bolender, J. Brown, and T. Earle. 2007. Eventful archaeology: the place of space in structural transformation. *Current Anthropology* 48 (6):833-60.

Beck, U. 1992. *Risk Society: Towards a New Modernity. translated by M. Ritter*. London: Sage.

Béget, J. 2000. "Volcanic tsunamis," in *Encyclopedia of Volcanoes*. Edited by H. Sigurdsson, pp. 1005-1013. San Diego: Academic Press.

Behling, H. 2000. A 2860-year high-resolution pollen and charcoal record from the Cordillera de Talamanca in Panama: a history of human and volcanic forest disturbance. *The Holocene* 10:387-393.

Beilke-Voigt, I. 2002. Archäologische Forschungen in Panamá [Investigaciones arqueológicas en Panamá][Archaeological Investigations in Panama]. *Ethnographisch-Archäologische Zeitschrift* 43:605-13.

Beilke-Voigt, I., L. G. Joly, and M. Kunne. 2004. *Fechas por radiocarbon de la excavación arqueológica en el Sitio Barriles Bajo (BU-24-I), Chiriquí, Panamá [Radiocarbon dates from the archaeological excavation of the Lower Barriles site (BU-24-I), Chiriquí, Panamá]*. Universidad Autónoma de Chiriquí [UNACHI] - Vicerrectoria de investigación y posgrado, URL: http://unachi.ac.pa/publicaciones/Fechamiento_por_radiocarbono.pdf

Belk, R. W. 2001. *Collecting in a Consumer Society*. London: Routledge.

Belzoni, G. 1857 [1565]. *History of the New World*. London: Hakluyt Society.

Benavides, O. H. 2004. *Making Ecuadorian Histories: Four Centuries of Defining Power*. Austin: University of Texas Press.

Bender, B. 1993. "Introduction," in *Landscape: Politics and Perspectives*. Edited by B. Bender, pp. 1-7. Oxford: Berg.

—. 1998. *Stonehenge: Making Space*. Oxford: Berg.

—. 1999. "Subverting the western gaze: Mapping alternative worlds," in *The Archaeology and Anthropology of Landscape: Shaping Your Landscape*. Edited by P. Ucko and R. Layton, pp. 31-45. London: Routledge.

—. 2001. "Introduction," in *Contested Landscapes: Movement, Exile and Place*. Edited by B. Bender and M. Winer, pp. 1-18. Oxford: Berg.

Bender, B., S. Hamilton, and C. Tilley. Editors. 2007. *Stone Worlds: Narrative and Reflexivity in Landscape Archaeology*. *University College London Institute of Archaeology Publications*. Walnut Creek, CA: Left Coast Press.

Benson, E. 1997. *Birds and Beasts of Ancient Latin America*. Gainesville: University Press of Florida.

Berggren, A., and I. Hodder. 2003. Social practice, method, and some problems of field archaeology. *American Antiquity* 68:421-434.

Berghaus, H. 1852. *Physikalischer Atlas*, 2nd edition. Gotha: Justus Perthes.

Bergmann, B. 2006. Final hours: victims of Vesuvius and their possessions (museum review). *American Journal of Archaeology* 110:493-501.

Bergson, H. 1911. *Creative Evolution (trans. A. Mitchell)*. London: Macmillan.

Bernbeck, R., and S. Pollock. 2007. "The political economy of archaeological practice and the production of heritage in the Middle East," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 335-352. Malden, MA and Oxford: Blackwell Publishing.

Betrand, S., J. Castiaux, and E. Juvigné. 2008. Tephrostratigraphy of the late glacial and Holocene sediments of Puyehue Lake (Southern Volcanic Zone, Chile, 40°S). *Quaternary Research (in press)*.

Biese, L. 1962. The archaeological society of Panama site report system. *Miscellaneous Publications in Isthmian Archaeology* 1.

Binford, L. 1972. "Some comments on historical versus processul archaeology," in *An Archaeological Perspective*, pp. 114-24. New York: Seminar Press.

—. 1977. "General Introduction," in *For Theory Building in Archaeology*. Edited by L. R. Binford, pp. 1-10. New York: Academic Press.

—. 1981. Behavioral archaeology and the "Pompeii premise". *Journal of Anthropological Research* 37 (3):195-208.

—. 1985. Human ancestors: Changing views of their behavior. *Journal of Anthropological Archaeology* 4:292-37.
—. 2001. Where do research problems come from? *American Antiquity* 66:669-78.
Bintliff, J. 1991. *The Annales School and Archaeology*. Leicester: Leicester University Press.
—. 2002. Time, process and catastrophism in the study of Mediterranean alluvial history: a review. *World Archaeology* 33 (3):417-435.
Blake, C. C. 1863. Note on stone celts, from Chiriqui. *Transactions of the Ethnological Society of London* N.S. 2:166-70.
Blake, E. 2007. "Space, spatiality, and archaeology," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 230-254. Malden, MA and Oxford: Blackwell Publishing.
Blanchot, M. 1995. *The Writing of the Disaster* London: University of Nebraska Press.
Blanton, R., S. Kowalewski, G. Feinman, and L. Finsten. 1997. *Ancient Mesoamerica: A Comparison of Change in Three Regions*, 2nd edition. Cambridge Cambridge University Press.
Blong, R. 1982. *The Time of Darkness, Local Legends and Volcanic Reality in Papua New Guinea*. Canberra: University of Washington Press/Australian National University Press.
—. 1984. *Volcanic Hazards - a Sourcebook on the Effects of Eruptions*. Sydney: Academic Press.
Bolge, L. L., M. J. Carr, M. D. Feigenson, and G. E. Alvarado. 2006. Geochemical stratigraphy and magmatic evolution at Arenal volcano, Costa Rica. *Journal of Volcanology and Geothermal Research* 157: 34-48.
Bollaert, W. 1860a. "Account of the recent discovery of Indian tombs, containing figures in gold and pottery, in Chiriqui, near Panamá," in *The Gentleman's Mazine and Historical Review, by Sylvanius Urban*, vol. 8 (208). London: John Henry and James Parker.
—. 1860b. Ethnological and other researches in New Granada, etc. *Antiquarian* 30.
—. 1863. On the ancient Indian tombs of Chiriqui in Veragua (southwest of Panama), on the Isthmus of Darien. *Transactions of the Ethnological Society of London* N.S. 2:147-66.
Borgogno, I., and O. Linares. 1980. "Computer typology - pro and con," in *Adaptive Radiations in Prehistoric Panama*, *Peabody Museum Monographs 5*. Edited by O. Linares and A. Ranere, pp. 394-403. Cambridge: Harvard University Press.
Bort, J. 1980. "Ecology and subsistence on opposite sides of the Talamancan range," in *Adaptive Radiations in Prehistoric Panama*, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 499-509. Cambridge, MA: Harvard University.
Bourgeois, J., T. K. Pinegina, V. Ponomareva, and N. Zaretskaia. 2006. Holocene tsunamis in the southwestern Bering Sea, Russian Far East, and their tectonic implications. *Geological Society of America Bulletin* 118:449-463
Bradley, R. 1984. "Studying monuments," in *Neolithic Studies*, vol. 133. Edited by R. Bradley and J. Gardiner, pp. 61-6: BAR.
—. 1997. *Rock Art and the Prehistory of Atlantic Europe*. London: Routledge.
—. 1998. *The Significance of Monuments*. London and New York: Routledge.
—. 2000. *An Archaeology of Natural Places*. London: Routledge.
—. 2002. *The Past in Prehistoric Societies*. London and New York: Routledge.
—. 2005. *Ritual and Domestic Life in Prehistoric Europe*: Routledge.
Brady, J. 1997. *Las Cuevas de Cobanerita, San Benito, Petén*. Unpublished report to the Instituto de Antropología e Historia.

Braidwood, R. 1952. *The Near East and the Foundations for Civilization*. Eugene: Oregon State System of Higher Education.

Braitseva, O., V. Pomomareva, L. Sulerzhitsky, I. Melekestsev, and J. Bailey. 1997. Holocene key-marker tephra layers in Kamchatka, Russia. *Quaternary Research* 47:125-139.

Brass, K. 2007. "In Panama, a home in the mountains," in *The New York Times, Dec 2*. New York.

Braudel, F. 1973. *The Mediterranean and the Mediterranean World in the Age of Philip II*. London: Collins.

Braun, B. 2002. *The Intemperate Rainforest: Nature, Culture, and Power on Canada's West Coast*. Minneapolis: University of Minnesota Press.

Bray, W. 1984. "Across the Darién Gap: a Colombian view of Isthmian archaeology," in *The Archaeology of Lower Central America*. Edited by F. Lange and D. Stone, pp. 305-338. Albuquerque: University of New Mexico Press.

—. 1992. "Sitio Conte metalwork in it pan-American context," in *River of Gold: Precolombian Treasures from the Sitio Conte*. Edited by P. Hearne and R. Shearer, pp. 33-46. Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology.

—. 2003. "Gold, stone, and ideology, symbols of power in the tairona tradition of northern Colombia," in *Gold and Power in Ancient Costa Rica, Panamá, and Colombia*. Edited by J. Quilter and J. Hoopes. Washington, D.C.: Dumbarton Oaks Research Library and Collections.

Breidenbach, J., and P. Nyíri. 2007. 'Our common heritage': New tourist nations, post-'socialist' pedagogy, and the globalization of nature. *Current Anthropology* 48 (2):322-330.

Briggs, P. 1989. *Art, Death, and the Social Order: the Mortuary Arts of Pre-Conquest Central Panama*. Vol. International Series 550. *British Archaeological Reports*. Oxford.

Brizuela, A. 2006. *Informe preliminar de Proyecto de Registro de Petroglifos en Volcán, Chiriquí (unpublished report)*. SENACYT and DNPH-INAC.

—. 2007. Los petroglifos de Volcán, Chiriquí, Panamá. Avances de investigación. www.rupestreweb.info/chiriqui.html.

Broecker, W., and G. Denton. 1989. The role of ocean-atmosphere reorganizations in glacial cycles. *Geochimica et Cosmochimica Acta* 53:2465-2501.

Bruhns, K. O. 2000. plunderedpast.com. *Society for American Archaeology Bulletin* 18 (2):14-15, 17.

Brumfiel, E. 2003. It's a Material World: History, Artifacts, and Anthropology. *Annual Review of Anthropology* 32:205-24.

Buchli, V. Editor. 2002. *The Material Culture Reader*. Oxford and New York: Berg.

—. 2007. "Material culture: Current problems," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 179-194. Malden, MA and Oxford: Blackwell Publishing.

Buck, C. E., T. F. G. Higham, and D. J. Lowe. 2003. Bayesian tools for tephrochronology. *Holocene* 13:639.

Builth, H., A. P. Kershaw, C. White, A. Roach, L. Hartney, M. McKenzie, T. Lewis, and G. Jacobsen. 2008. Environmental and cultural change on the Mt Eccles lava-flow landscapes of southwest Victoria, Australia. *Holocene* 18 (3):413-424.

Bull, T. 1965. *Site Report List - Republic of Panama*. Vol. 2. *Miscellaneous Publications in Isthmian Archaeology*. Panama: The Archaeological Society of Panama.

Bulwer-Lytton, E. 2003 [1834]. *The Last Days of Pompeii*. Holicong, Pa.: Wildside Press.

Bundschuh, J., and G. Alvarado. Editors. 2007. *Central America: Geology, Resources and Hazards*. London: Taylor & Francis.

Bundschuh, J., P. Birkle, R. Finch, M. Day, J. Romero, S. Paniagua, G. Alvarado, P. Bhattacharya, K. Tippman, and D. Chaves. 2007a. "Geology-related tourism for sustainable development," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 1015-1098. London: Taylor & Francis.

Bundschuh, J., M. Winograd, M. Day, and G. Alvarado. 2007b. "Geographical, social, economic, and environmental framework and developments," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 1-52. London: Taylor & Francis.

Burgess, C. 1989. Volcanoes, catastrophe and the global crisis in the late second millenium BC. *Current Archaeology* 117:325-329.

Bush, M., and P. Colinvaux. 1990. A pollen record of a complete glacial cycle from lowland Panama. *Journal of Vegetation Science* 1:105-118.

—. 1994. Tropical forest disturbance: paleoecological records from Darien, Panama. *Ecology* 75 (6):1761-1768.

Bush, M., D. Piperno, P. Colinvaux, P. de Oliveira, L. Krissek, M. Miller, and W. Rowe. 1992. A 14,300 yr. paleoecological profile of a lowland tropical lake in Panama. *Ecological Monographs* 62:251-275.

Butler, M. M. 2005. Place, memory and the ancient Costa Rican landscape: An exploration of footpaths, cemeteries, and habitation sites (advised by Payson Sheets), University of Colorado.

Byrami, M., Ogden, J., Horrocks, M., Deng, Y., Shane, P. and Palmer, J. 2002. A palynological study of Polynesian and European effects on vegetation in Coromandel, New Zealand, showing the variability between four records from a single swamp. *Journal of the Royal Society of New Zealand* 32:507-531.

Byron, G. G. 2007 [1869]. "Canto IV," in *Childe Harold's Pilgrimage; A Remaunt by Lord Byron*. Bel Air, CA: Echo Library.

Caballero, L., J. L. Macias, A. Garcia-Palomo, G. R. Saucedo, L. Borselli, D. Sarocchi, and J. M. Sanchez. 2006. The September 8-9, 1998 rain-triggered flood events at Motozintla, Chiapas, Mexico. *Natural Hazards* 39:103-126.

Caillois, R. 2005 [1966]. Extracts from Stones, translated from the French publication, Pierres (Paris, Gallimard, 1966). *Diogenes* 52:89-92.

Calanchi, N., and E. Dinellis. 2008. Tephrostratigraphy of the last 170 ka in sedimentary successions from the Adriatic Sea. *Journal of Volcanology and Geothermal Research (in press)*.

Callaghan, R., and W. Bray. 2007. Simulating prehistoric sea contacts between Costa Rica and Colombia. *Journal of Island and Coastal Archaeology* 2:4-23.

Carr, M. J., M. D. Feigenson, L. C. Patino, and J. A. Walker. 2003. "Volcanism and geochemistry in Central America: progress and problems," in *Inside the Subduction Factory*, vol. 138, *Geophysical Monograph*. Edited by J. Eiler, pp. 153-179. Washington, D.C.: American Geophysical Union.

Carrier, J. 2004. "Introduction," in *Confronting Environments: Local Environmental Understanding in a Globalising World*. Edited by J. Carrier, pp. 1-29. Walnut Creek, CA: Altamira Press.

Carrier, J., and D. Miller. 1998. *Virtualism: A New Political Economy*. Oxford, UK: Berg.

Carter, D. T., L. L. Ely, J. E. O'Connor, and C. R. Fenton. 2006. Late Pleistocene outburst flooding from pluvial Lake Alvord into the Owyhee River, Oregon *Geomorphology* 75:346-367.

Carvajal-Contreras, D. R., R. Cooke, and M. Jiménez. 2008. Taphonomy at two contiguous coastal rockshelters in Panama: Preliminary observations focusing on fishing and curing fish. *Quaternary International* 180:90-106.

Casey, E. 1996. "How to get from space to place in a fairly short stretch of time: phenomenological prolegomena," in *Senses of Place*. Edited by S. Feld and K. H. Basso. Santa Fe, NM: School of American Research.

Chambers, F. M., J. R. G. Daniell, J. B. Hunt, K. Karen Molloy, and M. O'Connell. 2004. Tephrostratigraphy of An Loch Mor, Inis Oirr, western Ireland: implications for Holocene tephrochronology in the northeastern Atlantic region. *The Holocene* 14:703-720.

Chapin, M., Z. Lamb, and B. Threlkeld. 2005. Mapping Indigenous Lands. *Annual Review of Anthropology* 34:619-638.

Chernet, T., W. K. Hart, J. L. Aronson, and R. C. Walter. 1998. New age constraints on the timing of volcanism and tectonism in the northern Main Ethiopian Rift-southern Afar transition zone (Ethiopia). *Journal of Volcanology and Geothermal Research* 80: 267–280.

Cherry, J., C. Scarre, and S. Shennen. Editors. 2004. *Explaining Social Change: Studies in Honor of Colin Renfrew*. *McDonald Institute Monographs*. Cambridge, UK: McDonald Institute for Archaeological Research, University of Cambridge.

Chesson, M. 2001. *Social Memory, Identity and Death: Ethnographic and Archaeological Perspectives on Mortuary Rituals*. Washington, D.C.: American Anthropological Association.

Chester, D. 1993. *Volcanoes and Society*. London: Edward Arnold.

Chester, D., and A. Duncan. 2007a. "Geomythology, theodicy and the continuing relevance of religious worldviews on responses to volcanic eruptions," in *Living Under the Shadow: The Archaeological, Cultural and Environmental Impact of Volcanic Eruptions*, *One World Archaeology*. Edited by J. P. Grattan and R. Torrence. London: UCL Press, Cavendish Publishing

—. 2007b. "Geomythology, theodicy, and the continuing relevance of religious worldviews on responses to volcanic eruptions," in *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*, *One World Archaeology Series*. Edited by J. Grattan and R. Torrence, pp. 203-224. Walnut Creek, CA: Left Coast Press.

Chester, D., A. Duncan, and C. Dibben. 2008. The importance of religion in shaping volcanic risk perception in Italy, with special reference to Vesuvius and Etna. *Journal of Volcanology and Geothermal Research* 172:216-228.

Chester, D., A. Duncan, P. Wetton, and R. Wetton. 2007. Responses of the Anglo-American military authorities to the eruption of Vesuvius, March 1944. *Journal of Historical Geography* 33 (1):168-196.

Chester, D. K. 2005. Theology and disaster studies: The need for dialogue. *Journal of Volcanology and Geothermal Research* 146:319-328.

Childe, V. G. 1957. *New Light on the Most Ancient East*. New York: Grove Press.

Chippendale, C. 2001. "Studying ancient pictures as pictures," in *Handbook of Rock Art Research*. Edited by D. Whitley, pp. 247-72. Walnut Creek, CA: Altamira Press.

Chippindale, C., and G. Nash. Editors. 2004a. *The Figured Landscapes of Rock-Art*. Cambridge: Cambridge University Press.

—. 2004b. "Pictures in place: approaches to the figured landscapes of rock-art," in *The Figured Landscapes of Rock-Art*. Edited by C. Chippindale and G. Nash, pp. 1-36. Cambridge: Cambridge University Press.

Cioni, R., C. D'Oriano, and A. Bertagnini. 2008. Fingerprinting ash deposits of small scale eruptions by their physical and textural features. *Journal of Volcanology and Geothermal Research (in press)*.

Clement, R., and S. Horn. 2001. Pre-Columbian land-use history in Costa Rica: A 3000-year record of forest-clearance, agriculture and fires from Laguna Zoncho. *Holocene* 11 (4):419-426.

Clift, P. D., L. H. Chan, J. Blusztajn, G. D. Layne, M. Kastner, and R. K. Kelly. 2005. Pulsed subduction accretion and tectonic erosion reconstructed since 2.5 Ma from the tephra record offshore Costa Rica. *Geochemistry Geophysics Geosystems* 6.

Coates, A. Editor. 1997a. *Central America: A Natural and Cultural History*. New Haven and London: Yale University Press.

—. 1997b. "The forging of Central America," in *Central America: A Natural and Cultural History*. Edited by A. Coates, pp. 1-37. New Haven and London: Yale University Press.

Coates, A., M.-P. Aubry, W. Berggren, L. Collins, and M. Kunk. 2003. Early Neogene history of the Central American arc from Bocas del Toro, western Panama. *GSA Bulletin* 115 (3):271-287.

Coates, A., L. Collins, M.-P. Aubry, and W. Berggren. 2004. The geology of the Darien, Panama, and the late Miocene-Pliocene collision of the Panama arc with northwestern South America. *GSA Bulletin* 116 (11/12):1327-1344.

Cobb, C. 1993. "Archaeological approaches to the political economy of non stratified societies," in *Archaeological Method and Theory*, vol. 4. Edited by M. Schiffer, pp. 43-100: University of Arizona Press.

Coggins, C. 1972. Archaeology and the Art Market. *Science* 175:263-66.

—. 1995. Illicit international travel in ancient art: let there be light! *International Journal of Cultural Property* 4 (1):61-79.

Cole, P. D., E. Fernandez, E. Duarte, and A. M. Duncan. 2005. Explosive activity and generation mechanisms of pyroclastic flows at Arenal volcano, Costa Rica between 1987 and 2001 *Bulletin of Volcanology* 67:695-716

Colloredo-Mansfeld, R. 2003. Introduction: Matter Unbound. *Journal of Material Culture* 8 (3):245-254.

Colman, S. M., D. S. Kaufman, J. Bright, C. Heil, J. W. King, W. E. Dean, J. G. Rosenbaum, R. M. Forester, J. L. Bischoff, M. Perkins, and J. P. McGeehin. 2006. Age model for a continuous, ca 250-ka Quaternary lacustrine record from Bear Lake, Utah-Idaho. *Quaternary Science Reviews* 25:2271-2282.

Colton, H. 1932. *A Survey of Prehistoric Sites in the Region of Flagstaff, Arizona*. *Bureau of American Ethnology, Bulletin no. 104*. Washington, D.C.: Smithsonian Institution.

Comaroff, J., and J. Comaroff. 1991. *Of Revelation and Revolution: Christianity, colonialism, and Consciousness in South Africa*. Chicago: University of Chicago Press.

Connolly, T. J. 1999. *Newberry Crater: A Ten-Thousand Year Old Record of Human Occupation and Environmental Change in the Basin-Plateau Borderlands*. Salt Lake City: University of Utah Press.

Conolly, J., and M. Lake. 2006. *Geographical Information Systems in Archaeology Cambridge Manuals in Archaeology*. Cambridge: Cambridge University Press.

Conrad, J. 2004 [1919]. Philadelphia: Pine Street Books, University of Pennsylvania.

Constructora Urbana, S. A. 2002. *Diseño, financiamiento, estudio de impacto ambiental y contrucción del camino ecológico Boquete-Cerro Punta.* . Panama City: CUSA.

Contraloria General de la República. 2003. 2000 Census, www.contraloria.gob.pa.

Cook, N. D. 2007. *People of the Volcano: Andean Counterpoint in the Colca Valley of Peru*: Duke University Press.

Cooke, R. 1979. Los impactos de las comunidades agricolas precolombinas sobre los ambientes del Tropico estacional: datos del Panama prehistorico. *Actas del IV Simposio de Ecologia Tropical* 3:919-973.

—. 1980. "Polychrome pottery from the Central Region of Panama at La Pitahaya," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by I. Linares and A. Ranere, pp. 376-384. Cambridge: Harvard University.

—. 1985. Ancient painted pottery from central Panama. *Archaeology*:33-39.

—. 1992. Etapes tempranas de la produccion de alimentos vegetales en la baja Centroamerica y partes de Colombia (region Historica Chibcha-Choco). *Revista de Arqueologia Americana* 6:35-70.

—. 1993. "Human influences on the zoogeography of Panamá: an update based on archaeological and ethnohistorical evidence," in *Biogeography of Mesoamerica. Proceedings of a Symposium (Mérida, Yucatán, México, October 26-30, 1984)*. Edited by S. Darwin and A. Welden, pp. 21-58: Special Publication of the Mesoamerican Ecology Institute.

—. 1995. "Monagrillo, Panama's first pottery (3800-1200 cal BC): Summary of research (1948-1993), with new interpretations of chronology, subsistence and cultural geography," in *The Emergence of Pottery: Technology and Innovation in Ancient Societies*. Edited by J. Barnett and J. Hoopes, pp. 169-184. Washington, D.C.: Smithsonian Institution Press.

—. 1997a. Huaqueria y coleccionismo en Panama. *Revista Nacional de Cultura (Panama)* 27:50-66.

—. 1997b. "Native peoples of Central America," in *Central America: A Natural and Cultural History*. Edited by A. Coates, pp. 137-176. New Haven and London: Yale University Press.

—. 1998. "The Felidae in Pre-Colombian Panama: a thematic approach to their imagery and symbolism," in *Icons of Power: Felid Symbolism in the Americas*. Edited by N. Saunders, pp. 77-121. London: Routledge.

—. 2001. "Cuidando a los ancestros: Rasgos mortuorios precolombinos en cerro Juan Díaz, Los Santos," in *Panamá: Puente Biológico*. Edited by S. Heckadon-Moreno, pp. 54-62. Panama City: Smithsonian Tropical Research Institute.

—. 2003. "Observations on the religious content of the animal imagery of the 'Gran Cocle' semiotic tradition of pre-Columbian Panamá," in *Behavior Behind Bones: The Zooarchaeology of Ritual, Religion, Status and Identity*. Edited by S. O'Day, W. van Neer, and A. Ervynck, pp. 114-127. Liverpool: Oxbow.

—. 2005. Prehistory of native Americans on the Central American land bridge: colonization, dispersal, and divergence. *Journal of Archaeological Research* 13 (2):129-187.

Cooke, R., and W. Bray. 1985. "The goldwork of Panama: an iconographic and chronological perspective," in *The Art of Precolombian Gold: the Jan Mitchell Collection*. Edited by J. Jones, pp. 35-49. London: Weidenfield and Nicholson.

Cooke, R., J. Griggs, L. Sánchez, C. Díaz, and D. Cavajal. 2001. *Recopilación y presuntación de datos de recursos ambientales y culturales en la región occidental de la Cuenca del Canal de Panamá. Inventario de sitios de recursos culturales y evaluación del potencial de sitios adicionales.* *www.pancanal.com/esp/cuenca/rocc/inf-cultural/inf-cultulral.pdf*. Autoridad del Canal de Panamá (ACP).

Cooke, R., I. Isaza, J. Griggs, B. Desjardins, and L. Sanchez. 2003a. "Who crafted, exchanged, and displayed gold in pre-Columbian Panama?," in *Gold and Power in Ancient Costa Rica, Panama, and Colombia*. Edited by J. Quilter and J. Hoopes, pp. 91-158. Washington, D.C.: Dumbarton Oaks Research Library.

Cooke, R., and M. Jiménez. in press. "Animal-derived artifacts at two pre-Columbian sites in the ancient savannas of central Panamá. An update on their relevance to studies of social hierarchy and cultural attitudes towards animals," in *TITLE PENDING*. Edited by S. DeFrance.

Cooke, R., L. Norr, and D. Piperno. 1996. "Native Americans and the Panamanian landscape: Harmony and discord between data sets appropriate for environmental history," in *Case Studies in Environmental Archaeology*. Edited by E. Reitz, L. Newsom, and S. Scudder, pp. 103-126. New York and London: Plenum Press.

Cooke, R., and A. Ranere. 1992a. "Human influences on the zoogeography of Panama: An update based on archaeological and ethnohistorical evidence," in *Biogeography of Mesoamerica. Proceedings of a Symposium, October 26-30, 1984*. Edited by S. Darwin and A. Welden. Mérida, México: Special Publication of the Mesoamerican Ecology Institute.

—. 1992b. "The origin of wealth and hierarchy in the central region of Panama (12,000-2,000 BP), with observations on its relevance to the history and phylogeny of Chibchan-speaking polities in Panama and elsewhere," in *Wealth and Hierarchy in the Intermediate Area*. Edited by F. Lange, pp. 243-316. Washington, D.C.: Dumbarton Oaks.

Cooke, R., D. Rocío Carvajal, J. G. Martín, and A. Lara. 2007. *Diversidad cultural y biológica del archipiélago de las Perlas antes de la Conquista Española (Primer Informe)*.

Cooke, R., and L. A. Sánchez Herrera. 2004a. "Panama Indígena: 1501-1550," in *Historia General de Panama: Las Sociedades Originarias*, vol. 1. Edited by A. Castillero Calvo, pp. 47-78. Presidencia de la República, Panamá: Comité Nacional del Centario de la República de Panamá.

—. 2004b. "Panama Prehispánico," in *Historia General de Panama: Las Sociedades Originarias*, vol. 1. Edited by A. Castillero Calvo, pp. 3-46. Presidencia de la República, Panamá: Comité Nacional del Centario de la República de Panamá.

Cooke, R., L. A. Sánchez Herrera, D. Rocío Carvajal, J. Griggs, and I. I. Isaza Aizpurua. 2003b. Los pueblos indígenas de Panamá durante el siglo IVA: Tranformaciones sociales y culturales desde una perspectiva arqueológica y paleoecológica. *Mesoamérica* 45:1-34.

Cooke, R., and L. Sanchez. 1998. Coetaneidad de metalurgia, artesanias de concha y ceramic pintada en cerro Juan Diaz, Panama. *Boletin del Museo del Oro (Colombia)* 42:57-85.

—. 2004. "Arqueologia en Panamá (1888-2003)," in *Panamá: Cien años de República*, pp. 3-104. Panamá: Manfer.

Cooke, R., L. Sanchez, and K. Udagawa. 2000. "An update based on recent excavations and new radiocarbon dates for associated pottery styles," in *PreColumbian Gold*. Edited by C. McEwan, pp. 154-176. Chicago: Dearborn Publishers.

Cooke, R., and L. A. Sánchez. 2003. "Alain Ichon en Panama (1967-1970): A reappraisal of the Tonosí Research Project in the light of new research," in *Misceláneas...En Honor a Alain Ichon*. Edited by M. C. Arnauld, A. Breton, M.-F. Fauvet-Berthelot, and J. A. Valdés, pp. 13-26. Mexico: Centro Francés de Estudios Mexicanos y Centroamericanos.

Cooke, R., L. A. Sánchez, and K. Udagawa. 2000. "Contextualized goldwork from 'Gran Cocle', Panama: An update based on recent excavations and new radiocarbon dates for associated pottery styles," in *Precolumbian Gold: Technology, Style and Iconography*. Edited by C. McEwan, pp. 154-176. London: British Museum Press.

Cooney, G. 2002. "So many shades of rock: colour symbolism and Irish stone axeheads," in *Colouring the Past*. Edited by A. Jones and G. MacGregor, pp. 93-107. London: Berg.

Cooper, J. D., R. H. Miller, and J. Patterson. 1986. *A Trip Through Time: Principles of Historical Geology*. Columbus: Merrill.

Corrales, F. 2000. An evaluation of long term cultural change in southern Central America: The ceramic record of the Diquis archaeological subregion, southern Costa Rica. PhD dissertation, University of Kansas.

Corrales, F., and I. Quintanilla. 1996. "The archaeology of the central Pacific Coast of Costa Rica," in *Paths to Central American Prehistory*. Edited by F. Lange, pp. 49-77. Niwot: University Press of Colorado.

Corrales Ulloa, F. 2000. An evaluation of long term cultural change in southern Central America: The ceramic record of the Diquis archaeological subregion, southern Costa Rica. PhD dissertation, University of Kansas.

Cosgrove, D. Editor. 1999. *Mappings*. London: Reaktion Press.

—. 2006. Modernity, Community and the Landscape Idea. *Journal of Material Culture* 11:49-66.

Costanza, R., and H. Daley. 1992. Natural capital and sustainable development. *Conservation Biology* 6:37-46.

Costenla-Umaña, A. 1991. *La lenguas del Area intermedia: Introducción a su estudio areal*. San José, Costa Rica: Editorial de la Universidad de Costa Rica.

Cowan, H. 1997. Paleoseismology in the Cocos-Nazca-Caribbean plate triple junction, southern Costa Rica and western Panama. *Forum Palaeoseismicum* http://geohazards.cr.usgs.gov/paleosei/PPForum?CowanPanama.html.

Cowgill, G. 2000. "The central Mexican highlands from the rise of Teotihuacan to the decline of Tula," in *The Cambridge History of the Native Peoples of the Americas*, vol. vol. II: Mesoamerica, Part I. Edited by R. E. W. Adams and M. MacLeod, pp. 250–317. Cambridge: Cambridge University Press.

Creamer, W., and J. Haas. 1985. Tribe versus chiefdom in Lower Central America. *American Antiquity* 50 (4):738-54.

Cronin, S., and K. Cashman. 2007. "Volcanic oral traditions in hazard assessment and mitigation," in *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*, *One World Archaeology Series*. Edited by J. Grattan and R. Torrence, pp. 175-202. Walnut Creek, CA: Left Coast Press.

Cronin, S., D. Gaylord, D. Charley, B. Alloway, S. Wallez, and J. Esau. 2004. Participatory methods of incorporating scientific with traditional knowledge for volcanic hazard management on Ambae Island, Vanuatu. *Bulletin of Volcanology* 66:652-668.

Cronin, S. J., and V. Neall. 2000. Impacts of volcanism on pre-European inhabitants of Taveuni, Fiji. *Bulletin of Volcanology* 62:199-213.

Cronon, W. 1995a. "The trouble with wilderness; or, Getting back to the wrong nature," in *Uncommon Ground: Toward Reinventing Nature*. Edited by W. Cronon, pp. 69-60. New York: W.W. Norton.

—. Editor. 1995b. *Uncommon Ground: Toward Reinventing Nature*. New York: W.W. Norton.

Cruikshank, J. 2005a. *Do glaciers listen? Local knowledge, colonial encounters, and social imagination*. Toronto: University of British Columbia Press.

—. 2005b. "Mapping boundaries: from stories to borders," in *Do Glaciers Listen? Local knowledge, colonial encounters, and social imagination*, pp. 213-242. Toronto: University of British Columbia Press.
Crumley, C., and W. Marquardt. 1987. *Regional dynamics: Burgundian Landscapes in Historical Perspective*. New York: Academic Press.
Curtis, K. 1958. My first archaeological experience in Panamá. *Panamá Archaeologist* 1(1):15-19.
D'Altroy, T., V. Williams, and A. M. Lorandi. 2007. "The Incas in the Southlands," in *Variations in the Expression of Inka Power*. Edited by R. Burger, C. Morris, and R. Matos Medieta, pp. 85-133. Washington, D.C.: Dumbarton Oaks.
Daga, R., S. Ribeiro Guevara, M. L. Sánchez, and M. Arribére. 2006. Geochemical analysis of recent tephra layers from a lacustrine sequence in Northern Patagonia Andean Range *Geophysical Research Abstracts* 8 (SRef-ID: 1607-7962/gra/EGU06-A-00790).
Dahlin, B. 1980. "Surveying the Volcan region with the posthole digger," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 276-279. Cambridge: Harvard University Press.
Darragh, M., J. Cole, I. Nairn, and P. Shane. 2006. Pyroclastic stratigraphy and eruption dynamics of the 21.9 ka Okareka and 17.6 ka Rerewhakaaitu eruption episodes from Tarawera Volcano, Okataina Volcanic Centre, New Zealand. *New Zealand Journal of Geology and Geophysics* 49:309-328
Davies, S. J., S. E. Metcalfe, A. B. MacKenzie, A. J. Newton, G. H. Endfield, and J. G. Farmer. 2004. Environmental changes in the Zirahuen Basin, Michoacan, Mexico, during the last 1000 years. *Journal of Paleolimnology* 31:77-98
de Boer, J. 2007. Delphi's small 'omphalos''; an enigma. *Syllecta Classica* 18:81-104.
de Boer, J., J. Chanton, and M. Zeitlhöfler. 2007. Homer's chimaera fires (SW of Atalya/Turkey); burning abiogenic methan gases; are they generated by a serpentinization process related to alkalic magmatism? *Z. dt. Ges. Geowiss. (Stuggart)* 158 (4):997-1003.
de Boer, J. Z., M. J. Defant, R. H. Stewart, and H. Bellon. 1991. Evidence for active subduction below western Panama. *Geology* 19 (6):649-652.
de Boer, J. Z., M. J. Defant, R. H. Stewart, J. F. Restrepo, L. F. Clark, and A. H. Ramirez. 1988. Quaternary calc-alkaline volcanism in western Panama: regional variation and implication for the plate tectonic framework. *Journal of South American Earth Sciences* 1:275-293.
de Boer, J. Z., M. S. Drummond, M. Borderlon, M. J. Defant, H. Bellon, and R. C. Maury. 1995. "Cenozoic magmatic phases of the Costa Rican island arc (Cordillera de Talamanca)," in *Geologic and Tectonic Development of the Caribbean Plate Boundary in Southern Central America*. Edited by P. Mann, pp. 35-53: Geological Society of America Special Paper 295.
de Boer, J. Z., and D. Sanders. 2002. *Volcanoes in Human History: The Far-Reaching Effects of Major Eruptions*. Princeton, NJ: Princeton University Press.
De Certeau, M. 1988. *The Practice of Everyday Life*: University of California Press.
de Stael, M. 1998 [1805]. *Corinne, or, Italy. translated by Sylvia Raphael, introduction by John Isbell*. *Oxford's World Classics*. Oxford and New York: Oxford University Press.
De Zeltner, A. 1860. *[pamphlet by the French Consul to Panama, with illustrations]*.
—. 1866. *Note sur les sepultares indiennes du department de Chiriquí, Panamá*. Marshall H. Saville Collection, Archives of the Museum of the American Indian, Heye Foundation.
de Zeltner, A. 1967 [1865]. Sepulturas indias del departamento de Chiriqui en el estado de Panama (reprint of De Zeltner, A., 1866, "Note sure les sepultares indiennes du

department de Chiriquí, Panamá". Marshall H. Saville Collection, Archives of the Museum of the American Indian, Heye Foundation; also printed April 16, 1867 in the Panamanian newspaper, El Cefiro). *Boletín de Museo Chiricano*:2-7.

Deetz, J. 1983. Scientific humanism and humanistic science: A plea for paradigmatic pluralism in historical archaeology. *Geoscience and Man* 23:27-34.

Defant, M., J. Restrepo, R. Stewart, J. Z. de Boer, and L. Clark. 1987. Pleistocene to recent volcanism in western Panama: a geochemical and tectonic investigation. *EOS, Transactions of the American Geophysical Union* 68:1526.

Defant, M. J., T. E. Jackson, M. S. Drummond, J. Z. de Boer, H. Bellon, M. D. Feigenson, R. C. Maury, and R. H. Stewart. 1992. The geochemistry of young volcanism throughout western Panama and southeastern Costa Rica: An overview. *Journal of the Geological Society of London* 149 (4):569-579.

Deleuze, G., and F. Guattari. 1977. *Anti-Oedipus: Capitalism and Schizophrenia*. New York: Viking Press.

—. 1987. *A Thousand Plateaus: Capitalism and Schizophrenia*. London: Athlone Press.

Demeritt, D. 1994. Ecology, objectivity and critique in writings on nature and human societies. *Journal of Historical Geography* 20 (1):22-37.

Demian, M., and S. Wastell. 2007. "Part II. Creative appropriations and institutional contexts: introduction," in *Creativity and Cultural Improvisation*. Edited by E. Hallam and T. Ingold, pp. 119-126. Oxford; New York: Berg.

Dengo, G. 1985. "Mid America: tectonic setting for the Pacific margin from southern Mexico to northwestern Colombia," in *The Ocean Basins and Margins*, vol. 7aL The Pacific Ocean. Edited by A. Nairn, F. Stehli, and S. Uyeda, pp. 123-180. New York: Springer.

Derrida, J. 1996. *Archive Fever* Vol. (translated by Eric Prenowitz). Chicago: University of Chicago Press.

Descola, P. 1993. *The Spears of Twilight: Life and Death in the Amazon Jungle, translated by Janet Lloyd*. New York: New Press.

—. 1996. "Constructing natures: symbolic ecology and social practice," in *Nature and Society: Anthropological Perspectives*. Edited by P. Descola and G. Pálsson, pp. 82-102. London and New York: Routledge.

Descola, P., and G. Pálsson. 1996. "Introduction," in *Nature and Society: Anthropological Perspectives*. Edited by P. Descola and G. Pálsson, pp. 1-21. London and New York: Routledge.

DeSilvey, C. 2006. Observed decay: telling stories with mutable things. *Journal of Material Culture* 11 (3):318-338.

Devi, M. 1995. *Imaginary Maps: Three Stories by Mahasweta Devi (translated and introduced by Gayatri Chakravorty Spivak)*. New York and London: Routledge.

Díaz, C. 1999. Estudio bio-antropológico de rasgos mortuorios de la operación 4 del sitio arqueológico Cerro Juan Díaz, Panamá Central. Unpublished Licenciatura thesis, Universidad de los Andes.

Dickau, R. 2005. Resource Use, Crop Dispersals, and theTransition to Agriculture in Prehistoric Panamá: Evidence from Starch Grains and Macroremains, Temple University.

Dickau, R., A. Ranere, and R. Cooke. 2007. Starch grain evidence for the preceramic dispersal of maize and root crops unto tropical dry and humid forests of Panama. *Proceedings of the National Academy of Sciences* 104 (9):3651-3656.

Dickens, C. 1846. *Pictures from Italy*. Paris: A. and W. Galignant.

Dickinson, W., and W. Snyder. 1979. Geometry of subducted slabs related to San Andreas transform. *Journal of Geology* 87:609-627.

Dillehay, T. 2009. Probing deeper into first American studies. *Proceedings of the National Academy of Sciences* 106 (4):971-978.

Dillian, C. 2007. "Archaeology of fire and glass: Cultural adoption of Glass Mountain obsidian," in *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*, *One World Archaeology Series*. Edited by J. Grattan and R. Torrence, pp. 253-273. Walnut Creek, CA: Left Coast Press.

Dobres, M.-A., and J. Robb. 2000. *Agency in Archaeology*. London: Routledge.

Dollfus, A., and E. de Montserrat. 1868. *Voyage géologique dans les Républiques de Guatémala et de San-Salvador: France, Mission Scientifique au Mexique et dans l'Amérique Centrale*. Paris: Imprimerie Imperiale.

Donnan, C. 1988. Unraveling the mystery of the warrior-priest. *National Geographic* October:551-553.

—. 1990. Masterworks of art reveal a remarkable pre-Inca world. *National Geographic* June:17-33.

—. 1991. Archaeology and looting: Preserving the record. *Science* 251:498.

Douglas, M., and B. Isherwood. 1996 [1979]. *The World of Goods: Towards an Anthropology of Consumption*. London: Routledge.

Douglas, M., and A. Wildavsky. 1982. *Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers*. Berkeley: University of California Press.

Dove, M. 2007. "Volcanic eruption as metaphor of social integration: a political ecological study of Mount Merapi, Central Java," in *Environment, Development and Change in Rural Asia-Pacific: Between Local and Global*. Edited by J. Connell and E. Waddell, pp. 16-37. London: Routledge.

—. 2008. Perception of volcanic eruption as agent of change on Merapi volcano, Central Java. *Journal of Volcanology and Geothermal Research* 172 (3-4):329-337.

Drennan, R. 1991. "Pre-Hispanic chiefdom trajectories in Mesoamerica, Central America, and northern South America," in *Chiefdoms: Power, Economy and Ideology*. Edited by T. Earle, pp. 263-287. Cambridge: Cambridge University Press.

—. 1996. Betwixt and between in the Intermediate Area. *Journal of Archaeological Research* 4 (2):95-131.

Driessen, J., and C. F. McDonald. 2000. "The eruption of the Santorini volcano and its effects on Minoan Crete," in *The Archaeology of Geological Catastrophes*, *Geological Society Special Publication, No. 171*. Edited by J. McGuire, D. Griffiths, P. Hancock, and I. S. Stewart, pp. 81–93. London: The Geological Society

Drolet, R. 1992. "The house and the territory: the organizational structure for chiefdom art in the Diquis subregion of Greater Chiriqui," in *Wealth and Hierarchy in the Intermediate Area*. Edited by F. Lange, pp. 207-241. Washington, D.C.: Dumbarton Oaks Research Library and Collection.

Drooker, P. Editor. 2001. *Fleeting Identities: Perishable Material Culture in Archaeological Research*. *Occasional Papers*. Carbondale: Southern Illinois University.

Drummond, M. S., M. J. Bordelon, J. Z. de Boer, M. J. Defant, H. Bellon, and M. D. Feigenson. 1995. Igneous petrogenesis and tectonic setting of plutonic and volcanic rocks of the Cordillera de Talamanca, Costa Rica–Panama, Central American arc. *American Journal of Science* 295:875-919.

Dugmore, A. J., C. Keller, and T. H. McGovern. 2007. Norse Greenland settlement: reflections on climate change, trade and the contrasting fates of human settlements in the North Atlantic islands. *Arctic Anthropology* 44 (1):12-36.

Dugmore, A. J., L. Larsen, and A. Newton. 2004. "Tephrochronology and its application to late quaternary environmental reconstruction, with special reference to the north Atlantic islands," in *Tools for Constructing Chronologies*. Edited by C. Buck and A. Millards, pp. 173-88. London: Springer-Verlag.

Dugmore, A. J., and A. Newton. 1999. "Tephrochronology at Kebister," in *Kebister: the four thousand year old story of one Shetland township*. Edited by O. Owen and C. Lowe, pp. 70-4. Edinburgh: Society of Antiquaries of Scotland Monograph Series No. 13.

Dugmore, A. J., A. Newton, G. Larsen, and G. Cooke. 2000. Tephrochronology, environmental change and the Norse settlement of Iceland. *Environmental Archaeology* 5:21-34.

Dull, R., J. Southon, and P. Sheets. 2001. Volcanism, ecology and culture: A reassessment of the Volcan Ilopango TBJ eruption in the southern Maya realm. *Latin American Antiquity* 12 (1):25-44.

Earle, T. 1978. *Economic and Social Organization of a Complex Chiefdom: The Haleka District, Hawaii*. Vol. 63. *Anthropological Papers*: University of Michigan.

—. 1982. "Prehistoric Economics and the Archaeology of Exchange," in *Contexts for Prehistoric Exchange*. Edited by J. Erickson and T. Earle, pp. 1-12. New York: Academic Press.

Earle, T., and J. Erickson. 1977. "Exchange Systems in Archaeological Perspective," in *Exchange Systems in Prehistory*. Edited by T. Earle and J. Erickson, pp. 3-12. New York: Academic Press.

Echo-Hawk, R. 2000. Ancient History in the New World: integrating oral traditions and the archaeological record in deep time. *American Antiquity* 65:267-290.

Economides, L. 2005. "Mont Blanc" and the Sublimity of Materiality *Cultural Critique* 61:87-114.

Edensor, T. 2005. *Industrial Ruins: Aesthetics, Materiality, and Memory*. Oxford: Berg.

Edmonds, M. 200. *Ancestral Geographies of the Neolithic*. London: Routledge.

—. 1993. "Interpreting causewayed enclosures in the past and the present," in *Interpretive Archaeology*. Edited by C. Tilley, pp. 99-142. Providence: Berg.

—. 2006. Who Said Romance Was Dead? *Journal of Material Culture* 11:167-188.

Edmonson, M. 1971. *The Book of Counsel: The Popul Vuh of the Quiche Maya of Guatemala*. New Orleans: Middle American Research Institute, Tulane University.

Ellen, R. 1996. "The cognitive geometry of nature: a contextual approach," in *Nature and Society: Anthropological Perspectives*. Edited by P. Descola and G. Pálsson, pp. 103-123. London and New York: Routledge.

Elson, M., and M. Ort. 2003. In the Shadow of the Volcano: Recent Research at Sunset Crater. *Archaeology Southwest* 17:1-11.

Elson, M., M. Ort, K. Anderson, and J. Heidke. 2007. "Living with the volcano: The 11th century AD eruption of Sunset Crater," in *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*, *One World Archaeology Series*. Edited by J. Grattan and R. Torrence, pp. 107-132: Left Coast Press.

Elson, M., M. Ort, J. Hesse, and W. Duffield. 2002. Lava, corn, and ritual in the northern Southwest. *American Antiquity* 67:119-135.

Erickson, J., and T. Earle. 1982. "Production for Obsidian Exchange in California," in *Contexts for Prehistoric Exchange*. Edited by J. Ericson and T. Earle, pp. 129-148. New York: Academic Press.

Escalante, G., and G. Soto. 2007. "History of geology," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 53-74. London: Taylor & Francis.

Espíndola, J. M., J. L. Macias, R. I. Tilling, and M. F. Sheridan. 2000. Volcanic history of El Chichón Volcano (Chiapas, Mexico) during the Holocene, and its impact on human activity. *Bulletin of Volcanology* 62:90-104.

Espinosa, G. d. 1873. Relacion a proceso quel Licenciado Gaspar Despinosa, alcade mayor, hizo en el viaje...desde esta Cibdad de Panama a las provincias comarcanas. *Documentos Ineditos de Indias* 20.

Estadística Panameña. 1973. *Meteorología: Serie L. Año XXXIV*. Dirección de Estadística y Censo. Contraloría General de la República.

—. 1975. *Meteorología: Situación Física, sección 121*. Dirección de Estadística y Censo. Contraloría General de la República.

Farrington, I. 1992. Ritual geography, settlement patterns and the characterization of the provinces of the Inka heartland. *World Archaeology* 23:368-385.

Fausto, C. 2007. Feasting on people: Eating animals and humans in Amazonia. *Current Anthropology* 48:497-530.

Feinman, G., and J. Neitzel. 1984. Too many types: An overview of sedentary prestate societies in the Americas. *Advances in Archaeological Method and Theory* 7:39-102.

Ferguson, T. J. 1996. Native Americans and the practice of archaeology. *Annual Review of Anthropology* 25:63-79.

Fernandez Esquivel, P., and I. Quintanilla. 2003. "Metallurgy and statuary in the Diquís Delta, Costa Rica: Local production of symbols of power," in *Gold and Power in Ancient Costa Rica, Panama, and Colombia*. Edited by J. Quilter and J. Hoopes. Washington, D.C.: Dumbarton Oaks.

Fernández Guardia, R. 1913. *History of the Discovery and Conquest of Costa Rica (translated by Harry Weston van Dyke)*. New York: Thomas Cromwell Company.

Fierstein, J. 2007. Explosive eruptive record in the Katmai region, Alaska Peninsula: an overview *Bulletin of Volcanology* 69:469-509.

Fitzgerald, C. 1999. *Informe para el Ministerio del Patrimonio Cultural*.

Flannery, K. V. 2006. On the Resilience of Anthropological Archaeology. *Annual Review of Anthropology* 35 (1):1-13.

Fleming, A. 2004a. "Explaining Social Change: Studies in Honor of Colin Renfrew," in *McDonald Institute Monographs*. Edited by J. Cherry, C. Scarre, and S. Shennen, pp. 141-147. Cambridge, UK: McDonald Institute for Archaeological Research, University of Cambridge.

—. 2004b. "Hail to the chiefdom? The quest for social archaeology," in *Explaining Social Change: Studies in Honor of Colin Renfrew*, *McDonald Institute Monographs*. Edited by J. Cherry, C. Scarre, and S. Shennen, pp. 141-147. Cambridge, UK: McDonald Institute for Archaeological Research, University of Cambridge.

Flood, J. 2004. "Linkage between rock-art and landscape in Aboriginal Australia," in *The Figured Landscapes of Rock-Art*. Edited by C. Chippindale and G. Nash, pp. 182-200. Cambridge: Cambridge University Press.

Fonseca Zamora, O. 1981. "Guayabo de Turrialba and its significance," in *Between Continents/Between Seas: Precolumbian Art of Costa Rica*. Edited by S. Abel-Vidor, pp. 104-111. New York: Abrams.

Fonseca Zamora, O., and V. Acúña Coto. 1982-3. Los petroglifos de Guayabo de Turrialba y su contexto. *Journal of the Steward Anthropological Society* 14 (1-2).
—. Editors. 1986. *Los petroglifos de Guayabo de Turrialba y su contexto*. Vol. 14 (1-2). *Prehistoric Settlement Patterns in Costa Rica. Journal of the Steward Anthropological Society*.
Fonseca Zamora, O., and S. Chávez Chávez. 2003. Contribución al estudio de la historia antigua del Pacífico sur de Costa Rica: El Sitio Java (CAT.U.C.R. No. 490). *Cuadernos de Antropología* 13:21-62.
Ford, A. 2007. *Maya Forest Garden and El Pilar Coloring Book*. Belize City: National Institute of Culture and History, Belize.
—. 2008. "Plants of the Maya forest and gardens of El Pilar: implications for environmental reconstructions," in *The World Archaeological Congress (WAC-6)*. Dublin.
Foreign Areas Studies Division. 1962. *Area Handbook for Panama*. Washington, DC: Special Operations Research Office, American University.
Forsythe, R. D., and E. P. Nelson. 1985. Geological manifestations of ridge collision: Evidence from the Golfo de Penas-Taitao Basin, southern Chile. *Tectonics* 4:477-495.
Fotiadis, M. 1999. "Comparability, equivalency, and contestation," in *Material Symbols: Culture and Economy in Prehistory*, *Center for Archaeological Investigations Occasional Paper, no. 26*. Edited by J. Robb, pp. 385-398. Carbondale: Southern Illinois University.
Foucault, M. 1995 [1977]. *Discipline and Punish*. Vol. 2nd. New York: Vintage.
Freud, S. 2007 [1917]. *Delusions and Dream* Freud Press.
Friedrich, W., B. Kromer, M. Friedrich, J. Heinemeier, T. Pfeiffer, and S. Talamo. 2006. Santorini eruption radiocarbon dated to 1627-1600 BC. *Science* 312 (5773):548.
Frierson, P. 1991. *The Burning Island: A journey through myth and history in volcano country, Hawai'i*. *Nature and Natural Philosophy Library*. San Francisco: Sierra Club Books.
Frost, R. J. 2009. High Status Cemeteries and Sociopolitical Organization in late pre-Columbian Costa Rica, PhD thesis, University of Wisconsin.
—. *in preparation*. High-status cemeteries and sociopolitical organization in late pre-Columbian Costa Rica, University of Wisconsin.
Fuchs, K. 1882. "Die vulcanischen Ereignisse des Jahres 1882," in *Tschermaks Mineralogische und Petrographische Mitteilungen*, pp. 339-384. Wien: Alfred Hölder.
—. 1887. *Les Volcans et Tremblements de Terre*, 5th edition. *Bibliothèque Scientifique Internationale*. Paris.
Gabb, W. M. 1875. On the Indian Tribes and Languages of Costa Rica. *American Philosophical Society* 14:483-602.
—. 1913 [1874]. "Report of the Talamanca Exploration, made during 1873 and 1874 by W.M. Gabb," in *Documents annexed to the Argument of Costa Rica before the Arbitrator Hon. Edward Douglass White, Chief Justice of the United States*. Edited by W. M. Gabb, pp. 97-142. Rosslyn, VA: The Commonwealth Co.
Gaffney, V., Z. Stancic, and H. Watson. 1995. "The impact of GIS on archaeology: A personal perspective," in *Archaeology and Geographical Information Systems: A European Perspective*. Edited by G. Lock and Z. Stancic, pp. 211-229. London: Taylor and Francis.
Gaillard, J.-C., and C. Dibben. 2008. Volcanic risk perception and beyond. *Journal of Volcanology and Geothermal Research* 172 (3-4):163-169.
Galinat, W. 1980. "The archaeological maize remains from Volcan, Panama - a comparative perspective," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum*

Monographs. Edited by O. Linares and A. Ranere, pp. 175-180. Cambridge: Harvard University Press.

Gaonkar, D. P., and E. Povinelli. 2003. Technologies of Public Forms: Circulation, Transfiguration, Recognition. *Public Culture* 15:385-397.

Garcia, A., and A. Jaén. 1996. *Es Sa' Yilìte: Historias Bribris*. San Jose, Costa Rica: Cooperacion Espanola.

Garcin, Y., D. Williamson, M. Taieb, A. Vincens, P. E. Mathe, and A. Majule. 2006. Centennial to millennial changes in maar-lake deposition during the last 45,000 years in tropical Southern Africa (Lake Masoko, Tanzania) *Palaeogeography Palaeoclimatology Palaeoecology* 239:334-354.

Gehrels, M., D. Lowe, Z. Hazell, and R. M. Newnham. 2006. A continuous 5300-yr Holocene cryptotephrostratigraphic record from northern New Zealand and implications for tephrochronology and volcanic hazard assessment. *The Holocene* 16 (2):173-187.

Gell, A. 1998. *Art and Agency: An Anthropological Theory*. Oxford: Oxford University Press.

Gilchrist, R. 1999. *Gender and Archaeology: Contesting the Past*. London: Routledge.

Gill, R. 1994. The great Maya droughts. PhD, University of Texas.

—. 2000a. *The Great Maya Droughts: Water, LIfe, and Death*. Albuquerque: University of New Mexico Press.

—. 2000b. "Volcanoes and climate," in *The Great Maya Droughts: Water, LIfe, and Death*, pp. 191-248. Albuquerque: University of New Mexico Press.

Gill, R., and J. Keating. 2002. Volcanism and mesoamerican archaeology. *Ancient Mesoamerica* 13:125-140.

Gilli, A., Ariztegui, D., Anselmetti, F. S., McKenzie, J. A., Markgraf, V., Hajdas, I. and McCulloch, R. D. . 2005. Mid-Holocene strengthening of the Southern westerlies in South America - Sedimentological evidences from Lago Cardiel, Argentina (49 degrees S). *Global and Planetary Change* 49:75-93.

Gillings, M., and G. Goodrick. 1996. Sensuous and Reflexive GIS. *Internet Archaeology* 1:http://interarch.ac.uk/journal/issue1/gillings/part1.html.

Given, M., H. Corley, and L. Sollars. 2007. Joining the dots: continuous survey, routine practice and the interpretation of a Cypriot landscape (with interactive GIS and integrated data archive). *Internet Archaeology* 20:http://intarch.ac.uk/journal/issue20/taesp_index.html.

Godelier, M. 1999 [1996]. *The Enigma of the Gift (L'Enigme du don, Librairie Arthème)*. Chicago: University of Chicago Press.

Goetzmann, W. 1995. *New Lands, New Men: America and the Second Great Age of Discovery*. Austin: Texas State Historical Association.

Golledge, R. 2003. "Human wafinding and cognitive maps," in *Colonization of Unfamiliar Landscapes: The Archaeology of Adaptation*. Edited by M. Rockman and J. Steele, pp. 25-43. London and New York: Routledge.

Gonzalez Chaves, A., and F. Gonzales Vasquez. 1989. *Arquetipos simbolicos*. *La casa cosmica Talamanquena y sus simbolismos*: Editorial de la Universidad de Costa Rica.

González Cháves, A., and F. González Vásquez. 1989. *La Casa Cósmica Talamanqueña y sus Simbolismos*. San José, Costa Rica: Editorial de la Universidad de Costa Rica.

Gonzalez, S. 1998. Petroglifos de la Provincia Chiriqui Tesis de Licenciatura, Universidad Autonoma de Chirirqui (UNACHI).

Gonzalez, V., and L. Persson. 1997. Regional Coda Q in Costa Rica, Central America. *Journal of Seismology* 1 (3):269-187.

Gordon, B. L. 1969. *Anthropogeography and Rainforest Ecology in Bocas del Toro Province, Panamá*. Berkeley: Dept. of Geography, University of California.

Gordon, J., F. Belton, W. Cribb, and J. Henry. 2005. Effects of the lunar cycle and changing barometric pressure on the timing and intensity of eruptions at Ol Doinyo Lengai volcano, Tanzania. *Geological Society of America, Abstracts with Programs* 37 (2):35.

Gosden, C. 1994. *Social Being and Time*. Oxford: Blackwell.

—. 2001. "Postcolonial archaeology: issues of culture, identity, and knowledge," in *Archaeological Theory Today*. Edited by I. Hodder, pp. 241-61. Cambridge: Polity Press.

Gosden, C., and G. Lock. 1998. Prehistoric histories. *World Archaeology* 30 (1):2-12.

Gräfe, K., W. Frisch, I. M. Villa, and M. Meschede. 2002. Geodynamic evolution of southern Costa Rica related to low-angle subduction of the Cocos Ridge: constraints from thermochronology *Tectonophysics* 348 (4):187-204.

Graham, M. 1992. "Art-tools and the language of power in the early art of the Atlantic watershed of Costa Rica," in *Wealth and Hierarchy in the Intermediate Area*. Edited by F. Lange, pp. 165-206. Washington, D.C.: Dumbarton Oaks.

Grattan, J., and M. Brayshay. 1995. An amazing and portentous summer: environmental and social responses in Britain to the 1783 eruption of an Iceland volcano. *The Geographical Journal* 161:125-34.

Grattan, J., D. D. Gilbertson, and A. Dill. 2000. "'A fire spitting volcano in our dear Germany': Documentary evidence for a low-intensity volcanic eruption of the Gleichberg in 1783?," in *The Archaeology of Geological Catastrophes*, *Geological Society Special Publication, No. 171*. Edited by J. McGuire, D. Griffiths, P. Hancock, and I. S. Stewart, pp. 307-315. London: The Geological Society

Grattan, J., S. Michnowicz, and R. Rabartin. 2007. "The long shadow: Understanding the influence of the Laki fissure eruption on human mortality in Europe," in *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*, *One World Archaeology Series*. Edited by J. Grattan and R. Torrence, pp. 153-174. Walnut Creek, CA: Left Coast Press.

Grattan, J., and R. Torrence. 2007a. "Beyond gloom and doom: The long-term consequences of volcanic disasters," in *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*, *One World Archaeology Series*. Edited by J. Grattan and R. Torrence, pp. 1-18. Walnut Creek, CA: Left Coast Press.

Grattan, J. P., and D. D. Gilbertson. 1994. Acid-loading from Icelandic Tephra Falling on Acidified Ecosystems as a Key to Understanding Archaeological and Environmental Stress in Northern and Western Britain. *Journal of Archaeological Science* 21:851-859.

Grattan, J. P., and R. Torrence. Editors. 2007b. *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*. *One World Archaeology Series*. Walnut Creek, CA: Left Coast Press.

Gray, H. 1918. *Anatomy of the Human Body, revised and re-edited by Warren Lewis*, 20th edition. Philadelphia: Lea & Febiger (copyrights to the lithograph images are now lapsed to the public domain and are available online at Bartleby.com, 2000).

Griggs, J. 2005. The Archaeology of Central Caribbean Panama. PhD thesis, University of Texas at Austin.

Griggs, J., L. Sánchez H., R. Cooke, C. Díaz, and D. R. Carvajal. 2002. "Recopilación y presentación de datos ambientales y culturales en la región cccidental de la Cuenca del Canal de Panam´a. Tarea 6: Inventario de sitios de recursos culturales y evaluacón del potencial de sitios adicionales. Volumen 2: Informe de los sitios de recursos culturales fuera de las áreas de impacto directo y sitios de recursos culturales dentro de las áreas de impacto directo en las cuencas de los Ríos Caño Sucio e Indio." Unpublished report, Panama CIty: Autoridad del Canal.

Grigore, J. 1992. *The Boquete Navel Orange of Panamá*. Panamá: Panamá Canal Historical Society.

Grosz, E. 2005. *Time Travels: Feminism, Nature, Power*. Durham and London: Duke University Press.

Guerrero, J. V., and F. Solís. 1997. *Los Pueblos Antiguos de la Zona Cañas-Liberia*. San José: Museo Nacional de Costa Rica.

Guidoboni, E., and C. Ciuccarelli. 2008. First historical evidence of a significant Mt. Etna eruption in 1224. *Journal of Volcanology and Geothermal Research (in press)*.

Gunderson, A. 2007. "Your second home: real estate tours; house-hunting as vacation, October 12," in *The New York Times*. New York.

Gutscher, M.-A., R. Maury, J.-P. Eissen, and E. Bourdon. 2000. Can slab melting be caused by flat subduction? *Geology* 28 (6):535-538.

Haberland, W. 1957. Excavations in Costa Rica and Panama. *Archaeology* 10:258-263.

—. 1958. notes and news: Chiriqui fieldwork planned. *American Antiquity* 24 (2):227.

—. 1959. Chiriquian pottery types. *Panamá Archaeologist* 2 (1):52-55.

—. 1960. Villalba: a preliminary report. *Panama Archaeologist* 3 (1):7-21.

—. 1961a. *Archäeologische Untersuchungen in der Provinz Chiriquí, Panamá*. Vol. 3. *Acta Humboldtiana, Series Geographica et Ethnographica*. Wiesbaden: Franz Steiner Verlag.

—. 1961b. New names for Chiriquian pottery types. *Panama Archaeologist* 4:56-60.

—. 1963. Current Research: Central America. *American Antiquity* 29 (1):140-1.

—. 1965. Current Research:. *American Antiquity* 31 (1):136-8.

—. 1968. Las figuras líticas de Barriles. *Boletín del Museo Chiricano del Colegio Félix Olivares* 6 (May):8-13.

—. 1973. "Stone sculpture from southern Central America," in *The Iconography of Middle American Sculpture*. Edited by D. Easby. New York: Metropolitan Museum of Art.

—. 1983. Review of Adaptive Radiations in Prehistoric Panama. *American Antiquity* 48 (2):419-420.

—. 1984a. "The archaeology of Greater Chiriqui," in *The Archaeology of Lower Central America*. Edited by F. Lange and D. Stone, pp. 233-254. Albuquerque: University of New Mexico Press.

—. 1984b. "The Valle del General and Panamanian Chiriqui: Temporal and regional differences," in *Inter-Regional Ties in Costa Rica Prehistory*, vol. 226, *British Archaeological Reports International Series*. Edited by E. Skirboll and W. Creamer, pp. 261-276. Oxford.

Haberle, S. G., and K. D. Bennett. 2004. Postglacial formation and dynamics of North Patagonian Rainforest in the Chonos Archipelago, southern Chile. *Quaternary Science Reviews* 23:2433-2452

Habermas, J. 1989. *The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society*. Cambridge: MIT Press.

Haberzettl, T., H. Corbella, M. Fey, S. Janssen, A. Lücke, C. Mayr, C. Ohlendorf, F. Schäbitz, G. Schleser, M. Wille, S. Wulf, and B. Zolitschka. 2007. Lateglacial and Holocene wet–dry cycles in southern Patagonia: chronology, sedimentology and geochemistry of a lacustrine record from Laguna Potrok Aike, Argentina. *The Holocene* 17 (3):297-310.

Hack, W. 1685. "The bay of Chiriqui," in *A Wagoner of the South Sea describeing [sic] the sea coast from acapulco to Albermarle isle. Bound sheet, 40.5 x 50 cm. English translation of a Spanish derrotero captured from the Spanish ship 'Rosario' by Captain Bartholomew Sharpe in 1680*. London: Wapping.

Haflidason, H., J. Eiriksson, and S. van Kreveld. 2000. The tephrochronology of Iceland and the North Atlantic region during the Middle and Late Quaternary: a review. *Journal of Quaternary Science* 15 (1):3-22.

Halbwachs, M. 1980 [1950]. *The Collective Memory (Le Memoire Collective)*. New York: Harper & Row Colophon Books.

Hall, C., and H. Pérez Brignoli. 2003. *Historical Atlas of Central America*. Norman: University of Oklahoma Press.

Hall, M. 2001. Social archaeology and the theatres of memory. *Journal of Social Archaeology* 1:50-61.

Hall, M. L., P. Samaniego, J. Le Pennec, and J. Johnson. 2008. Ecuadorian Andes volcanism: A review of Late Pliocene to present activity. *Journal of Volcanology and Geothermal Research (in press)*.

Hall, V. 2003. Assessing the impact of Icelandic volcanism on vegetation systems in the north of Ireland in the fifth and sixth millennia BC. *The Holocene* 13 (1):131-138.

Haller, M. 2004. The emergence and development of chiefly societies in the Rio Parita valley, Panama. PhD, University of Pittsburgh.

Hamilton, S. W. 1776. *Campi Phlegraei: Observations on the volcanos of the two Sicilies as they have been communicated to the Royal Society of London*. Naples.

—. 1998 [1776]. *Campi Phlegraei: Observations on the volcanos of the two Sicilies as they have been communicated to the Royal Society of London / by William Hamilton ... To which, in order to convey the most precise idea of each remark, a new and accurate map is annexed, with 54 plates illuminated from drawings taken and colour'd after nature, under the inspection of the author, by the editor Mr. Peter Fabris*, Sonderausgabe edition. Vol. 3, Supplement to the Campi Phlegraei (an account of the eruption of Vesuvius of August 1779). Graz: ABB-Art Buchbinderei Dr. Struckl.

Hamilton, T. 1967. *Process and Pattern in Evolution*. New York: Macmillan.

Handwerk, B. 2002. "Are Volcanic Eruptions Tied to Lunar Cycle?," http://news.nationalgeographic.com/news/2002/02/0215_020215_volcanohunter.html edition, vol. accessed February 13, 2004: National Geographic News.

Hansen, K. T. 2003. Fashioning Zambian moments. *Journal of Material Culture* 8 (3):301-9.

Harangi, S., P. R. D. Mason, and R. Lukacs. 2005. Correlation and petrogenesis of silicic pyroclastic rocks in the Northern Pannonian Basin, Eastern-Central Europe: In situ trace element data of glass shards and mineral chemical constraints *Journal of Volcanology and Geothermal Research* 143:237-257.

Haraway, D. 1991. *Simians, Cyborgs, and Women: The Re-Invention of Nature*. London: Free Association.

—. 2003. *The Companion Species Manifesto: Dogs, People, and Significant Otherness*. Chicago: Prickly Paradigm Press.

Hardesty, D. 2007. Perspectives on global-change archaeology. *American Anthropologist* 109 (1):1-7.

Harpel, C., P. R. Kyle, and N. Dunbar. 2008. Englacial tephrostratigraphy of Erebus volcano, Antarctica. *Journal of Volcanology and Geothermal Research (in press)*.

Harris, R. 2003. *Pompeii*. New York: Random House.
Harry, D., and N. Green. 1999. Slab dehydration and slab petrogenesis in subduction systems involving very young oceanic lithosphere. *Chemical Geology* 160:309-333.
Harte, E. 1959. Petroglyphs in Panamá. *Panamá Archaeologist* 2(1):58-69.
Harte, N. 1960. *Panorama of Panama Petroglyphs*. Canal Zone, Panamá: Curundu.
Harvey, D. 1984. On the history and present condition of geography: an historical materialist manifesto. *The Professional Geographer* 36 (1):1-11.
—. 1996. *Justice, Nature, and the Geography of Difference*. Cambridge, MA: Blackwell Publishers.
—. 1998. The Humboldt Connection. *Annals of the Association of American Geographers* 88 (4):723-730.
—. 2000. Cosmopolitanism and the banality of geographical evils. *Public Culture* 12 (2):529-564.
Haug, G., D. Gunther, L. Peterson, D. Sigman, K. Hughen, and B. Aeschlimann. 2003. Climate and the collapse of Maya civilization. *Science* 299:1731-1735.
Haug, G., and R. Tiedmann. 1998. Effect of the formation of the isthmus of Panama on Atlantic Ocean thermohaline circulation. *Nature* 393:673-676.
Hawkins, G., and S. Muecke. Editors. 2003. *Culture and Waste: The Creation and Destruction of Value*. Lanham, MD: Rowman & Littlefield.
Hbobat, K. 2007. Use of oral tradition in archaeology: the case of Ajdovšina Above Rodik, Slovenia. *European Journal of Archaeology* 10 (1):31-56.
Head, L. 2008. Is the concept of human impacts past its use-by date? *Holocene* 18 (3):373-377.
Heckadon-Moreno, S. 1997. "Spanish rule, independence, and the modern colonization frontiers," in *Central America: A Natural and Cultural History*. Edited by A. Coates, pp. 177-214. New Haven and London: Yale University Press.
Heckenberger, M. 2004. *The Ecology of Power; Culture, Place and Personhood in the Southern Amazon, AD 1000-2000 Critical Perspectives in Identity, Memory and the Built Environment*. New York: Routledge.
Heckenberger, M., A. Kuikuro, U. T. Kuikuro, J. C. Russell, and M. Scmidt. 2003. Amazonia 1492: Pristine Forest or Cultural Parkland? *Science* 301:1710-14.
Heidegger, M. 1978. "Building, Dwelling, Thinking," in *Martin Heidegger: Basic Writings from 'Being and Time' (1927) to 'The Task of Thinking'*. Edited by D. F. Krell, pp. 319-40. London: Routledge and Kegan Paul.
Held, D. 1995. *Democracy and the Global Order: From the Modern State to Cosmopolitan Governance*. Stanford, CA: Stanford University Press.
Helferich, G. 2004. *Humboldt's Cosmos: Alexander von Humboldt and the Latin American Journey that Changed the Way We See the World*. New York: Gotham Books.
Helms, M. 1979. *Ancient Panama: Chiefs in Search of Power*. Austin: University of Texas Press.
—. 1988. *Ulysses Sail*. Austin: University of Texas Press.
—. 1993. *Craft and the Kingly Ideal: Art, Trade, and Power*. Austin: University of Texas Press.
Hendon, J. 1999. "Multiple sources of prestige and the social evaluation of women in prehispanic Mesoamerica " in *Material Symbols: Culture and Economy in Prehistory, Center for Archaeological Investigations, Occasional Paper, 26*. Edited by J. Robb, pp. 257–276. Carbondale: Southern Illinois University.
Herrstrom, E. A., M. K. Reagan, and J. D. Morris. 1995. Variations in lava composition associated with flow of asthenosphere beneath southern Central America. *Geology* 23:617-620.

Hetherington, K. 2004. Secondhandedness: consumption, disposal, and absent presence. *Society and Space* 22 (1):157-173.
Hidalgo, P., G. Alvarado, and L. Linkimer. 2004. La *lavina* del Valle Central (Costa Rica): lahar o *debris avalanche*? *Revista Geológica de América Central* 30:101-109.
Hill, M. 2007. Contesting patrimony: Cusco's mystical tourist industry and the politics of *Incanismo*. *Ethnos* 72 (4):433-460.
Hillenbrand, C. D., S. G. Moreton, A. Caburlotto, C. J. Pudsey, R. G. Lucchi, J. L. Smellie, S. Benetti, H. Grobe, J. B. Hunt, and R. D. Larter. 2008. Volcanic time-markers for Marine Isotopic Stages 6 and 5 in Southern Ocean sediments and Antarctic ice cores: implications for tephra correlations between palaeoclimatic records *Quaternary Science Reviews* 27:518-540
Himmelheber, H. 1993. *Eskimo Artists*. Fairbanks: University of Alaska Press.
Hinchliffe, S. 2003. ""Inhabiting": Landscapes and natures," in *Handbook of Cultural Geography*. Edited by K. Anderson, M. Domosh, S. Pile, and N. Thrift, pp. 207-25. London: Sage.
Hirsch, E. 1995. "Landscape: between place and space," in *The Anthropology of Landscape: Perspectives on Place and Space*. Edited by E. Hirsch and M. O'Hanlon, pp. 1-30. Oxford: Clarendon Press.
—. 2006. Landscape, Myth and Time. *Journal of Material Culture* 11:151-65.
Hobsbawm, E. 1983. "Introduction," in *The Invention of Tradition*. Edited by E. Gobsbawm and T. Ranger, pp. 1-14. Cambridge: Cambridge University Press.
Hodder, I. 1986. *Reading the Past: Current Approaches to Interpretation in Archaeology*, 2 edition. Cambridge: Cambridge University Press.
—. 1987. "The contribution of the long term," in *Archaeology as Long-Term History*. Edited by I. Hodder, pp. 1-8. Cambridge: Cambridge University Press.
Hodell, D. A., M. Brenner, J. H. Curtis, and T. Guilderson. 2001. Solar forcing of drought frequency in the Maya lowlands. *Science* 292.
Hodell, D. A., J. H. Curtis, G. Jones, A. HIguera-Gundy, M. Brenner, M. W. Binford, and K. Dorsey. 1995. Possible role of climate in the collapse of Classic Maya civilization. *Nature* 375:391-94.
Hoffman, D. 2005. Violent events as narrative blocks: the disarmament at Bo, Sierra Leone. *Anthropology Quarterly* 78 (2):329-353.
Hoffman, S. 1999. "After Atlas shrugs: cultural change or persistence after a disaster," in *The Angry Earth: Disaster in Anthropological Perspective*. Edited by A. Oliver-Smith and S. Hoffman, pp. 302-325. London: Routledge.
Hoffman, S., and A. Oliver-Smith. Editors. 2002. *Catastrophe and Culture: The Anthropology of Disaster*. *School of American Research Advanced Seminar Series*. Santa Fe, NM: School of American Research Press.
Hogg, A. G., T. F. G. Higham, D. J. Lowe, J. G. Palmer, P. J. Reimer, and R. M. Newnham. 2003. A wiggle-match date for Polynesian settlement of New Zealand. *Antiquity* 77:116-125.
Hohmann, H. 1996. Review: Creations of the Rainbow Serpent by Mary Helms. *Latin American Antiquity* 7:374-5.
Hole, M. J. 1988. Post-subduction alkaline volcanism along the Antarctic Peninsula. *Journal of the Geological Society of London* 145:985-998.
Holmberg, K. 2005. "The voices of stones: unthinkable materiality in the volcanic context of western Panamá," in *Archaeologies of Materiality*. Edited by L. Meskell, pp. 190-211: Blackwell Publishing.

—. 2007a. "Beyond the catastrophe: The volcanic landscape of Barú, western Panamá," in *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*, *One World Archaeology Series*. Edited by J. Grattan and R. Torrence, pp. 274-297. Walnut Creek, CA: Left Coast Press.

—. 2007b. "Curiouser cabinets: collections of heritage and material culture in highland Panamá," in *40th Annual Society for Historical Archaeology Meeting*. Williamsburg, VA. January 10-14.

Holmes, W. H. 1887. *The use of gold and other metals among the ancient inhabitants of Chiriqui, Isthmus of Darien*. Washington, D.C.: Gov't print. off.

—. 1888. "Ancient Art of the Province of Chiriqui, Colombia," in *Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution*, vol. Six (1884-85). Edited by J. W. Powell, pp. 13-187. Washington, D.C.: Government Printing Office.

Hoopes, J. 1992. "Early formative cultures in the Intermediate Area: a background to the emergence of social complexity," in *Wealth and Hierarchy in the Intermediate Area*. Edited by F. Lange, pp. 43-83. Washington, D.C.: Dumbarton Oaks.

—. 1996a. Reviews and book notes: Creations of the Rainbow Serpent. *Latin American Antiquity* 7:374-375.

—. 1996b. "Settlement, subsistence, and the origins of social complexity in Greater Chiriqui: a reappraissal of the Aguas Buenas tradition," in *Paths to Central American Prehistory*. Edited by F. Lange, pp. 15-48. Niwot: University Press of Colorado.

—. 2005. The emergence of social complexity in the Chibchan world of southern Central America and Northern Colombia, AD 300-600. *Journal of Archaeological Research* 13 (1):1-47.

Horn, S. 2007. "Late Quaternary lake and swamp sediments: Climate and environment," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado. London: Taylor & Francis.

—. in press. "Pre-Columbian maize agriculture in Costa Rica: pollen and other evidence from lake and swamp settlements," in *Histories of Maize: Multidisciplinary approaches to the prehistory, biogeography, domestication, and evolution of maize*. Edited by J. Staller, R. Tykot, and B. Benz. San Diego, CA: Elsevier Press.

Horn, S., and L. M. Kennedy. 2001. Pollen evidence of maize cultivation 2700 BP at La Selva Biological Station, Costa Rica. *Biotropica* 33 (1) 191-196.

Horn, S., and R. Sanford Jr. 1992. Holocene fires in Costa Rica. *Biotropica* 24 (3):354-361.

Horrocks, M., P. Augustinus, Y. B. Deng, P. Shane, and S. Andersson. 2005a. Holocene vegetation, environment, and tephra recorded from Lake Pupuke, Auckland, New Zealand. *New Zealand Journal of Geology and Geophysics* 48:85-94

Horrocks, M., S. L. Nichol, D. M. D'Costa, P. Shane, and C. Prior. 2005b. Palaeoenvironment and human impact in modifying vegetation at Mt St John, Auckland Isthmus, New Zealand *New Zealand Journal of Botany* 43:211-221.

Horrocks, M., S. L. Nichol, D. M. D'Costa, P. Augustinus, T. Jacobi, P. A. Shane, and A. Middleton. 2007. A late quaternary record of natural change and human impact from Rangihoua Bay, Bay of Islands, northern New Zealand. *Journal of Coastal Research* 23:592-604.

Hoskins, J. 1993. *The Play of Time: Kodi Perspectives on Calendars, History, and Exchange*. Berkeley: University of California Press.

—. 1998. *Biographical Objects*. London: Routledge.

Houghton, J., and B. Bell. 2004. *Latin American indigenous movements in the context of globalization (http://www.globalpolicy.org/globaliz/special/2004/1011indigenous.htm)*. Interhemispheric Resource Center, Global Policy Forum of the United Nations.
Hrobat, K. 2007. Use of oral tradition in archaeology: the case of Ajdovšina Above Rodik, Slovenia. *European Journal of Archaeology* 10 (1):31-56.
Hulme, M. 2008. The conquering of climate: discourses of fear and their dissolution. *The Geographical Journal* 174 (1):5-16.
Humboldt, A. v. 1831. *Fragmens de Géologie et de Climatologie Asiatiques*. Paris: A. Pihan Delaforest.
—. 1852-3. *Personal Narrative of Travels to the Equinoctial Regions of America, 1799-1804*, translated by Thomasina Ross; orig. published in French between 1814 and 1825 edition. Vol. 1-3. London: Henry G. Bohn.
—. 1861. *Kosmos*. Vol. 4. Stuttgart: Krais & Hoffman.
—. 1997 [1851]. *Cosmos: A Sketch of a Physical Description of the Universe. translated from German by E.C. Otté*. Stark, Kansas: De Young Press.
Hunt, J. B. 2004. Tephrostratigraphical evidence for the timing of pleistocene explosive volcanism at Jan Mayen. *Journal of Quaternary Science* 19 (2):121-136.
Hurtado de Mendoza, L. 2004. *Guayabo: Historia Antigua de Turrialba*. San José, Costa Rica: Tibás: Litografia e Imprenta LiL.
Huyssen, A. 1993. "Mapping the Postmodern," in *A Postmodern Reader*. Edited by J. Natoli and L. Hutcheon, pp. 105-156. Albany: SUNY Press.
Hviding, E. 1996. "Nature, culture, magic, science: on meta-languages for comparison in cultural ecology," in *Nature and Society: Anthropological Perspectives*. Edited by P. Descola and G. Pálsson, pp. 165-184. London and New York: Routledge.
Hyslop, J. 1990. *Inka Settlement Planning*. Austin: University of Texas Press.
Ichon, A. 1968a. Le probleme de la ceramique de Barriles. *Boletín del Museo Chiricano del Colegio Félix Olivares* 6 (May):15-25.
—. 1968b. Le probleme de la ceramique de Barriles. *Boletin del Museo Chiricano* 6:15-24.
Igoe, J. 2004. *Conservation and Globalisation: A Study of National Parks and Indigenous Communties from East Africa to South Dakota*. Belmont, CA: Wadsworth/Thomson Learning.
Ingold, T. 1993. The Temporality of the Landscape. *World Archaeology* 25:152-174.
—. 2000. "To journey along a way of life: Maps, wayfinding and navigation," in *The Perception of the Environment: Essays in Livelihood, Dwelling, and Skill*, pp. 219-242. London and New York: Routledge.
Ingold, T., and E. Hallam. 2007. "Creativity and cultural improvisation: an introduction," in *Creativity and Cultural Improvisation*. Edited by E. Hallam and T. Ingold, pp. 1-24. Oxford; New York: Berg.
Instituto de Recursos Hidraulicos y Electrificacion (IHRE). 1987. *Final report on the reconnaissance study of geothermal resources in the Republic of Panama*. Instituto de Recursos Hidraulicos y Electrificacion - InterAmerican Development Bank - Organización Latinoamericana de Energía (IRHE - IDB - OLADE), Panama City, Panama and Quito, Ecuador.
IRHE. 1987. *Instituto de Recursos Hidraulicos y Electrificacion. Final report on the reconnaissance study of geothermal resources in the Republic of Panama*. Instituto de Recursos Hidraulicos y Electrificacion - InterAmerican Development Bank - Organización

Latinoamericana de Energía (IRHE - IDB - OLADE), Panama City, Panama and Quito, Ecuador.
Isaacson, J., and J. Zeidler. 1998. "Accidental history: volcanic activity and the end of the Formative in Northwestern Ecuador," in *Actividad Volcanica y Pueblos Precolombinos en el Ecuador*. Edited by P. Mothes, pp. 41-72. Quito: Abya-Yala.
Isaza Aizpurua, I. I. 2007. The Ancestors of Parita: Pre-Columbian Settlement Patterns in the Lower La Villa River Valley, Azuero Peninsula, Panama. PhD, Boston University.
Islebe, G. A., H. Hooghiemstra, M. Brenner, J. H. Curtis, and D. A. Hodell. 1996. "A Holocene vegetation history from lowland Guatemala," vol. 63, pp. 200.
Jashemski, W., and F. Meyer. Editors. 2002. *The Natural History of Pompeii*. Cambridge: Cambridge University Press.
Jensen, W. H. 2001 [1903]. *Gradiva: A Pompeiian Fantasy (Gradiva: Ein Pompejanisches Phantasiestuck)*. Boston: Adamant Media.
Johnson, M. 2009. "Common sense is not enough," in *Archaeological Theory: An Introduction*, 2nd edition. Oxford, UK and Malden, MA: Blackwell.
Johnston, S., and D. Thorkelson. 1997. Cocos-Nazca slab window beneath Central America. *Earth and Planetary Science Letters* 146:465-474.
Joly Adames, L. G. 2005. *Lenguaje y Literatura Ngöbe/Ngäbe*. David, Panamá: Rapi Impresos.
—. 2007. *Conoce el Arte Rupestre en Panamá*. David, Panamá: Alianza Estratégica para la Conservación y la Divulgación del Arte Rupestre en Panamá.
Jones, A. 2001. "Drawn from memory": The archaeology of aesthetics and the aesthetics of archaeology in Earlier Bronze Age Britain and the present. *World Archaeology: Archaeology and Aesthetics* 33:334-356.
Jones, M. 2005. "Environmental archaeology," in *Archaeology: The Key Concepts*. Edited by C. Renfrew and P. Bahn, pp. 85-9. London: Routledge.
Jopling, C. Editor. 1994. *Indios y Negros en Panama en los Siglos XVI y XVII: Selecciones de los documentos del Archivo General de Indias*. Vol. 7. South Woodstock, VT: Plumsock Mesoamerican Studies and Antigua, Guatemala: Centro de Investigaciones Regionales de Mesoamerica.
Journet, N. 1995. *La Paix des Jardins: Structures Sociales des Indiens Curripaco du Haut Rio Negro (Colombie)*. Paris: Institut d'Ethnologie, Musée de l'Homme.
Joyce, R. 2000. "Heirlooms and Houses: Materiality and Social Memory," in *Beyond Kinship: Social and Material Reproduction in House Societies*. Edited by R. Joyce and S. Gillespie, pp. 189-212. Philadelphia: University of Philadelphia Press.
—. 2001. *Gender and Power in Prehispanic Mesoamerica*. Austin: University of Texas Press.
—. 2003. "Concrete Memories: Fragments of the Past in the Classic Maya Present (500-1000 AD)," in *Archaeologies of Memory*. Edited by R. Van Dyke and S. Alcock, pp. 104-125. Malden, MA: Blackwell.
Joyce, T. 1916a. *Central American and West Indian Archaeology*. London: Philip Lee Warner.
—. 1916b. *Central American and West Indian Archaeology, Being an Introduction to the Archaeology of the States of Nicaragua, Costa Rica, and the West Indies*. New York: Putnam.
Karsten, H. 1858 [1947]. Mapa geológico de la Gran Colombia. *Reproduced in: Revista de la Academia Colombiana de Ciencias Exactas, Físicas y Naturales* VII:27.
Kehoe, A. B. 1998. *The Land of Prehistory*. London: Routledge.

Kellog, J., J. Oguijiofor, and D. Kansakar. 1985. "Cenezoic tectonics of the Panama and the north Andes blocks." *Memoirs of the 6th Latin American Geological Congress, Bogotá, Colombia, 1985*, pp. 1-40.

Kellog, J., and V. Vega. 1995. "Tectonic development of Panama, Costa Rica, and the Colombian Andes: constraints from global positioning system geodetic studies and gravity," in *Geologic and Tectonic Development of the Caribbean Plate Boundary in Southern Central America*, *Geological Society of America Special Paper, 295*. Edited by P. Mann, pp. 57-74. Boulder, CO: Geological Society of America.

Kennedy, L., and S. Horn. 1997. Prehistoric maize cultivation at the La Selva Biological Station, Costa Rica. *Biotropica* 29:368-370.

Kenoyer, M. 2004. *Sarang and Jeevi: A coloring book story of the ancient Indus Valley (published in Urdu)*. Karachi: Oxford University Press.

Kilian, R., M. Hohner, H. Biester, H. Wallrage-Adams, and C. Stern. 2003. Holocene peat and lake sedient tephra record from the southernmost Chilean Andes (53-55 degrees S). *Revista Geológica de Chile* 30 (1):23-37.

King, C. 1878. *Systematic Geology*. Vol. 1: Report of the US Geological Exploration of the Fortieth Parallel. Washington, D.C.: Government Printing Office.

Kirby, M. A., D. Jones, and B. MacFadden. 2008. Lower Miocene stratigraphy along the Panama Canal and its bearing on the Central American Peninsula. *PLoS ONE (Public Library of Science)* 3 (7).

Knapp, B. Editor. 1992. *Archaeology, Annales, and Ethnohistory*. Cambridge, New York: Cambridge University Press.

Knight, P. Editor. 2006. *Glacier Science and Environmental Change*. Oxford: Blackwell.

Kobayashi, T., I. Nairn, V. Smith, and P. Shane. 2005. Proximal stratigraphy and event sequence of the c.5600 cal. yr BP Whakatane rhyolite eruption episode from Haroharo volcano, Okataina Volcanic Centre, New Zealand. *New Zealand Journal of Geology and Geophysics* 48:471-490.

Kolman, C., E. Bermingham, R. Cooke, R. H. Ward, T. Arias, and F. Guionneau-Sinclair. 1995. Reduced mtDNA diversity in the Ngobe Amerinds of Panama. *Genetics* 140:275-283.

Kopytoff, I. 1986. "The cultural biography of things: commoditization as a process," in *The Social Life of Things*

Edited by A. Appadurai, pp. 64-91. Cambridge: Cambridge University Press.

Kottak, C. 1971. Cultural adaptation, kinship and descent in Madagascar. *Southwestern Journal of Anthropology* 27:129-47.

—. 1972. "A cultural adaptive approach to Malagasy political organization," in *Social Exchange and Interaction*, *Anthropological Papers no. 46*. Edited by E. Wilmsen. Ann Arbor: University of Michigan.

Koyen, J. 2007. "The Costa Rica experience moves next door, August 19," in *The New York Times*. New York.

Kraul, C. 2007. "A friendly town among the hills," in *The Los Angeles Times*. Los Angeles.

Kreimer, A. Editor. 2003. *Building Safer Cities: The Future of Disaster Risk*. Washington, D.C. : The World Bank.

Kristiansen, K., and M. Rowlands. Editors. 1998. *Social Transformations in Archaeology: Global and Local Perspectives*. London: Routledge.

Kristjánsdóttir, G. B., J. Stoner, A. Jennings, J. Andrews, and K. Grönvold. 2007. Geochemistry of Holocene cryptotephras from the North Iceland Shelf (MD99-2269): intercalibration with radiocarbon and palaeomagnetic chronostratigraphies. *Holocene* 17:155-176.

Künne, M. 2003. "Arte rupestre de Panama," in *Arte rupestre de Mexico oriental y centro america*, vol. 16, *Indiana*. Edited by M. Kunne and M. Strecker, pp. 223-239. Berlin: Gebr. Mann Verlag.

—. 2005. "Nuevos estudios y enfoques sobre los petrograbados de Panamá," in *Boletín de Sociedad de Investigacion del arte rupestre de Bolivia*, vol. 19, pp. 24-27. La Paz, Bolivia: Sociedad de Investigaciones del Arte Rupestre de Bolivia.

—. 2006. "Zone I: Central America," in *Rock Art of Latin America and the Caribbean. Thematic Study*, pp. 11-42. Paris: UNESCO-ICOMOS.

—. 2008a. "Arte rupestre de Panamá," in *Arte Rupestre de México Oriental y América Central*. Edited by M. Kunne and M. Strecker, pp. 241-257. La Paz, Bolivia: Sociedad de Investigacion del Arte Rupestre de Bolivia.

—. 2008b. "Rock art research in Eastern Mesoamerica and Lower Central America," in *Rock Art Studies: News of the World*. Edited by P. Bahn, N. Franklin, and M. Strecker, pp. 215-232. Oxford, UK: Oxbow.

Künne, M., and I. Beilke-Voigt. in prep. Mito y realidad: una excavación arqueológica en el sitio Barriles (Panamá) y sus consecuencias sociales. *Vinculos* 32 (1-2).

—. nd. Mito y realidad: una excavación arqueológica en el sitio Barriles (Panamá) y sus consecuencias sociales. *Revista de Historia de Nicaragua y Centroamérica* 19.

Künne, M., I. Beilke-Voigt, and K.-U. Voigt. 2000. "Petroglyphs in the northern part of the General Valley in Costa Rica (Central America): Their situation in different landscapes," in *BAR International Series*, vol. 902. Edited by G. Nash, pp. 131-141. Oxford, England: Archaeopress.

Künne, M., and M. Strecker. Editors. 2003. *Arte Rupestre de Mexico Oriental y Centro America (Rock art of East Mexico and Central America)*. Vol. 16. *Indiana Beihefte/Ibero-Amerikanisches Institut*. Berlin: Gebr. Mann Verlag.

—. Editors. 2008. *Arte Rupestre de México Oriental y América Central*. La Paz, Bolivia: Sociedad de Investigacion del Arte Rupestre de Bolivia.

Kutterolf, S., U. Schacht, H. Wehrmann, A. Freundt, and T. Mörz. 2007. "Onshore to offshore tephrostratigraphy and marine ash diagenesis," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 395-418. London: Taylor & Francis.

Lachniet, M. S., S. J. Burns, D. R. Piperno, Y. Asmerom, V. J. Polyak, C. M. Moy, and K. Christenson. 2004. A 1500-year El Niño/Southern Oscillation and rainfall history for the Isthmus of Panama from speleothem calcite. *Journal of Geophysical Research* 109 (D20117).

Ladd, J. 1964. *Archaeological Investigations in Parita and Santa Maria Zones of Panama*. Vol. Bulletin 193. Washington, D.C.: Bureau of American Ethnology.

Lane, C., S. Horn, and C. Mora. 2004. Stable Carbon Isotope Ratios in Lake and Swamp Sediments as a Proxy for Prehistoric Forest Clearance and Crop Cultivation in the Neotropics. *Journal of Paleolimnology* 32 (4):375–381.

Lane, C., S. Horn, Z. Taylor, and C. Mora. in press Assessing the scale of prehistoric human impact in the neotropics using stable carbon isotope analyses of lake sediments: a test case from Costa Rica. *Latin American Antiquity* xx (xx):xx.

Lange, F. 1984. "Cultural Geography of Precolumbian Lower Central America," in *The Archaeology of Lower Central America*. Edited by F. Lange and D. Stone, pp. 33-60. Albuquerque: University of New Mexico Press.
—. 1992. "Summary: Perspectives on wealth and hierarchy in the Intermediate Area," in *Wealth and Hierarchy in the Intermediate Area*. Edited by F. Lange, pp. 423-444. Washington, D.C.: Dumbarton Oaks.
—. 1996a. "Gaps in our databases and blanks in our syntheses: the potential for Central American archaeology in the twenty-first century," in *Paths to Central American Prehistory*. Edited by F. Lange, pp. 305-326. Niwot: University Press of Colorado.
—. Editor. 1996b. *Paths to Central American Prehistory*. Niwot: University Press of Colorado.
Lange, F., and D. Stone. 1984. "Introduction," in *The Archaeology of Lower Central America*. Edited by F. Lange and D. Stone, pp. 3-12. Albuquerque: University of New Mexico Press.
Larsen, G., J. Eiriksson, K. L. Knudsen, and J. Heinemeier. 2002. Correlation of late Holocene terrestrial and marine tephra markers, north Iceland: implications for reservoir age changes *Polar Research* 21:283-290
Lathrap, D. 1973. The antiquity and importance of long distance trade relationships in the moist tropics of pre-Colombian South America. *World Archaeology* 5:170-186.
Latour, B. 1991. *We Have Never Been Modern*. Cambridge: Harvard University Press.
—. 1993. *We Have Never Been Modern*. Cambridge: Harvard University Press.
—. 2004. *Politics of Nature, translated by Catherine Porter*. Cambridge, MA: Harvard University Press.
—. 2005. *Reassembling the Social: An Introduction to Actor-Network-Theory*. *Clarendon lectures in management studies*. Oxford; New York: Oxford University Press.
—. 2007a. "A Plea for Earthly Sciences (http://www.bruno-latour.fr/articles/article/102-BSA-GB.pdf)," in *The Annual Meeting of the British Sociological Association*. East London.
—. 2007b. *Reassembling the Social: An Introduction to Actor-Network-Theory*. *Clarendon Lectures in Management Studies*: Oxford University Press.
Layton, R., and P. Ucko. 1999. "Introduction: Gazing on the landscape and encountering environment," in *The Archaeology and Anthropology of Landscape: Shaping Your Landscape*. Edited by P. Ucko and R. Layton, pp. 458-482. London: Routledge.
Lazzari, M. 2003. Archaeological Visions: Gender, Landscape and Optic Knowledge. *Journal of Social Archaeology* 3:194-222.
Le Pennec, J., D. Jaya, P. Samaniego, P. Ramón, S. Moreno Yánez, J. Egred, and J. Van der Plicht. 2008. The AD 1300–1700 eruptive periods at Tungurahua volcano, Ecuador, revealed by historical narratives, stratigraphy and radiocarbon dating. *Journal of Volcanology and Geothermal Research*.
Le Roy Ladurie, E. 1974. *The Peasants of Languedoc*. Urbana: University of Illinois Press.
Lee, B., and E. LiPuma. 2002. Cultures of Circulation: The Imaginations of Modernity. *Public Culture* 14:191-213.
Leeman, W., and M. J. Carr. 1995. "Geochemical constraints in subduction processes in the Central American Volcanic Arc: Implications of boron chemistry," in *Geologic and Tectonic Development of the Caribbean Plate Boundary in Southern Central America*, *GSA Special Paper 295*. Edited by P. Mann, pp. 57-74.
Lefebvre, H. 1991. *The Production of Space*. Oxford: Basil Blackwell.
Lehmann, W. 1907-9. "unpublished manuscripts and notes: notebook numbers 29, 62, 107, 109, 115; cabinets 4 and 8." Berlin: Ibero-Amerkianisches Institut, Preuβischer Kulturbesitz.

Lele, V. P. 2006. Material habits, identity, semeiotic. *Journal of Social Archaeology* 6 (1):48-70.
Leone, M. 1984. "Interpreting ideology in historical archaeology: The William Paca garden in Annapolis, Maryland," in *Ideology, Power, and Prehistory*. Edited by D. Miller and C. Tilley, pp. 25-32. Cambridge: Cambridge University Press.
Leroi-Gourhan, A. 1982. *The Dawn of European Art: An Introduction to Palaeolithic Cave Painting*. Cambridge: Cambridge University Press.
Lesage, P., M. Mora, W. Strauch, D. Escobar, O. Matías, V. Tenorio, E. Talavera, á. Rodríguez, and G. Alvarado. 2007. "Volcanic seismology," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 1189-1216. London: Taylor & Francis.
Levi-Strauss, C. 1966. *The Savage Mind*. Chicago: University of Chicago Press.
—. 1969. *The Raw and the Cooked*. *Mythologiques: Volume I*. New York: Harper and Row.
Lewis-Williams, D. 2002a. *A Cosmos in Stone: Interpreting Religion and Society through Rock Art*. Walnut Creek, CA: AltaMira Press.
—. 2002b. *The Mind in the Cave: Consiousness and the Origins of Art*. London: Thames & Hudson.
Lewis-Williams, D., and D. Pearse. 2005. *Inside the Neolithic Mind: Consciousness, Cosmos, and the Realm of the Gods*. London: Thames & Hudson.
Linares de Sapir, O. 1968. Ceramic phases for Chiriqui, Panama and their relationships to neighboring sequences. *American Antiquity* 33:216-225.
Linares, O. 1964. Archaeological Investigations in the Gulf of Chiriqui, Panama. PhD thesis, Harvard University.
—. 1968. *Cultural Chronology of the Gulf of Chiriquí, Panamá*. Vol. 8. *Smithsonian Contributions in Anthropology*. Washington, D.C.: Smithsonian Institution Press.
—. 1976. "Animals that were bad to eat were good to compete with: an analysis of the Conte style from ancient Panama," in *Ritual and Symbol in Native South America*, vol. 9. Edited by P. Young and J. Howe. Eugene: University of Oregon Anthropological Papers.
—. 1977a. Adaptive strategies in western Panama. *World Archaeology* 8 (3):304-319.
—. 1977b. *Ecology and the Arts in Ancient Panama*. Vol. 17. *Dumbarton Oaks Studies in Pre-Columbian Art and Archaeology*. Washington, D.C.
—. 1979. What is Lower Central American Archaeology? *Annual Review of Anthropology* 8:21-43.
—. 1980a. "The ceramic record: time and place," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 81-117. Cambridge: Harvard University.
—. 1980b. "Conclusions," in *Adaptive Radiations in Prehistoric Panama*, vol. 5. Edited by O. Linares and A. Ranere, pp. 233-247. Cambridge: Harvard University Press.
—. 1980c. "Ecology and prehistory of the Aguacate Peninsula in Bocas del Toro," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 57-66. Cambridge: Harvard University Press.
—. 1980d. "Ecology and prehistory of the Chiriqui Gulf states," in *Adaptive Radiations in Prehistoric Panama*. Edited by O. Linares and A. Ranere, pp. 67-80. Cambridge: Harvard University Press.
—. 1980e. "Introduction," in *Adaptive Radiations in Prehistoric Panama*, vol. 5. Edited by O. Linares and A. Ranere, pp. 7-14. Cambridge: Harvard University Press.

—. 1980f. "Miscellaneous artifacts of special use," in *Adaptive Radiations in Prehistoric Panama*. Edited by O. Linares and A. Ranere, pp. 139-145. Cambridge: Harvard University Press.
Linares, O., and A. Ranere. 1971. Human adaptations to the tropical forests of western Panama. *Archaeology* 24 (4):346-355.
—. Editors. 1980a. *Adaptive Radiations in Prehistoric Panama*. Vol. 5. *Peabody Museum Monographs*. Cambridge, MA: Harvard University.
—. 1980b. "Cultural inferences from artifactual remains," in *Adaptive Radiations in Prehistoric Panama*, vol. 5. Edited by O. Linares and A. Ranere, pp. 78-80. Cambridge: Harvard University Press.
—. 1980c. "From preceramic shelters to large villages and centers," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 15. Cambridge, MA: Harvard University.
Linares, O., and P. Sheets. 1980. "Highland agricultural villages in the Volcan Baru region," in *Adaptive Radiations in Prehistoric Panama*, vol. 5. Edited by O. Linares and A. Ranere, pp. 44-55. Cambridge: Harvard University Press.
Linares, O., P. Sheets, and J. Rosenthal. 1975. Prehistoric Agriculture in Tropical Highlands. *Science* 187:137-45.
Linares, O., and R. White. 1980. "Terrestrial fauna from Cerro Brujo (CA-3) in Bocas del Toro and La Pitahaya (IS-3) in Chiriqui," in *Adaptive Radiations in Prehistoric Panama*, vol. 5. Edited by O. Linares and A. Ranere, pp. 181-193. Cambridge: Harvard University Press.
Lindbergh, C. 1928. To Bogotá and back by air. *National Geographic*.
Lindholm, C. 2008. *Culture and Authenticity*. Cambridge, MA: Blackwell.
Lindholm, C., A. Climent, E. Comacho, W. Strauch, J. Cepeda, D. Cáceres, J. Ligorría, and H. Bungum. 2007. "Seismic hazard and microzonation," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 1099-1118. London: Taylor & Francis.
Linné, S. 1936. Archaeological fieldwork in Chiriquí. *Ethnos* 1:95-102.
Lizarrága, K. G. 1999. From social archaeology to national archaeology: up from domination. *American Antiquity* 64 (2):363-8.
Lock, G., and Z. Stancic. Editors. 1995. *Archaeology and Geographical Information Systems: A European Perspective*. London: Taylor and Francis.
Lockhart, B. 2004. The dating game. *Bottles and Extras*:24-27.
Lockhart, B., M. Miller, B. Lindsey, C. Serr, and D. Whitten. 2005. The dating game: Illinois Pacific - a division of the Illinois Glass Co. *Bottles and Extras* 16 (2-4):73-80.
Loendorf, L., C. Chippendale, and D. Whitley. 2006. "The discovery of North American rock art and its meaning," in *Discovering North American Rock Art*. Edited by L. Loendorf, C. Chippendale, and D. Whitley, pp. 3-11. Tucson: University of Arizona Press.
Loose, R. 2008. Tse'Biinaholts'a Yalti (Curved Rock That Speaks). *Time and Mind: The Journal of Archaeology, Consciousness and Culture* 1 (1):31-50.
López, C., and M. Cano. 2008. "Trayectorias culturales divergentes en escalas milenarias: cacería especializada vs. horticultura temprana en los valles interandinos del Magdalena y el Cauca, Colombia." *Il Congreso Latinoamericano de Antropología. July 28-31, San José, Costa Rica, 2008*, pp. 89-98.
López, C., M. Cano, and D. Rodríguez. Editors. 2007. *Cambios Ambientales en Perspectiva Histórica*. Vol. 2. *Ecología Histórica y Cultura Ambiental*. Pereira, Colombia: Universidad Tecnológica de Pereira.

Lothrop, S. 1919. "The discovery of gold in the graves of Chiriqui, Panama," in *Museum of the American Indian Indian Notes and Monographs*, vol. 6 (2), pp. 27-37. New York: Heye Foundation.

—. 1934. Archaeological investigation in the province of Cocle, Panama. *American Journal of Archaeology* 38:207-211.

—. 1937. *Cocle: an Archaeological Study of Central Panama, Part 1*. Vol. 7. *Memoirs of the Peabody Museum of Archaeology and Ethnology*. Cambridge: Harvard University Press.

—. 1942. *Cocle: an Archaeological Study of Central Panama, Part 2*. *Memoirs of the Peabody Museum of Archaeology and Ethnology*. Cambridge: Harvard University Press.

—. 1948. "The archaeology of Panama," in *Handbook of South American Indians*, vol. 4, *Smithsonian Institution Bureau of American Ethnology Bulletin 143*. Edited by J. Steward, pp. 143-168. Washington, D.C.: Government Printing Office.

—. 1960. C-14 dates for Venado Beach, Canal Zone. *Panama Archaeologist* 3:96-98.

—. 1963. *Archaeology of the Diquis Delta, Costa Rica*. Vol. 51. *Papers of the Peabody Museum of Archaeology and Ethnology*. Cambridge: Harvard University Press.

Lowe, D. J., and J. B. Hunt. 2001. "A summary of terminology used in tephra-related studies," in *Tephras: Chronology, Archaeology*, *Les Dossiers de l'Archéo-Logis 1: 17-22*. Edited by E. T. Juvigné and J.-P. Raynal. Goudet (France): CDERAD.

Lowe, D. J., B. G. McFadgen, T. F. G. Higham, A. G. Hogg, P. C. Froggatt, and I. A. Nairn. 1998. Radiocarbon age of the Kaharoa Tephra, a key marker for late- Holocene stratigraphy and archaeology in New Zealand. *Holocene* 8:487-495.

Lowe, D. J., R. M. Newnham, and J. D. McCraw. 2002. "Volcanism and early Maori society in New Zealand," in *Natural Disasters and Cultural Change*, vol. 45, *One World Archaeology*. Edited by R. Torrence and J. Grattan, pp. 126-161. London and New York: Routledge.

Lowe, D. J., R. M. Newnham, B. G. McFadgen, and T. F. G. Higham. 2000. Tephras and New Zealand archaeology. *Journal of Archaeological Science* 27:859-870.

Lowe, D. J., P. A. R. Shane, B. V. Alloway, and R. M. Newnham. 2008. Fingerprints and age models for widespread New Zealand tephra marker beds erupted since 30,000 years ago: a framework for NZ-INTIMATE. *Quaternary Science Reviews* 27:95-126

Lowenthal, D. 1998. *The Heritage Crusade and the Spoils of History*. *Possessed By the Past*. Cambridge: Cambridge University Press.

Lowry, M. 1961. "The present estate of Pompeii," in *Hear Us O Lord From Heaven They Dwelling Place*, pp. 175-200. Philadelphia and New York: Lippincott.

Lozano-Garcia, S., and L. Vazquez-Selem. 2005. A high-elevation Holocene pollen record from Iztaccihuatl volcano, central Mexico. *The Holocene* 15:329-338

Lucas, G. 2002. Disposability and dispossession in the twentieth century. *Journal of Material Culture* 7 (1):5-22.

—. 2005. *The Archaeology of Time*. *Themes in Archaeology*. London and New York: Routledge.

—. 2008. Time and the archaeological event. *Cambridge Archaeological Journal* 18 (1):59-65.

Lutz, O. 1922. "Die Ureinwohner am Isthmus von Panama," in *Festschrift Eduard Seler*. Edited by W. Lehmann, pp. 363-78. Stuttgart: Strecker und Schröder.

—. 1924. *Los habitantes primitivos de la República de Panamá*. Leipzig, Alemania: Imprenta de Oscar Brandstetter.

Lyon, S. 2006. Migratory imaginations: The commodification and contradictions of shade grown coffee. *Social Anthropology* 14:377-390.

MacCannell, D. 1976. *The Tourist. A New Theory of the Leisure Class*, 2nd edition. Berkeley: University of California Press.
MacCurdy, G. 1911. *A Study of Chiriquian Antiquities*. Vol. 3. *Memoirs of the Connecticut Academy of Arts and Sciences*. New Haven.
—. 1913. A note on the archaeology of Chiriqui. *American Anthropologist* 15 (4):661-667.
Machida, H. 1999. The stratigraphy, chronology and distribution of distal marker-tephras in and around Japan *Global and Planetary Change* 21:71-94.
MacMillan, I., P. Gans, and G. Alvarado. 2004. Middle Miocene to present plate tectonic history of the southern Central America volcanic arc. *Technonophysics* 392:325-348.
Magnoni, A., T. Ardren, and S. Hutson. 2007. Tourism in the Mundo Maya: Inventions and (mis)representations of Maya identities and heritage. *Archaeologie*:353-383.
Maldonado-Koerdel, M. 1958. *Bibliografía Geológica y Paleontológica de América Central*. Vol. 204. México: Instituto Panemricano de Geografía e Historia
Malinowski, B. 1948 [1926]. "Myth in primitive psychology," in *Magic, Science and Religion and Other Essays*. Edited by B. Malinowski, pp. 72-124. Boston: Beacon Press.
Mallery, G. 1893. "Picture Writing of the American Indians," in *Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, Tenth Annual Report (1888-89)*. Edited by J. W. Powell. Washington, D.C.: Government Printing Office, Smithsonian Insitution.
Mann, P., R. Rogers, and L. Gahagan. 2007. "Overview of plate tectonic history and its unresolved tectonic problems," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 205-241. London: Taylor & Francis.
Manning, S. 1999. *A Test of Time: The Volcano of Thera and the Chronology and History of the Aegean and East Mediterranean in the Mid Second Millennium BC*. Oxford: Oxbow Books.
Manning, S., C. Bronk Ramsey, W. Kutschera, T. Higham, B. Kromer, P. Steier, and E. Wild. 2006. Chronology for the Aegean Late Bronze Age 1700-1400 BC. *Science, April 28* 312:565-9.
Manning, S., and D. Sewell. 2002. "Volcanoes and history: a significant relationship? The case of Santorini," in *Natural Disasters and Cultural Change*, vol. 45, *One World Archaeology*. Edited by R. Torrence and J. Grattan, pp. 264-291. London and New York: Routledge.
Marcus, J. 2008. The archaeological evidence for social evolution. *Annual Review of Anthropology* 37:251-66.
Margari, V., D. M. Pyle, C. Bryant, and P. L. Gibbard. 2007. Mediterranean tephra stratigraphy revisited: Results from a long terrestrial sequence on Lesvos Island, Greece *Journal of Volcanology and Geothermal Research* 163:34-54
Markels, A. 2005. "Beauty and tax breaks lure buyers to Panama, February 13," in *The New York Times*. New York.
Marshall, J. 2000. Active Tectonics and Quaternary Landscape Evolution Across the Western Panama Block, Costa Rica, Central America, Pennsylvania State University.
—. 2007. "The geomorphology and physiographic provinces of Central America," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 1-51. London: Taylor & Francis.
Marshall, J., D. M. Fisher, and T. W. Gardner. 2000. Central Costa Rica deformed belt: kinematics of diffuse faulting across the western Panama Block. *Tectonics* 19:468-492.
Marshall, J., B. D. Idleman, T. W. Gardner, and D. M. Fisher. 2003. Landscape evolution within a retreating volcanic arc, Costa Rica, Central America. *Geology* 31:419-422.

Martin del Pozzo, A. L., M. F. Sheridan, D. Barrera, J. Lugo Hubp, and L. Vazquez Selem. 1995. Potential hazards from Colima volcano, Mexico. *Geofisica Internacional* 34 (4):363-376.

Martyr, P. 1555. *Decades*. *The Decades of the Newe Worlde or West India*. Alcalá: Guilhelmi Powell.

Marx, K. 1969 [1848]. "The Communist Manifesto (republished 1969; accessed January 2009 from www.marxists.org/archive/marx/works/download/manifest.txt)," in *Marx/Engels Selected Works*, vol. 1, pp. 98-137. Moscow: Progress Publishers.

—. 1969 [1856]. "Speech at the anniversary of the *People's Paper* " in *Marx/Engels Selected Works*, vol. 1, pp. 500. Moscow: Progress Publishers.

Mason, B. G., D. M. Pyle, W. B. Dade, and T. Jupp. 2004. Seasonality of volcanic eruptions. BO4206, doi: 10.1029/2002JB002293. *Journal of Geophysical Research* 109:1-12.

Mason, J. A. 1941. Gold from the grave: Central American Indian cemeteries yield exquisite ornaments of almost pure metal. *Scientific American*:261-263.

Mason, R. 2000. Archaeology and Native North American Oral Traditions. *American Antiquity* 65 (2):239-266.

Massey, D. 2005. *For Space*. London: Sage.

—. 2006. Landscape as a Provocation: Reflections on Moving Mountains. *Journal of Material Culture* 11:33-48.

Matos Medieta, R. 1994. "Peru: Some comments," in *History of Latin American Archaeology*. Edited by A. Oyuela-Caycedo, pp. 104-123. Hampshire, UK: Avebury.

Matsuda, D. 1994. Looted artifacts: seeds of change in Latin America. *Anthropos* 89:222-224.

Mauss, M. 1980 [1925]. *The Gift: Forms and function of exchange in archaic societies* London: Routledge and Kegan Paul.

Mayo, C., and J. Mayo. 2007. El arte rupestre de la cuenca del rio Coclé del Sur, Panamá. *Revista Española de Antropologia Americana* 37:149-157.

Mayo, J. 2003. "Estilos Ceramico de Gran Coclé, Panamá (http://www.cocle.es.kz/)," in *Sociedades Americanas: Caracteres Históricos y Antropológicos; Método de Análisis*. Universidad Complutense de Madrid: Departamento de Historia de América II (Antropología Americana).

Mayo, J., and C. Mayo. 2009. "Proyecto Arqueológico el Caño: Avance de los resultados de la campaña de excavación 2008 (session: Reconstructing the natures of communities in the Intermediate Area; organized by Scott Palumbo and William Locascio)," in *74th Annual Meeting of the Society for American Archaeology*. Atlanta, GA.

McCoy, F., and G. Heiken. Editors. 2000. *Volcanic Hazards and Disasters in Human Antiquity*. *Geological Society of America Special Paper 345*. Denver: Geological Society of America.

McDougall, I., and F. H. Brown. 2006. Precise Ar-40/Ar-39 geochronology for the upper Koobi Fora Formation, Turkana Basin, northern Kenya *Journal of the Geological Society of London* 163:205-220

McGovern, T. H., O. Vesteinsson, A. Fridriksson, M. Church, I. A. N. Lawson, I. A. Simpson, A. Einarsson, A. Dugmore, G. Cook, S. Perdikaris, K. J. Edwards, A. M. Thomson, W. P. Adderley, A. Newton, G. Lucas, R. Edvardsson, O. Aldred, and E. Dunbar. 2007. Landscapes of Settlement in Northern Iceland: Historical Ecology of Human Impact and Climate Fluctuation on the Millennial Scale. *American Anthropologist* 109 (1):27-51.

McGuire, J., D. Griffiths, P. Hancock, and I. S. Stewart. Editors. 2000. *The Archaeology of Geological Catastrophes*. *Geological Society Special Publication, No. 171*. London: The Geological Society

McHenry, L. 2005. Phenocryst composition as a tool for correlating fresh and altered tephra, Bed I, Olduvai Gorge, Tanzania. *Stratigraphy* 2 (2):101-115.
McHenry, L., G. Mollel, and C. I. Swisher. 2008. Compositional and textural correlations between Olduvai Gorge Bed 1 tephra and volcanic sources in the Ngorongoro volcanic highlands, Tanzania. *Quaternary International* 178:306-319.
McKee, B. 2002. "Structure 9: a precolumbian sweat bath at Cerén," in *Before the Volcano Erupted: The Ancient Cerén Village in Central America*. Edited by P. Sheets, pp. 89-96. Austin: University of Texas Press.
McKibben, B. 1989. *The End of Nature*. New York: Anchor Books.
McLane, D. 2001. "Frugral Traveler: In Panama, sipping coffee at its source, February 25," in *The New York Times*. New York.
McNeil, J. A. n.d. "archived documents: drawings of the Piedra Pintada at Caldera, Panamá." New Haven: Yale University, Peabody Museum.
Meagher, T. 1861. New route through Chiriqui. *Harpers New Monthly Magazine* 22:198-209.
Mehringer, P. J., A. M. Sarna-Wojcicki, L. K. Wollwage, and P. Sheets. 2005. Age and extent of the Ilopango TBJ tephra inferred from a holocene chronostratigraphic reference Section, lago de yojoa, Honduras *Quaternary Research* 63:199-205
Melton, P., I. Briceño, A. Gómez, E. J. Devor, J. E. Bernal, and M. H. Crawford. 2007. Biological relationship between Central and South American Chibchan speaking populations: Evidence from mtDNA. *American Journal of Physical Anthropology* 133:753-770.
Mendoza, C., and S. Nishenko. 1989. The north Panama earthquake of 7 September 1882: Evidence for active underthusting. *Bulletin of the Seismological Society of America* 79:1264-1269.
Merle, O., L. Michon, and P. Bachèlery. 2008. Caldera rim collapse: a hidden volcanic hazards. *Journal of Volcanology and Geothermal Research (in press)*.
Merleau-Ponty, M. 1962. *Phenomenology of Perception*. London and New York: Routledge.
Merritt, J. K. 1860. *Report on the Huacals or Ancient Graveyards of Chiriqui*. New York: Bulletin of the American Ethnological Society.
Meskell, L. 1996. The somatization of archaeology: Institutions, discourses, corporeality. *Norwegian Archaeology Review* 29:1-16.
—. 1999. *Archaeologies of Social Life*. Oxford: Blackwell.
—. 2002. Negative heritage and past mastering in archaeology. *Anthropological Quarterly* 75 (3):557-574.
—. 2003. "Memory's materiality: ancestral presence, commemorative practice and disjunctive locales," in *Archaeologies of Memory*. Edited by R. Van Dyke and S. Alcock, pp. 34-55. Malden, MA: Blackwell.
—. 2004. *Object Worlds in Ancient Egypt: Material Biographies Past and Present*. Oxford and New York: Berg.
—. 2005. "Objects in the mirror appear closer than they are," in *Materiality*. Edited by D. Miller, pp. 51-87. Durham and London: Duke University Press.
—. Editor. 2009. *Cosmopolitan Archaeologies*. Durham: Duke University Press.
Meskell, L., C. Gosden, I. Hodder, R. Joyce, and R. Preucel. 2001. Editorial statement. *Journal of Social Archaeology* 1 (1):5-12.
Meskell, L., and R. Joyce. 2003. *Embodied Lives: Figuring Ancient Maya and Egyptian Experience*. London: Routledge.

Meskell, L., and R. Preucel. 2007a. "Identities," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 121-141. Malden, MA and Oxford: Blackwell Publishing.
—. 2007b. "Politics," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 315-334. Malden, MA and Oxford: Blackwell Publishing.
Michaels, A. 1996. *Fugitive Pieces*. New York: Random House.
Miller, C. D. 2002. "Volcanology, stratigraphy, and effects on structures," in *Before the Volcano Erupted: The Ancient Cerén Village in Central America*. Edited by P. Sheets, pp. 10-23. Austin: University of Texas Press.
Miller, D. 2005. "Materiality: an Introduction," in *Materiality*. Edited by D. Miller. Durham and London: Duke University Press.
Miller, M. E. 1996. *Art of Mesoamerica from Olmec to Aztec*, 2nd edition. New York: Thames and Hudson.
Mills, B. 2000. "Gender, craft production, and inequality," in *In Women and Men in the Prehispanic Southwest: Labor, Power, and Prestige.* Edited by P. Crown, pp. 301–343. Santa Fe, NM: School of American Research Press.
—. 2004. The establishment and defeat of hierarchy: inalienable possessions and the history of collective prestige structures in the Pueblo Southwest. *American Anthropologist* 106:238-251.
Mills, B., and W. Walker. 2008. *Memory Work: Archaeologies of Material Practice*. Santa Fe, NM: School of American Research.
Minc, L. 1986. Scarcity and survival: the role of oral tradition in mediating subsistence crisis. *Journal of Anthropological Archaeology* 5:39-113.
Minc, L., and K. Smith. 1989. "The spirit of survival: cultural responses to resource variability in north Alaska," in *Bad Year Economics: Cultural Responses to Risk and Uncertainty*. Edited by P. Halstead and J. O'Shea. Cambridge: Cambridge University Press.
Minelli, L., and L. Minelli. 1966. "Informe preliminar sobre excavaciones alrededor de San Vito de Java." *36th Congreso Internacional de Americanistas, 1966*, pp. 415-427.
Miranda de Cabal, B. 1974. *Un Pueblo Visto a Través de su Lenguaje*. Panamá: Impresora Panamá.
—. 1989. *Dole-gó: el lugar del colibrí*. Perú: Sesator.
Mitchell, R. 1962. A limestone figure from Tumba Vieja. *Panama Archaeologist* 5 (1).
Molloy, C., P. Shane, and I. A. Nairn. 2008. Pre-eruption thermal rejuvenation and stirring of a partly crystalline rhyolite pluton revealed by the Earthquake Flat Pyroclastics deposits, New Zealand *Journal of the Geological Society of London* 165:435-447
Montessus de Ballore, F., comte de. 1884. *Temblores y Erupciones Volcanicas en Centro-America*. San Salvador: F. Sagrini.
—. 1888. *Tremblements de Terre et Éruptions Volcaniques au Centre-Amérique Depuis la Conquête Espagnole Jusqu'à nos Jours*. Dijon: Imprimperie Eugéne Jobard.
Morell, K., D. Fisher, and T. Gardner. 2008. Inner forearc response to subduction of the Panama Fracture Zone, southern Central America. *Earth and Planetary Science Letters* 265:82-95.
Morrison, K. 2007. "Making places and making states: agriculture, metallurgy, and the wealth of nature in south India," in *The Wealth of Nature: How Natural Resources Have Shaped Asian History, 1600-2000*. Edited by P. Boomgaard and G. Bankoff, pp. 81-99: Palgrave MacMillan.
Morton, T. 2007. *Ecology Without Nature*. Cambridge, MA and London: Harvard University Press.

Mothes, P. Editor. 1998. *Actividad Volcánica y Pueblos Precolombinos en el Ecuador*. Quito: Abya-Yala, Ducotech.

Motoki, A., Orihashi, Y. and Naranjo, J. A. 2006. Geologic reconnaissance of Lautaro Volcano, Chilean Patagonia. *Revista Geologica De Chile* 33:177-187.

Mühlhäusler, P., and A. Peace. 2006. Environmental Discourses. *Annual Review of Anthropology* 35:457-479.

Munn, N. 1986. *The Fame of Gawa. A Symbolic Study of Value Transformation in a Massim (Papua New Guinea) Society*. Durham adn London: Duke University Press.

Nakada, S., Nagai, M., Kaneko, T., Nozawa, A. and Suzuki-Kamata, K. 2005. Chronology and products of the 2000 eruption of Miyakejima Volcano, Japan. *Bulletin of Volcanology* 67:205-218.

Nakamura, C. 2005. "Magical sense and apotropaic figurine worlds," in *Archaeologies of Materiality*. Edited by L. Meskell, pp. 18-45: Blackwell Publishing.

Naranjo, J., and C. Stern. 1998. Holocene explosive activity of Hudson volcano, southern Andes. *Bulletin of Volcanology* 59:291-306.

Narasimhan, T. N. 2007. Limitations of science and adapting to Nature. *Environmental Research Letters* 2 (034003).

Nash, G. Editor. 2000. *Signifying place and space*. Vol. 902. *BAR International Series*. Oxford, England: Archaeopress.

Neall, V., R. Wallace, and R. Torrence. 2008. The volcanic environment for 40,000 years of human occupation on the Willaumez Isthmus, West New Britain, Papua New Guinea. *Journal of Volcanology and Geothermal Research*.

Newton, A., A. Dugmore, and B. Gittings. 2007. Tephrabase: tephrochronology and the development of a centralized European database. *Journal of Quaternary Science* 22.

Newton, A., S. Metcalfe, S. Davies, G. Cook, P. Barker, and R. Telford. 2005. Late Quaternary volcanic record from lakes of Michoacan, central, Mexico. *Quaternary Science Reviews* 24:91-104.

Newton, A., and S. E. Metcalfe. 1999. Tephrochronology of the Toluca Basin, central Mexico. *Quaternary Science Reviews* 18:1039-1059.

Nieves Zedeño, M., and R. Stoffle. 2003. "Tracking the role of pathways in the evolution of a human landscape: The St Croix Riverway in ethnohistorical perspective," in *Colonization of Unfamiliar Landscapes: The Archaeology of Adaptation*. Edited by M. Rockman and J. Steele, pp. 59-80. London and New York: Routledge.

Nolan, M. L. 1979. "Impact of Paricutin on five communities," in *Volcanic Activity and Human Ecology*. Edited by P. Sheets and D. Grayson, pp. 293-338. New York: Academic Press.

Northrop, L. A., and S. Horn. 1996. PreColumbian agriculture and forest disturbance in Costa Rica: palaeoecological evidence from two lowland rainforest lakes. *The Holocene* 6:289-299.

Nowell, D. A. G., M. C. Jones, and D. M. Pyle. 2006. Episodic Quaternary voicanism in France and Germany. *Journal of Quaternary Science* 21: 645-675

Oelschlaeger, M. 1991. *The Idea of Wildness: From Prehistory to the Age of Ecology*. New Haven and London: Yale University Press.

Ogden, L. 2008. The Everglades ecosystem and the politics of nature. *American Anthropologist* 110 (1):21-32.

Oliver-Smith, A. 1996. Anthropological research on hazards and disasters. *Annual Review of Anthropology* 25:303-328.

Oliver-Smith, A., and S. Hoffman. Editors. 1999. *The Angry Earth: Disaster in Anthropological Perspective*. New York: Routledge.

Oliver, J. 1998. *El Centro Ceremonial de Caguana, Puerto Rico: Simbolismo Iconografico, Cosmovision y el Poderio Caciquil Taino de Boriquen*. *BAR International Series S727*. Oxford: Archaeopress.

Oppenshaw, S. 1991. A view on the GIS crisis in geography, or, using GIS to put Humpty-Dumpty back together again. *Environment and Planning* 23:621-628.

Ortega-Guerrero, B., and A. J. Newton. 1998. Geochemical characterisation of late Pleistocene–Holocene tephra layers from the Basin of Mexico, central Mexico. *Quaternary Research* 50 (1):90–106.

Osgood, C. 1935. The archaeological problem of Chiriqui. *American Anthropologist* 37:234-243.

Otis, F. 1859. The new gold discoveries on the Isthmus of Panama. *Harper's Weekly* 3:499-500.

—. 1861. *Illustrated History of the Panamá Railroad*. New York: Harper & Brothers.

Oviedo y Valdés, G. F. d. 1851-55 [1535-1547]. *Historia General y Natural de las Indias*. Madrid: Impr. de la Real academia de la historia.

Oyuela-Caycedo, A. 2001. "The rise of religious routinization: the study of changes from shaman to priestly elite," in *Mortuary practices and ritual associations: shamanic elements in prehistoric funerary contexts in South America*, *BAR International Series*. Edited by J. Staller and E. Currie, pp. 5-17. Oxford: British Archaeological Reports.

—. 2004. The ecology of a masked dance: Negotiating at the frontier of identity in the northwest Amazon. *Baessler-Archiv: Beiträge Zur Völkerkunde (Berlin)* 52:54-74.

Oyuela-Caycedo, A., A. Anaya, C. Elera, and L. Valdes. 1997. Social archaeology in Latin America? Comments to T.C. Patterson. *American Antiquity* 62 (2):365-374.

Oyuela-Caycedo, A., and R. Bonzani. 2005. *San Jacinto I: A Historical Ecological Approach to an Archaic Site in Colombia*. Tuscaloosa: University of Alabama Press.

P. Shane, S. B. M., V. C. Smith, K. F. Beggs, M. B. Darragh, J. W. Cole and I. A. Nairn. 2007. Multiple rhyolite magmas and basalt injection in the 17.7 ka Rerewhakaaitu eruption episode from Tarawera volcanic complex, New Zealand. *Journal of Volcanology and Geothermal Research* 164:1-26

Pálsson, G. 1996. "Human-environment relations: Orientalism, paternalism, and communalism," in *Nature and Society: Anthropological Perspectives*. Edited by P. Descola and G. Pálsson, pp. 63-81. New York: Routledge.

Palumbo, S. 2008. "Una comparación de escalas y metodologías en Volcán Barú, Panamá." *II Congreso Latinoamericano de Antropología. July 28-31, San José, Costa Rica, 2008*, pp. 51-59.

Parkes, G. 2005. Thinking Rocks, Living Stones: Reflections on Chinese Lithophilia. *Diogenes* 52:75-87.

Paterson, M. 2006. *Consumption and Everday Life*. *The New Sociology*. London and New York: Routledge.

Patterson, T. 1994. Social archaeology in Latin Americ: An appreciation. *American Antiquity* 59:201-227.

—. 1995. "Archaeology, history, *indigenismo*, and the state in Peru and México," in *Making Alternative Histories: The Practice of Archaeology and History in Non-Western Settings*. Edited by P. R. Schmidt and T. C. Patterson, pp. 69-86. Santa Fe: School of American Research Press.

—. 1999. A reply to Guthertz Lizárraga. *American Antiquity* 64 (2):369.

Pauketat, T. 1992. "The reign and ruin of the Lords of Cahokia: a dialectic of dominance," in *Lords of the Southeast: Social Inequality and the Native Elites of Southeastern North America*, *Archeological Papers of the American Anthropological Association, no. 3*. Edited by A. Barker and T. Pauketat, pp. 31–52. Washington, DC: American Anthropological Association.

Payne, R., J. Blackford, and J. Van der Plicht. 2008. Using cryptotephras to extend regional tephrochronologies: An example from southeast Alaska and implications for hazard assessment. *Quaternary Research* 69:42-55.

Pearsall, D., K. Chandler-Ezell, and J. Zeidler. 2004. Maize in ancient Ecuador: Results of residue analysis of stone tools from the Real Alto site. *Journal of Archaeological Science* 31 (4):423-442.

Pearson, C., S. Manning, M. Coleman, and K. Jarvis. 2005. Can tree-ring chemistry reveal absolute dates for past volcanic eruptions? *Journal of Archaeological Science* 32:1265-1274.

Pearson, G. 2002. Pan-continental Paleoindian Expansions and Interactions as Viewed from the Earliest Lithic Industries of Lower Central America; PhD thesis, University of Kansas.

Pearson, G., and R. Cooke. 2002. The role of the Panamanian land bridge during the initial colonization of the Americas. *Antiquity* 76 (294):931.

—. 2008. Cueva de los Vampiros, Coclé, Panama. Nuevos datos sobre la antigüedad del ser humano en el istmo de Panamá. *Arqueología del Area Intermedia* 7:39-70.

Peel, M., B. Finlayson, and T. McMahon. 2007. Updated world map of the Köppen-Geiger climate classification. *Hydrology and Earth System Sciences* 11 (5):1633-1644.

Peirce, C. 1992 [1877]. "The Fixation of Belief," in *The Essential Peirce: Selected Philosophical Writings, Volume 1 (1867-1893)*. Edited by N. Houser and C. Kloesel, pp. 109-123. Bloomington and Indianapolis: Indiana University Press.

Peraldo, G., and W. Montero. 1994. *Temblores del Período Colonial de Costa Rica*. Cartago, Costa Rica: Editorial Tecnológica de Costa Rica.

Perez-Franco, R. 2004. "The solar-lunar calendar of Caldera (http://rp-f.com/espanol.php?leer=petindex)." *Seminario-Taller: Archaeological Visions of Boquete. December 3, Boquete, Panamá, 2004*.

Pérez-Franco, R. 2007. "El calendario solar-lunar de Caldera," in *Conoce el Arte Rupestre en Panamá*. Edited by L. G. Joly Adames, pp. 42-47. David, Panamá: Alianza Estratégica para la Conservación y la Divulgación del Arte Rupestre en Panamá.

Pérez Franco, R. 2007. "El calendario solar-lunar de Caldera," in *Conoce el Arte Rupestre en Panamá*. Edited by L. G. Joly Adames, pp. 42-47. David, Panamá: Alianza Estratégica para la Conservación y la Divulgación del Arte Rupestre en Panamá.

Phillips, S., G. E. Rouse, and R. M. Bustin. Vegetation Zones and Diagnostic Pollen Profiles of a Coastal Peat Swamp, Bocas del Toro, Panamá. *Palaeogeography Palaeoclimatology Palaeoecology* 128:301–338.

Piccardi, L., and W. Masse. Editors. 2007. *Myth and Geology*. *Geological Society Special Publications, no 273*. London: Geological Society.

Pim, B., and B. Seemann. 1869. *Dottings on the Roadside in Panamá, Nicaragua, and Mosquito*. London: Chapman and Hall.

Pinart, A. L. 1885. Chiriqui: Bocas del Toro, Valle Miranda. *Bulletin de la Société de Géographie, Paris* 7 (6):433-452.

Piperno, D. 1984. Phytolithic analysis of geological sediments from Panama. *Antiquity* 59:13-19.

—. 1988. *Phytolith Analysis: an Archaeological and Geological Perspective*. San Diego: Academic Press.
—. 1994. Phytolith and charcoal evidence for prehistoric slash and burn agriculture in the Darien rainforest of Panama. *The Holocene* 4:321-325.
—. 2006a. "Identifying manioc (*Manihot esculenta Crantz)* and other crops in pre-columbian tropical America through starch grain analysis: A case study from central Panama," in *Documenting Domestication*. Edited by M. Zeder, D. Bradley, E. Emshwiller, and B. Smith, pp. 46-67. Berkeley: University of California Press.
—. 2006b. *Phytoliths: A Comprehensive Guide for Archaeologists and Paleoecologists*. Walnut Creek: Rowman Altamira.
—. 2006c. Quaternary environmental history and agricultural impact on vegetation in Central America. *Annals of the Missouri Botanical Garden* 93 (2):274-296.
Piperno, D., T. Andres, and K. Stothert. 2000. Phytoliths in Cucurbita and other Neotropical Cucurbitaceae and their occurrence in early archaeological sites from the lowland American tropics. *Journal of Archaeological Science* 27:193-208.
Piperno, D., M. Bush, and P. Colinvaux. 1990. Paleoenvironments and human occupation in late-glacial Panama. *Quaternary Research* 33:108-116.
—. 1991a. Paleoecological perspectives on human adaptation in Panama: Part I - The Pleistocene. *Geoarchaeology* 6:201-26.
—. 1991b. Paleoecological perspectives on human adaptation in Panama: Part II - The Holocene. *Geoarchaeology* 6:227-250.
Piperno, D., and D. Pearsall. 1998. *The Origins of Agriculture in the Lowland Neotropics*. San Diego: Academic Press.
Piperno, D., A. Ranere, I. Holst, and P. Hansell. 2000. Starch grains reveal early root crop horticulture in the Panamanian tropical forest. *Nature* 407:894-7.
Piperno, D., A. Ranere, I. Holst, J. Iriarte, and R. Dickau. 2009. Starch grain and phytolith evidence for early ninth millennium B.P. maize from the Central Balsas River Valley, Mexico. *Proceedings of the National Academy of Sciences* 106 (13):5019-5024.
Piperno, D. R., and J. G. Jones. 2003. Paleocological and Archaeological Implications of a Late Pleistocene/Early Holocene Record of Vegetation and Climate from the Pacific Coastal Plain of Panama. *Quaternary Research* 59:79–87.
Pittier, H. 1903. Folk-lore of the Bribri and Brunka indians in Costa Rica. *The Journal of American Folklore* 16 (60):1-9.
Plano, R. 2008. "Historia Cervecera de Panamá (online article published Nov 13) ": Historiadores de la Cocina, Grupo Gastronautas (http://www.historiacocina.com/historia/cerveza/panama.htm).
Platz, T., S. J. Cronin, K. Cashman, R. Stewart, and I. E. M. Smith. 2007. Transition from effusic to explosive phases in andesite eruptions: a case study from the AD 1655 eruption of Mt. Taranaki, New Zealand. *Journal of Volcanology and Geothermal Research* 161:15-34.
Plunket, P., and G. Urunuela. 1998a. Appeasing the volcano gods. *Archaeology (online: www.archaeology.org/9807/abstracts/volcano.html* 51.
—. 1998b. The impact of Popocatepetl Volcano on Preclassic settlement in Central Mexico. *Quaternaire* 9:53-59.
—. 1998c. Preclassic household patterns preserved under volcanic ash at Tetimpa, Puebla, Mexico. *Latin American Antiquity* 9:287-309.

Plunket, P., and G. Uruñuela. 2000. "The archaeology of a Plinian eruption of the Popocatépetl volcano," in *The Archaeology of Geological Catastrophes*, *Geological Society Special Publication, No. 171*. Edited by J. McGuire, D. Griffiths, P. Hancock, and I. S. Stewart, pp. 195-203. London: The Geological Society

—. 2005a. "Cultural responses to risk and disaster: an example from the slopes of the Popocatépetl volcano in central México," in *Cultural Responses to Volcanic Landscape: The Mediterranean and Beyond*, *AIA Colloquia and Conference Papers, 8*. Edited by M. S. Balmuth, D. K. Chester, and P. Johnston, pp. 109-145. Boston: David Brown.

—. 2005b. Recent research in Puebla prehistory. *Journal of Archaeological Research* 13 (2):89-127.

—. 2006. Social and cultural consequences of a late Holocene eruption of Popocatépetl in central Mexico. *Quaternary International* 151 (1):19-28.

—. 2008. Mountain of sustenance, mountain of destruction: The prehispanic experience with Popocatépetl Volcano. *Journal of Volcanology and Geothermal Research* 170 (1-2):111-120.

Politis, G., and J. A. Pérez Gollán. 2007. "Latin American archaeology: From colonialism to globalization," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 353-373. Malden, MA and Oxford: Blackwell Publishing.

Pollock, S. 2003. The looting of the Iraq Museum: Thoughts on archaeology in a time of crisis. *Public Archaeology* 3:117-124.

Pollock, S., and R. Bernbeck. 2005. "Archaeology in the news," in *Archaeologies of the Middle East*, *Blackwell Studies in Global Archaeology*. Malden, MA: Blackwell.

Ponomareva, V., P. R. Kyle, I. V. Melekestsev, P. G. Rinkleff, O. V. Dirksen, L. D. Sulerzhitsky, N. E. Zaretskaia, and R. Rourke. 2004. The 7600 (C-14) year BP Kurile Lake caldera-forming eruption, Kamchatka, Russia: stratigraphy and field relationships *Journal of Volcanology and Geothermal Research* 136:199-222.

Povinelli, E. 1995. Do rocks listen? The cultural politics of apprehending Australian Aboriginal Labor. *American Anthropologist* 97 (3):505-518.

Powell, J. W. Editor. 1888. *Annual Report of the Bureau of Ethnology*. Vol. 6. Washington, D.C.: Smithsonian Institution.

Preucel, R., and L. Meskell. 2007a. "Knowledges," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 3-22. Malden, MA and Oxford: Blackwell Publishing.

—. 2007b. "Places," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 215-229. Malden, MA and Oxford: Blackwell Publishing.

Protti, M., F. Guendel, and K. McNally. 1994. The geometry of the Wadati–Benioff zone under southern Central America and its tectonic significance: results from a high-resolution local seismographic network. *Physics of the Earth and Planetary Interiors* 84:271–287.

—. 1995. "Correlation between the age of the subducting Cocos Plate and the geometry of the wadati–benioff zone under Nicaragua and Costa Rica. ," in *Geologic and Tectonic Development of the Caribbean Plate Boundary in Southern Central America*, *Geological Society of America Special Paper, 295*. Edited by P. Mann, pp. 309–326. Boulder: Geological Society of America, Inc.

Pyle, D. M. 1999. Widely dispersed Quaternary tephra in Africa. *Global and Planetary Change* 21:95–112.

Pyle, D. M., G. D. Ricketts, V. Margari, T. H. van Andela, A. A. Sinitsyn, N. D. Praslov, and S. Lisitsyn. 2006. Wide dispersal and deposition of distal tephra during the Pleistocene 'Campanian Ignimbrite/Y5' eruption, Italy *Quaternary Science Reviews* 25 2713-2728

Pynchon, T. 1997. *Mason & Dixon*. New York: Henry Holt & Co.

Quesada Pacheco, M. A. 2001. *Entre Silladas y Rejoyas: Viajeros por Costa Rica de 1850 a 1950*. Cartago, Costa Rica: Editorial Tecnológica de Costa Rica.

Quilter, J. 1990. The Moche revolt of the objects. *Latin American Antiquity* 1 (1):42-65.

—. 1997. The narrative approach to Moche iconography. *Latin American Antiquity* 8 (2):113-133.

—. 2000. "The general and the queen: gold objects from a ceremonial and mortuary complex in southern Costa Rica," in *Precolumbian Gold: Technology, Style and Iconography*. Edited by C. McEwan, pp. 177-195. London: British Museum Press.

—. 2004. *Cobble Circles and Standing Stones: Archaeology at the Rivas Site, Costa Rica*. Iowa City: University of Iowa Press.

—. 2006. "Introduction," in *A Pre-Columbian World*. Edited by J. Quilter and M. Miller, pp. 7-19. Washington, D.C.: Dumbarton Oaks Research Library & Collection, Harvard University Press.

Quilter, J., and A. Blanco. 1995. Monumental architecture and social organization at the Rivas site, Costa Rica. *Journal of Field Archaeology* 22.

Quilter, J., and R. J. Frost. 2007a. Investigaciones en el complejo arqueológico Rivas-Panteón de la Reina en el suroeste de Costa Rica. *Vinculos* 30 (1-2):23-56.

—. 2007b. Investigaciones en el complejo arqueológico Rivas-Panteón del la Reina en el suroeste de Costa Rica. *Vinculos* 30 (1-2):23-56.

—. 2008. Investigaciones en el complejo arqueológico Rivas-Panteón de la Reina en el suroeste de Costa Rica. *Vinculos* 30.

Quilter, J., and J. Hoopes. 2003. "Introduction: The golden bridge of the Darien," in *Gold and Power in Ancient Costa Rica, Panama and Colombia*. Edited by J. Quilter and J. Hoopes, pp. 1-14. Washington, D.C.: Dumbarton Oaks.

Quintanilla, I. 2007. *Esferas precolombinas de Costa Rica* San José, Costa Rica: Fundación Museos del Banco Central de Costa Rica/Hölcim.

—. 2008. "Cambio y continuidad cultural en la Gran Chiriquí: la escultura en piedra a través del tiempo (simposio: Regiones, comunidades y áreas domésticas: acercamiento al estudio del cambio social precolombino en América Central Meridional y el Norte de América del Sur usando escalas múltiples de análisis)," in *II Congreso Latinoamericano de Antropología*. San José, Costa Rica.

Raffles, H. 2002. *In Amazonia: A Natural History*. Princeton and Oxford: Princeton University Press.

Ramage, N. 1992. Goods, graves, and scholars: 18th-century archaeologists in Britain and Italy. *American Journal of Archaeology* 96:653-661.

Ramenofsky, A., and A. Steffen. 1998. "Units as tools of measurement," in *Unit Issues in Archaeology*. Edited by A. Ramenofsky and A. Steffen, pp. 3-20. Salt Lake City: University of Utah Press.

Ramirez, A. 1988. Present status of geothermal reconnaissance studies in the republic of Panama (Instituto de Recursos Hidraulicos y Electrificacion). *Geothermics* 17 (2/3):355-67.

Ramsey, M. 2007. "Cup of Boquete Joe comes with serious price tag, August 13," in *Canada.com (CanWest News Service)*. Vancouver.

Ranere, A. 1968. "Appendix 2: Analysis of pottery surface collections from the Pacific districts of Punta Burica, San Felix, and Remedios in Chiriqui," in *Cultural Chronology of the Gulf of Chiriqui*, vol. 8, *Smithsonian Contributions to Anthropology*. Edited by O. Linares, pp. 107-119. Washington, D.C.: Smithsonian Institution.

—. 1980a. "Preceramic shelters in the Talamancan Range," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 16-43. Cambridge: Harvard University Press.

—. 1980b. "Stone tools from the Rio Chiriqui shelters," in *Adaptive Radiations in Prehistoric Panama*. Edited by O. Linares and A. Ranere, pp. 316-53. Cambridge, MA: Harvard University Press.

—. 1996. "Stone tools and cultural boundaries in prehistoric Panama: an initial assessment," in *Paths to Central American Prehistory*. Edited by F. Lange, pp. 49-77. Niwot: University Press of Colorado.

Ranere, A., and R. Cooke. 1991. "Paleoindian occupation in the Central American tropics," in *Clovis: Origins and Adaptations*. Edited by R. Bonnichsen and K. Turnmire, pp. 237-253. Corvallis, OR: Center for the Study of the First Americans.

—. 1995. "Evidencias de occupación humana en Panamá a postrimerías del pleistoceno y a comienzos del holoceno," in *Ambito y Ocupaciones Tempranas de la América Tropical*. Edited by I. Cavelier and S. Mora. Bogotá: Fundación Erigiae y Instituto Colombiano de Antropología.

—. 2003. "Late glacial and early Holocene occupation of Central American tropical forests," in *Under the Canopy: The Archaeology of Tropical Rain Forests*. Edited by J. Mercader, pp. 219-248. New Brunswick, NJ: Rutgers University Press.

Ranere, A., and C. E. López. 2007. Cultural Diversity in Late Pleistocene/Early Holocene Populations in Northwest South America and Lower Central America. *International Journal of South American Archaeology* 1.

Ranere, A., D. Piperno, I. Holst, R. Dickau, and J. Iriarte. 2009. The cultural and chronological context of early Holocene maize and squash domestication in the Central Balsas River Valley, Mexico. *PNAS* Early Edition:1-5.

Rapport, N. 2007. An outline for cosmopolitan study: reclaiming the human through introspection. *Current Anthropology* 48 (2):257-283.

Rausch, S. 2007. Geochemical Signatures in Subduction Zone Magmatism at Volcan Baru, Panama. Masters thesis, Georg-August-Universität Göttingen.

Reagan, M., E. Duarte, G. J. Soto, and E. Fernández. 2006. "The eruptive history of Turrialba volcano, Costa Rica, and potential hazards from future eruptions. Geological Society of America Special Paper, vol. 412," in *Volcanic Hazards in Central America*. Edited by W. I. Rose, G. J. S. Bluth, M. J. Carr, J. W. Ewert, L. C. Patino, and J. W. Vallance, pp. 235–257.

Reichel-Dolmatoff, G. 1954. Investigaciones arqueologicas en la Sierra Nevada de Santa Marta. Partes 1-2. *Revista Colombiana de Antropologia* 2:146-206.

—. 1975. *The Shaman and the Jaguar: A Study of Narcotic Drugs among the Indians of Colombia*. Philadelphia: Temple University Press.

Reid, J., and G. Hanily. 2003. *Economic analysis of three road developments through western Panama's Barú Volcano National Park and surrounding areas*. The Nature Conservancy.

Reilly, K., S. Kaufman, and A. Bodino. 2003. *Racism: A Global Reader*. Armonk, NY: M.E. Sharpe.

Reimer, P., M. Baillie, E. Bard, A. Bayliss, J. Beck, C. Bertrand, P. Blackwell, C. Buck, G. Burr, K. Cutler, P. Damon, R. Edwards, R. Fairbanks, M. Friedrich, T. Guilderson, K. Hughen, B.

Kromer, F. McCormac, S. Manning, C. B. Ramsey, R. Reimer, S. Remmele, J. Southon, M. Stuiver, S. Talamo, F. Taylor, J. van der Plicht, and C. Weyhenmeyer. 2004. IntCal04 terrestrial radiocarbon age calibration, 0-26 cal kyr BP. *Radiocarbon* 46:1029-1058.
Renfrew, C. 1973. "Monuments. mobilization, and social organization in Neolithic Wessex," in *The Explanation of Culture Change: Models in Prehistory*. Edited by C. Renfrew, pp. 539-558. Duckworth.
—. 1974. *Before Civilization*. New York: Alfred A. Knopf.
Renfrew, C., and S. Shennan. Editors. 1982. *Ranking, Resource and Exchange: Aspects of the Archaeology of Early European Societies*. Cambridge: Cambridge University Press.
Reycraft, R., and G. Bawden. Editors. 2000. *Environmental Disaster and the Archaeology of Human Response*. Albuquerque: Maxwell Museum of Anthropology, Anthropological Paper No. 7.
Riley, M., D. Harvey, T. Brown, and S. Mills. 2005. Narrating Landscape: The Potential of Oral History for Landscape Archaeology. *Public Archaeology* 4:15-26.
Robinson, D., R. Korisettar, and J. Koshy. 2008. Metanarratives and the (re)invention of the Neolithic. *Journal of Social Archaeology* 8(3):355-379.
Robinson, E., and G. Ware. 2001. *Multi-spectral imaging of La Casa de las Golondrinas rock paintings.* www.famsi.org/reports/99052/html. Foundation for the Advancement of Mesoamerican Studies (FAMSI).
Rockman, M. 2003. "Knowledge and learning in the archaeology of colonization," in *Colonization of Unfamiliar Landscapes: The Archaeology of Adaptation*. Edited by M. Rockman and J. Steele, pp. 3-24. London and New York: Routledge.
Rodbell, D., S. Bagnato, J. Nebolini, G. Seltzer, and M. Abbott. 2002. A late glacial–Holocene tephrochronology for glacial lakes in southern Ecuador. *Quaternary Research* 57:343-354.
Roe, P. 1982. *The Cosmic Zygote, Cosmology and the Amazon Basin*. New Brunswick, NJ: Rutgers University Press.
Rogers, R., H. Kárason, and R. van der Hilst. 2002. Epeirogenic uplift above a detached slab in northern central America. *Geology* 30:1031-1034.
Rose, W. I., C. M. Riley, and S. Dartevelle. 2003. Sizes and shapes of 10-Ma distal fall pyroclasts in the Ogallala Group, Nebraska. *Journal of Geology* 111:115-124.
Rosenthal, J. 1980. "Excavations at Barriles (BU-24): A small testing program," in *Adaptive Radiations in Prehistoric Panama*, vol. 5. Edited by O. Linares and A. Ranere, pp. 288-291. Cambridge: Harvard University Press.
Rubio, A. 1950. *Panamá: Monumentos Históricos y Arquelógicos*. Vol. Núm. 109, Ed. Cultura. *Publicaciones del I.P.G.H.* México: Comisión de Historia.
Rupke, N. 2008. *Alexander von Humboldt: A Metabiography*. Chicago: University of Chicago Press.
Sachs, A. 2006. *The Humboldt Current: 19th Century Exploration and the Sources of American Environmentalism*. New York: Viking.
Sahlins, M. 1958. *Social Stratification in Polynesia*. Seattle: University of Washington Press.
—. 1981. *Historical metaphors and mythical realities: Early history of the Sandwich Islands kingdom* Ann Arbor: University of Michigan Press.
—. 1985. *Islands of History*. Chicago University of Chicago Press.
—. 1991. "The return of the event, again: with reflections on the beginnings of the Great Fijian War of 1843 to 1845 between the kingdoms of Bau and Rewa " in *Clio in Oceania:*

Toward a historical anthropology. Edited by A. Biersack, pp. 37-100. Washington, D.C: Smithsonian Institution Press.
Saitta, D. 1999. "Prestige, agency, and change in middle-range societies," in *Material Symbols: Culture and Economy in Prehistory*, *Center for Archaeological Investigations, Occasional Paper, no. 26*. Edited by J. Robb, pp. 135–149. Carbondale: Southern Illinois University.
Samaniego, P., M. Monzier, C. Robin, and M. L. Hall. 1998. Late Holocene eruptive activity at Nevado Cayambe Volcano, Ecuador. *Bulletin of Volcanology* 59(7):451-459.
Sánchez H., L., L. Alberto, and R. Cooke. 1997. Quién presta y quién imita? Orfebreria e iconografia en "Gran Cocle", Panamá. *Boletin del Museo del Oro (Colombia)* 42:87-111.
Sánchez H., L., and R. Cooke. 1998. ¿Quién presta y quién imita?: Orfebrería e iconografía en 'Gran Coclé'. *Boletín Museo del Oro* 42:87-111.
Sander, D. 1960. Pottery stamps from the province of Chiriquí, Panamá. *Panama Archaeologist* 3 (1):99-104.
Sandweiss, D., and J. Quilter. 2008. *El Niño: Catastrophism, and Culture Change in Ancient America*. Washington, D.C.: Dumbarton Oaks, Harvard University Press.
Santacroce, R., R. Cioni, P. Marianelli, A. Sbrana, R. Sulpizio, G. Zanchetta, D. Donahue, and J. L. Joron. 2008. Age and whole rock–glass compositions of proximal pyroclastics from the major explosive eruptions of Somma-Vesuvius: A review as a tool for distal tephrostratigraphy. *Journal of Volcanology and Geothermal Research (in press)*.
Santos-Granero, F. 2009. *Vital Enemies: Slavery, Predation, and the Amerindian Political Economy of Life*. Austin: University of Texas Press.
Sapper, K. 1913. *Die Mittelamerikanischen Vulkane*. Vol. 178. *Petermanns Geographische Mitteilungen, Ergänzungsheft*. Gotha: Justus Perthes.
—. 1917a. *Geoligischer Bau und Landschaftsbild*. Vol. Band 61. *Einzeldarstellungen aus der Naturwissenschaft und der Technik*. Braunschweig: Friedrick Vieweg & Sohn.
—. 1917b. *Katalog der Geschichtlichen Vulkanausbruche*. Strasbourg: Karl J Trubner.
—. 1925. *Los Volcanes de la America Central*, extra-serie edition. Vol. 1. *Estudios sobre Amé rica y Españ a* Halle (Saale): Verlag von Max Niemeyer.
—. 1937. *Mittelamerika: Hanbuch der Regionalen Geologie*. Vol. 29 Heft. Band VIII.4a. Heidelberg: Verlags, Carl Winter's Universitätsbuchhandlung.
Sarmiento, G. 2000. "La creación de los primeros centros ceremoniales," in *Historia Antigua de México*, 2nd edition, vol. 1: El México Antiguo, sus Areas Culturales, los Orígenes y el Horizonte Preclásico. Edited by L. Manzanilla and L. López Luján, pp. 335–362. Mexico City: Miguel Angel Porrúa.
Saucedo, R., J. L. Macias, M. F. Sheridan, M. I. Bursik, and J. C. Komorowski. 2005. Modeling of pyroclastic flows of Colima Volcano, Mexico: implications for hazard assessment *Journal of Volcanology and Geothermal Research* 139:103-115.
Saylor, B. Z., J. M. Poling, and W. D. Huff. 2005. Stratigraphic and chemical correlation of volcanic ash beds in the terminal Proterozoic Nama Group, Namibia. *Geological Magazine* 142: 519-538.
Scham, S. A. 2009. "'Time's wheel runs back': conversations with the Middle East past," in *Cosmopolitan Archaeologies*. Edited by L. Meskell, pp. 166-183. Durham: Duke University Press.
Schama, S. 1995. *Landscape and Memory*. London: Harper Collins.

Scheele, J. 2007. "Revolution as a convention: rebellion and political change in Kabylia," in *Creativity and Cultural Improvisation*. Edited by E. Hallam and T. Ingold, pp. 151-165. Oxford; New York: Berg.
Schiff, C. J., D. Kaufman, K. Wallace, A. Werner, T. L. Ku, and T. A. Brown. 2008. Modeled tephra ages from lake sediments, base of Redoubt Volcano, Alaska. *Quaternary Geochronology* 3 (1-2).
Schmid, R. 1981. Descriptive nomenclature and classification of pyroclastic deposits and fragments: Recommendations of the IUGS subcommission on the systematics for igneous rocks. *Geology* 9 (1):41-43.
Schobinger, J. 1997. *Arte Prehistórico de América*. *Consejo Nacional para la Cultura y las Artes, México*. Milano: Editoriale Jaca Book.
Schulz, P., B. Lockhart, C. Serr, and B. Lindsey. 2009. Rim codes: a Pacific coast dating system for milk bottles. *Historical Archaeology* 43 (2):31-40.
Schurr, T., and S. Sherry. 2004. Mitochondrial DNA and Y chromosome diversity and the peopling of the Americas: evolutionary and demographic evidence. *American Journal of Human Biology* 16:420-439.
Sebald, W. G. 1988. After Nature.
SEDAC. 1998. "Central American Vegetation/Land Cover Classification and Conservation Status (accessed August 2008, data provide conservation status up to 1995 with an 80% accuracy). vector digital data," Socioeconomic Data and Applications Center, access provided by CIESIN (Center for International Earth Science Information Network). funding provided under NASA Contract NAS5-03117.
Seemann, B. 1853a. *Narrative of the voyage of H.M.S. Herald, Volume 1*. London.
—. 1853b. *Reise um die welt und drei fahrten der kö niglich britischen fregatte Herald nach dem nö rdlichen Polarmeere zur aufsuchung sir John Franklin's in den jahren1845-1851. [Narrative of the voyage of H.M.S. Herald, Volume 1]*. Hannover: C. Rümpler.
—. 1866. "On the resemblances of inscriptions found on ancient British rocks with those of Central America," in *Memoirs read before the Anthropological Society of London (1865-1866)*, vol. II, pp. 277-282. London: Anthropological Society of London.
Selwyn, T. Editor. 1996. *The Tourist Image: Myths and Myth Making in Tourism*. Chichester: John Wiley.
Sendón, P., and D. Villar. 2007. Dualismo, terminología de parentesco y alianza matrimonial en Amazonía y Andes. *Acta Americana* 15 (1):47-88.
Séptimo, R., and L. G. Joly. 1986. *Kugue kira nie ngabere (sucesos antiguos dichos en Guaymi)*. Universidad de Panama.
—. 1998. "Ñaglon bata sö (El sol y la luna)," in *Pueblos Indigenos de Panama*. Edited by C. Picón, J. Alemancia, and I. Gólcher, pp. 21-26. Panamá: UNESCO, Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura.
Service, E. 1962. *Primitive Social Organization*. New York: Random House.
Shane, P. 2000. Tephrochronology: A New Zealand case study. *Earth Science Reviews* 49 (1-4):223-259.
Shane, P., I. A. Nairn, S. B. Martin, and V. C. Smith. 2008. Compositional heterogeneity in tephra deposits resulting from the eruption of multiple magma bodies: Implications for tephrochronology. *Quaternary International* 178:44-53

Shane, P., E. L. Sikes, and T. P. Guilderson. 2006. Tephra beds in deep-sea cores off northern New Zealand: implications for the history of Taupo Volcanic Zone, Mayor Island and White Island volcanoes. *Journal of Volcanology and Geothermal Research* 154:276-290

Shanks, M., and I. Hodder. 1995. "Processual, postprocessual, and interpretive archaeologies," in *Interpreting Archaeology: Finding Meaning in the Past*. Edited by I. Hodder, M. Shanks, and A. Alexandri, pp. 3-29. London: Routledge.

Shaw, A. M., D. R. Hilton, T. P. Fischer, J. A. Walker, and G. A. M. de Leeuw. 2006. Helium isotope variations in mineral separates from Costa Rica and Nicaragua: Assessing crustal contributions, timescale variations and diffusion-related mechanisms *Chemical Geology* 230:124-139

Sheets, P. 1973. The pillage of prehistory. *American Antiquity* 38 (3):317-20.

—. 1975. Behavioral analysis and the structure of a prehistoric industry. *Current Anthropology* 16:369-391.

—. 1979. Maya recovery from volcanic disasters: Ilopongo and Ceren. *Archaeology* 32:32-42.

—. 1980. "The Volcán Barú region: a site survey," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 267-275. Cambridge: Harvard University Press.

—. Editor. 1983. *Archaeology and Volcanism in Central America*. Austin: University of Texas Press.

—. 1984. "The prehistory of El Salvador: An interpretive summary," in *The Archaeology of Lower Central America*. Edited by F. Lange and D. Stone, pp. 85-112. Albuquerque: New Mexico Press.

—. 1992. "The pervasive pejorative in Intermediate Area studies," in *Wealth and Hierarchy in the Intermediate Area*. Edited by F. Lange, pp. 15-42. Washington, D.C.: Dumbarton Oaks.

—. 1999. "The effects of explosive volcanism on ancient egalitarian, ranked and stratified societies in Middle America," in *The Angry Earth: Disaster in Anthropological Perspective*. Edited by A. Oliver-Smith and S. Hoffman, pp. 36-58. London: Routledge.

—. 2001. "The effects of explosive volcanism on simple to complex societies in ancient Middle America," in *Interhemispheric Climate Linkages*. Edited by V. Markgraf, pp. 73-86. San Diego: Academic Press.

—. Editor. 2002. *Before the Volcano Erupted: The Ancient Cerén Village in Central America*. Austin: University of Texas Press.

—. 2004. "The origins of monumentality in ancient Costa Rica, revealed by satellite and aircraft remote sensing," in *1st International Conference on Remote Sensing in Archaeology, October 18-21*. Beijing, China: The Chinese Academy of Sciences.

—. 2006. *The Ceren Site: An Ancient Village Buried by Volcanic Ash in Central America*, 2nd edition. *Case Studies in Archaeology*. Belmont, CA: Thomson Wadsworth.

—. 2007. "People and volcanoes in the Zapotitan Valley, El Salvador," in *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*, *One World Archaeology Series*. Edited by J. Grattan and R. Torrence, pp. 67-89. Walnut Creek, CA: Left Coast Press.

—. 2008. "Armageddon to the Garden of Eden: explosive volcanic eruptions and societal resilience in ancient Middle America," in *El Niño: Catastrophism, and Culture Change in Ancient America*. Edited by D. Sandweiss and J. Quilter, pp. 167-186. Washington, D.C.: Dumbarton Oaks, Harvard University Press.

Sheets, P., and D. Grayson. Editors. 1979. *Volcanic Activity and Human Ecology*. New York: Academic Press.

Sheets, P., and B. McKee. Editors. 1994. *Archaeology, Volcanism, and Remote Sensing in the Arenal Region, Costa Rica*. Austin: University of Texas Press.

Sheets, P., J. Rosenthal, and A. Ranere. 1980. "Stone tools from Volcan Baru," in *Adaptive Radiations in Prehistoric Panama*, vol. 5. Edited by O. Linares and A. Ranere, pp. 404-428. Cambridge: Harvard University Press.

Sheets, P., and T. Sever. 1991. "Prehistoric footpaths in Costa Rica: Transportation and communication in a tropical rainforest," in *Ancient Road Networks and Settlement Hierarchies in the New World*. Edited by D. Trombold, pp. 54-65. Cambridge: Cambridge University Press.

Shelley, P. B. 1985. "Ode to Naples," in *Shelley: Selected Poetry*. Edited by I. Quigly. New York: Penguin.

Shelton, C. 1984. Formative settlement in western Chiriqui, Panama: Ceramic chronology and phase relationships. PhD thesis, Temple University.

—. 1994. A recent perspective from Chiriqui, Panama. *Vinculos* 20 (1-2):79-101.

Shelton Einhaus, C. 1980. "Stone tools from La Pitahaya," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 429-466. Cambridge: Harvard University Press.

Shepard, K. 2002. *Contract Archaeology: The Coloring Book*, 2nd edition. Albuquerque: Thumbprint Publishing.

Sherbondy, J. 1986. The canal systems of Hanan Cuzco. PhD thesis, University of Illinois at Urbana-Champaign.

Sherrod, D., J. Vallance, A. Tapia Espinosa, and J. McGeehin. 2007. *Volcán Barú: Eruptive history and volcano-hazards assessment (Open-File Report 2007-1401)*. United States Geological Survey.

Siebe, C. 2000. Age and archaeological implications of Xitle volcano, southwestern Basin of Mexico-City. *Journal of Volcanology and Geothermal Research* 104:45-64.

Siebe, C., V. Rodriguez-Lara, P. Schaaf, and M. Abrams. 2004. Radiocarbon ages of Holocene Pelado, Guespalapa, and Chichinautzin scoria cones, south of Mexico City: implications for archaeology and future hazards. *Bulletin of Volcanology* 66 (3):203-225.

Siebert, L., G. Alvarado, J. Vallance, and B. v. W. de Vries. 2006a. Large-volume volcanic edifice failures in Central America and associated hazards. *Geological Society of America* Special Paper 412.

Siebert, L., P. Kimberly, C. Calvin, J. Luhr, and G. Kysar Mattietti. 2006b. *Volcanoes of Central America, CD-ROM*. *Digital Information Series, GVP-7*. Washington, DC: Smithsonian Institution Global Volcanism Project.

Siebert, L., P. Kimberly, and C. R. Pullinger. 2004. "The voluminous Acajutla debris avalanche from Santa Ana volcano, western El Salvador, and comparison with other Central American edifice-failure events," in *Natural Hazards in El Salvador*, vol. 375. Edited by R. W. I., B. J. J., L. D. L., C. M. J., and M. J. J., pp. 5-23: Geological Society of America Special Papers.

Sigurdsson, H. 1999. *Melting the Earth: The History of Ideas on Volcanic Eruptions*. New York: Oxford.

Simkin, T., and L. Siebert. 2002-2008. in *Digital Information Series, GVP-5 (http://www.volcano.si.edu)*: Smithsonian Institution, Global Volcanism Program

Simmons, S., and P. Sheets. 2002. "Divination at Cerén: the evidence from structure 12," in *Before the Volcano Erupted: The Ancient Cerén Village in Central America*. Edited by P. Sheets, pp. 104-113. Austin: University of Texas Press.
Simpson, G. G. 1949. *The Meaning of Evolution: A Study of the History of Life and of Its Significance for Man*. New Haven: Yale University Press.
Smalley, J., and M. Blake. 2003. Stalk sugar and the domestication of maize. *Current Anthropology* 44 (5):675-703.
Smith, A. 2003. *Political Landscapes: Constellations of Authority in Early Complex Polities*: University of California Press.
Smith, C. 1980. "Plant remains from the Chiriqui sites and ancient vegetational patterns," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 151-174. Cambridge: Harvard University Press.
Smith, G. 1934. *In the Beginning: The Origin of Civilization*. London: Watts.
Smith, N. 1990. *Uneven Development: Nature, Capital, and the Production of Space*. Cambridge: Basil Blackwell.
—. 2008. *Uneven Development: Nature, Capital, and the Production of Space (afterword by David Harvey)*, 3rd edition. Athens: University of Georgia Press.
Smith, V. C., P. Shane, and I. A. Nairn. 2005. Trends in rhyolite geochemistry, mineralogy, and magma storage during the last 50 kyr at Okataina and Taupo volcanic centres, Taupo Volcanic Zone, New Zealand. *Journal of Volcanology and Geothermal Research* 148:372-406
Snarskis, M. 1981a. "The archaeology of Costa Rica," in *Between Continents/Between Seas: The Precolumbian Archaeology of Costa Rica*, pp. 15-84. New York: Harry Abrams.
—. 1981b. "Catalogue," in *Between Continents, Between Seas: Precolombian Art of Costa Rica*, pp. 178-227. New York: Abrams.
—. 1984. "Central America: The lower Caribbean," in *The Archaeology of Lower Central America*. Edited by F. Lange and D. Stone, pp. 195-232. Albuquerque: University of New Mexico.
—. 1986. "La iconografía comparativa de metales y otros medios en Costa Rica precolombina," in *Metalurgia de América Precolombina, 45° Congreso Internacional de Americanistas*. Edited by C. Plazas, pp. 87-136. Bogotá: Banco de la República.
—. 1992. "The Archaeology of Eastern and Central Costa Rica," in *Wealth and Hierarchy in the Intermediate Area*. Edited by F. Lange, pp. 141-164. Washington, D.C.: Dumbarton Oaks Research Library and Collection.
Soja, E. 1989. *Postmodern Geographies: The Reassertion of Space in Critical Social Theory*. London: Verso.
Solleiro-Rebolledo, E., J. L. Macias, J. Gama-Castro, S. Sedov, and L. A. Sulerzhitsky. 2004. Quaternary pedostratigraphy of the Nevado de Toluca volcano. *Revista Mexicana De Ciencias Geologicas* 21:101-109
Solomon, A. 2008. Myths, making, and consciousness: differences and dynamics in San rock arts. *Current Anthropology* 49 (1):59-86.
Soto, G., and G. Alvarado. 2006. Eruptive history of Arenal volcano, Costa Rica, 7 ka to present. *Journal of Volcanology and Geothermal Research* 157:254-269.
Spang, S., and E. Rosenthal. 1980. "The Pitti-Gonzales (BU-17) site: excavations and stratigraphy," in *Adaptive Radiations in Prehistoric Panama*, vol. 5. Edited by O. Linares and A. Ranere, pp. 280-287. Cambridge: Harvard University Press.
Squier, E. G. 1891. *Adventures on the Mosquito Shore*. New York: Worthington.

Stahl, P. 1986. Hallucinatory imagery and the origin of early South American figurine art. *World Archaeology* 18 (1):134-150.

—. Editor. 1995. *Archaeology in the Lowland American Tropics*. Cambridge: Cambridge University Press.

Staller, J. 2001. "Shamanic cosmology embodied in Valdivia VII-VIII mortuary contexts from the site of La Emergenciana, Ecuador," in *Mortuary Practices and Ritual Associations: Shamanic Elements in Prehistoric Funerary Contexts in South America*. Edited by J. Staller and E. Currie, pp. 19-36. Oxford, UK: BAR International Series 982.

Steffian, A., J. Beget, and P. Saltonstall. 1996. Prehistoric Alutiiq artifact from Kodiak Island provides oldest documentary record of ancient volcanic eruptions in Alaska. *Alaska Volcano Observatory Bimonthly Report* 8:13-14.

Stehli, F., and S. Webb. 1985. *The Great American Biotic Interchange*. New York: Plenum Press.

Stephens, J. L., and F. Catherwood. 1969 [1841]. *Incidents of travel in Central America, Chiapas, and Yucutan*. Vol. 2. New York: Dover.

Steward, J. 1955. *Theory of Culture Change: The Methodology of Multilinear Evolution*. Chicago: University of Illinois Press.

Stewart, R. 1978. *Preliminary geology: el Volcán region, province of Chiriquí, Republic of Panamá. manuscript on file, STRI library*. Smithsonian Tropical Research Institute, Panama.

Stier, F. 1979. The Effect of Demographic Change on Agriculture in San Blas. Ph.D. dissertation, University of Arizona, Tuscon.

Stirling, M. 1950. Exploring ancient Panama by helicopter. *National Geographic Magazine* 97 (2), February:227-246.

Stirling, M., and M. Stirling. 1964. Archaeological notes on Almirante Bay, Bocas del Toro, Panama. *Smithsonian Institution Bureau of American Ethnology Bulletin* 191:259-284.

Stitchler, J. C., D. M. Fisher, T. W. Gardner, and M. Protti. in press. Constraints on inner forearc deformation from balanced cross sections, Fila Costeña Thrust Belt, Costa Rica. *Tectonics*.

Stock, J., and J. Lee. 1994. Do microplates in subduction zones leave a geological record? . *Tectonics* 13:1472-1487.

Stollhofen, H., I. Stanistreet, L. McHenry, G. Mollel, R. Blumenschine, and F. Masao. 2008. Fingerprinting facies of the Tuff IF marker, with implications for early hominin palaeoecology, Olduvai Gorge, Tanzania. *Palaeogeography, Palaeoclimatology, Palaeoecology* 259:382-409.

Stone-Miller, R. 2002. *Seeing with New Eyes*. Atlanta: Michael C. Carlos Museum, Emory University

Stone, D. 1943. A preliminary investigation of the flood plain of the rio Grande de Terraba, Costa Rica. *American Antiquity* 9 (1):74-88.

—. 1961. *Las Tribus Talmanqueas de Costa Rica*. San José, Costa Rica: Museo Nacional de Costa Rica.

—. 1963. Cult traits in southeastern Costa Rica and their significance. *American Antiquity* 28 (3):339-359.

Stone, P., and R. MacKenzie. 1990. *The Excluded Past: Archaeology in Education*. London: Unwin Hyman.

Stone, R. 2007. Using the past to heal the present: rock art and curing in western Amazonia. *Acta Americana* 15 (1):5-26.

Straight, B. 2008. Killing god: exceptional moments in the colonial missionary encounter. *Current Anthropology* 49 (5):837-860.
Strathern, M. 1980. "No nature, no culture: The Hagen case," in *Nature, Culture, and Gender*. Edited by C. MacCormack and M. Strathern, pp. 174-222. Cambridge: Cambridge University Press.
—. 1988. *The Gender of the Gift: Problems with Women and Problems with Society in Melanesia*. Berkeley: University of California Press.
—. 1992. *After Nature: English Kinship in the Late Twentieth Century*. Cambridge: Cambridge University Press.
Strong, W. L., and L. V. Hills. 2005. Late-glacial and Holocene palaeovegetation zonal reconstruction for central and north-central North America. *Journal of Biogeography* 32:1043-1062.
Stuiver, M., and P. J. Reimer. 1993. Extended C-14 database and revised CALIB 3.0 C-14 age calibration program. *Radiocarbon* 35:215-30.
Sullivan, T., and T. Knab. 1994. *A Scattering of Jades*. New York: Simon and Schuster.
Swidler, N., K. Dongoske, R. Anyon, and A. Downer. Editors. 1997. *Native Americans and Archaeologists: Stepping Stones to a Common Ground*. Walnut Creek: Alta Mira Press.
Tamm, E., T. Kivisild, M. Reidla, M. Metspalu, D. G. Smith, C. J. Mulligan, C. M. Bravi, O. Rickards, C. Martinez-Labarga, E. K. Khusnutdinova, S. A. Fedorova, M. V. Golubenko, V. A. Stepanov, M. A. Gubina, S. I. Zhadanov, L. P. Ossipova, L. Damba, M. I. Voevoda, J. E. Dipierri, R. Villems, and R. S. Malhi. 2007. Beringian Standstill and Spread of Native American Founders. *PLoS ONE* 2:e829.
Taussig, M. 1993. *Mimesis and Alterity*. New York: Routledge.
Taylor, A. B. 1867. *Golden relics from Chiriqu. A paper read before the Numismatic and Antiquarian Society of Philadelphia on Thursday October 5, 1865*. The Numismatic and Antiquarian Society.
Taylor, W. 1948. *A Study of Archaeology*. Carbondale: Southern Illinois University Press.
Tedeschi, B. 2006. "Content to watch bananas grow, more retirees relocate to Panama," in *The New York Times*. New York.
Telford, J. T., P. Barker, S. E. Metcalfe, and A. J. Newton. 2004. Lacustrine responses to tephra deposition: examples from Mexico. *Quaternary Science Reviews* 23:2337-2353.
Terry, R. 1956. *A Geological Reconnaissance of Panama*. *Occasional Papers of the California Academy of Sciences: no. 23*. San Francisco: California Academy of Sciences.
Thacker, C. 1984. "The Volcano: culmination of the landscape garden," in *British and American Gardens in the Eighteenth Century*. Edited by R. Maccubbin and P. Martin, pp. 75-83. Williamsburg, Virginia: The Colonial Williamsburg Foundation.
The Archaeological Society of Panamá. 1965. Membership List. *Panama Archaeologist* 6(1):71-72.
Thomas, J. 2001. "Archaeologies of place and landscape," in *Archaeological Theory Today*. Edited by I. Hodder, pp. 165-86. Cambridge: Polity Press.
—. 2004a. *Archaeology and Modernity*. London, New York: Routledge.
—. 2004b. "History and nature," in *Archaeology and Modernity*, pp. 78-95. London, New York: Routledge.
—. 2004c. "Materialities," in *Archaeology and Modernity*, pp. 202-222. London, New York: Routledge.

—. 2004d. "Mind, perception and knowledge," in *Archaeology and Modernity*, pp. 171-201. London, New York: Routledge.
—. 2004e. "The tyrrany of method," in *Archaeology and Modernity*, pp. 55-77. London, New York: Routledge.
—. 2007. "Mesolithic-Neolithic transitions in Britain: from essence to inhabitation," in *Going Over: The Mesolithic-Neolithic Transition in North-West Europe*, *Proceedings of the British Academy 144*. Edited by A. Whittle and V. Cummings, pp. 423-40. Oxford: Oxford University Press.
Thomas, N. 1991. *Entangled Objects*. Cambridge: Harvard University Press.
Thompson, S. 1990. "Metaphors the Chinese age by," in *Anthropology and the Riddle of the Sphinx: Paradoxes of Change in the Life of Course*. Edited by S. Thompson. London: Routledge.
Thórarinsson, S. 1944. Tefrokronologiska studier på Island - Thjórsárdalur och dess förödelse [Tephrochronological studies in Iceland]. *Geografiska Annaler* 26 (1-2):1-217.
—. 1958. The Oraefajokull eruption of 1362 *Acta Naturalia Islandica* 2(2) 1-99
—. 1980. "Tephrochronology in medieval Iceland," in *Scientific Methods in Medieval Archaeology*. Edited by R. Berger, pp. 295-328. Berkeley: University of California Press.
—. 1981a. Greetings from Iceland - ash falls and volcanic aerosols in Scandinavia. *Geografiska Annaler Series A 63*:109-110.
—. 1981b. "Tephra studies and teprochronology: An historical review with special reference to Iceland," in *Tephra Studies*. Edited by Self S and S. RSJ, pp. 1-12 Dordrecht: Ed. D. Reidal.
Thorkelson, D. J., and R. P. Taylor. 1989. Cordilleran slab windows. *Geology* 17:833-836.
Thouret, J. C. 2005. The stratigraphy, depositional processes, and environment of the late Pleistocene Polallie-period deposits at Mount Hood Volcano, Oregon, USA. *Geomorphology* 70:12-32.
Thouret, J. C., E. Juvigne, A. Gourgaud, P. Boivin, and J. Davila. 2002. Reconstruction of the AD 1600 Huaynaputina eruption based on the correlation of geologic evidence with early Spanish chronicles. *Journal of Volcanology and Geothermal Research* 115:529-570.
Thouret, J. C., M. Rivera, G. Worner, M. C. Gerbe, A. Finizola, M. Fornari, and K. Gonzales. 2005. Ubinas: the evolution of the historically most active volcano in southern Peru. *Bulletin of Volcanology* 67:557-589.
Tilley, C. 1994. *A Phenomenology of Landscape: Places, Paths and Monuments*. Oxford: Berg.
—. 2004a. *The Materiality of Stone*. Oxford: Berg.
—. 2004b. "Sprouting rhizomes and giant axes: experiencing Breton menhirs," in *The Materiality of Stone*, pp. 33-86. Oxford: Berg.
—. 2006. Introduction: Identity, Place, Landscape and Heritage. *Journal of Material Culture* 11:7-32.
Tomascak, P., J. Ryan, and M. Defant. 2000. Lithium isotope evidence for light element decoupling in the Panama subarc mantle. *Geology* 28 (6):507-10.
Toms, P. S., M. King, M. A. Zarate, R. A. Kemp, and F. F. Foit. 2004. Geochemical characterization, correlation, and optical dating of tephra in alluvial sequences of central western Argentina. *Quaternary Research* 62:60-75.
Torrence, R. 1986. *Production and Exchange of Stone Tools: Prehistoric Obsidian in the Aegean*. *New Studies in Archaeology*. Cambridge: Cambridge University Press.
—. 1989. "Tools as Optimal Solutions," in *Time, Energy and Stone Tools*. Edited by R. Torrence, pp. 1-6. Cambridge: Cambridge University Press.

—. 2008. "Punctuated landscapes: Creating cultural places in volcanically active environments," in *Landscape Archaeology Handbook*. Edited by J. Thomas and B. David, pp. 333-343: Left Coast Press.

Torrence, R., and T. Doelman. 2007. "Chaos and selection in catastrophic environments: Willaumez Peninsula, Papua New Guinea," in *Living Under the Shadow: Cultural Impacts of Volcanic Eruptions*, *One World Archaeology Series*. Edited by J. Grattan and R. Torrence, pp. 42-66. Walnut Creek, CA: Left Coast Press.

Torrence, R., and J. Grattan. Editors. 2002. *Natural Disasters and Cultural Change*. London and New York: Routledge.

Torrence, R., C. Pavlides, P. Jackson, and J. Webb. 2000. "Volcanic disasters and cultural discontinuities in the Holocene of West New Britain, Papua New Guinea," in *The Archaeology of Geological Catastrophes*, vol. 171. Edited by B. McGuire, D. Griffiths, and I. Stewart, pp. 225-244. London: Geological Society of London.

Toulouse, J. H. 1971. *Bottle Makers and their Marks*. New York: Thomas Nelson.

Trigger, B. 1978. *Time and Traditions: Essays in Archaeological Interpretation*. New York: Columbia University Press.

—. 2006. *A History of Archaeological Thought*, 2nd edition. New York: Cambridge University Press.

—. 2007. "Cross-cultural comparisons and archaeological theory," in *A Companion to Social Archaeology*. Edited by L. Meskell and R. Preucel, pp. 43-65. Malden, MA and Oxford: Blackwell Publishing.

Tringham, R. 1991. "Households with faces: The challenges of gender in prehistoric architectural remains," in *Engendering Archaeology: Women and Prehistory*. Edited by J. Gero and M. Conkey, pp. 93-131. Oxford: Basil Blackwell.

Trouillot, M.-R. 1997. *Silencing the Past: Power and the Production of History*. Boston: Beacon Press.

Tryon, C. 2003. The Acheulian to Middle Stone Age Transition: Tephrostratigraphic Context for Archaeological Change in the Kapthurin Formation, Kenya; PhD thesis, University of Connecticut.

Tryon, C., A. Logan, D. Mouralis, S. Kuhn, L. Slimak, and N. Balkan-Atli. in press (accepted 2008). Building a tephrostratigraphic framework for the Paleolithic of Central Anatolia, Turkey. *Journal of Archaeological Science*.

Tryon, C., and S. McBrearty. 2006a. Tephrostratigraphy of the Bedded Tuff Member (Kapthurin Formation, Kenya) and the nature of archaeological change in the later middle Pleistocene *Quaternary Research* 65:492-507.

Tryon, C. A., and S. McBrearty. 2006b. Tephrostratigraphy of the Bedded Tuff Member (Kapthurin Formation, Kenya) and the nature of archaeological change in the later middle. *Pleistocene Quaternary Research* 65:492-507

Tsing, A. L. 1993. *In the Realm of the Diamond Queen: Marginality in an Out-of-the-way Place*. Princeton, NJ: Princeton University Press.

Tuan, Y.-F. 1990. *Topophilia: A Study of Environmental Perceptions, Attitudes, and Values*, Morningside edition. New York: Columbia University Press.

Turner, M., S. Cronin, R. Stewart, M. Bebbington, and I. E. M. Smith. 2008. Using titanomagnetite textures to elucidate volcanic eruption histories. *Geology* 36 (1):31-34.

Turner, V. 1968. "Myth and symbol," in *International Encyclopedia of the Social Sciences*, vol. 9. Edited by D. Sills. New York: Macmillan.

Turner, W. 1999. *Maya Designs*. Mineola, NY: Dover Publications.
Turney, C., S. Blockley, J. Lowe, S. Wulf, N. Branch, G. Mastrolorenzo, G. Swindle, R. Nathan, and M. Pollard. 2008. Geochemical characterization of Quaternary tephras from the Campanian Province, Italy. *Quaternary International* 178:288-305.
Turney, C., J. Lowe, S. Davies, S. Hall, D. Lowe, S. Wastegard, W. Hoek, and B. Alloway. 2004. Tephrochronology of Last Termination Sequences in Europe: A protocol for improved analytical precision and robust correlation procedures (a joint SCOTAV-INTIMATE proposal). *Journal of Quaternary Science* 19:111-120.
Twain, M. 2007 [1869]. "The buried city of Pompeii," in *Innocents Abroad: or, The New Pilgrims' Progress*. Whitefish, MT: Kessinger Publishing.
Universidad Tecnológica de Panamá. 1992. Evaluación de la amenaza, estimacion de la vulnerabilidad y del factor costo del riesgo del Volcán Baru, Republica de Panamá. Universidad Tecnológica de Panama, Facultad de Ingenieria Civil, Departmento de Ingeniería Civil. 129 p. and 1:100,000 scale map. March:1-129.
Uriost, G. 1983. *Hijos de Pariya Qaqa: La tradición oral de Waru Chiri (mitología y costumbres)*. *Latin American Series no 6, vol 11*. Syracuse: Foreign and Comparative Studies Program, Maxwell School of Citizenship and Public Affairs.
Urrutia, R., A. Araneda, F. Cruces, L. Torres, L. Chirinos, H. C. Treutler, N. Fagel, S. Bertrand, I. Alvial, R. Barra, and E. Chapron. 2007. Changes in diatom, pollen, and chironomid assemblages in response to a recent volcanic event in Lake Galletue (Chilean Andes) *Limnologica* 37:49-62
USGS. 2008 "Tephrachronology," in http://geology.cr.usgs.gov/capabilities/gronemtrac/geochron/teph/tech.html.
Van der Hoorn, M. 2003. Exorcizing remains: architectural fragments as intermediaries between history and individual experience. *Journal of Material Culture* 8 (2):189-213.
Van Wyk de Vries, B., P. Grosse, and G. Alvarado. 2007. "Volcanism and volcanic landforms," in *Central America: Geology, Resources and Hazards*. Edited by J. Bundschuh and G. Alvarado, pp. 123-154. London: Taylor & Francis.
Vargas, C. A. Editor. 1979. *Antología: El Volcán Poás*. Vol. 1. *Serie Educacion Ambiental no. 3*. San José, Costa Rica: Editorial Universidad Estatal a Distancia.
Verrill, H. 1928a. "A mystery of the vanished past in Panama: newly discovered relics of a vanished civilization destroyed by earthquake or volcanic eruption. October 13 edition," in *Illustrated London News*, vol. 173. London.
—. 1928b. The Pompeii of Ancient America: a vast settlement destroyed centuries before Christ. *The World's Work*:279-288.
Verrill, H., and R. Verrill. 1929. "The Pompeii of America," in *Old Civilizations of the New World*, pp. 72-93. New York.
Villarosa, G., V. Outes, A. Hajduk, E. C. Montero, D. Selles, M. Fernandez, and E. Crivelli. 2006. Explosive volcanism during the Holocene in the Upper Limay River Basin: The effects of ashfalls on human societies, Northern Patagonia, Argentina. *Quaternary International* 158:44-57
Vitaliano, D. 1973. "Volcano Lore," in *Legends of the earth; their geologic origins*. Bloomington: Indiana University Press.
Viveiros de Castro, E. 1996. Images of Nature and Society in Amazonian Ethnography. *Annual Review of Anthropology* 25:179-200.

—. 1998. Cosmological deixis and Amerindian perspectivism. *Journal of the Royal Anthropological Institute* 4:469-88.

von Frantzius, A. 1861. "Beiträge zue Kenntniss der Vulkane Costa Rica's," in *Petermann's Geographische Mittheilungen*, vol. IX-X, pp. 329-338. Gotha: Justus Perthes.

—. 1979 [1861]. "Antología: El Volcán Poás," in *Serie Educacion Ambiental no. 3*, vol. 1. Edited by C. A. Vargas, pp. 11-34. San José, Costa Rica: Editorial Universidad Estatal a Distancia.

Wagner, M. 1861. Beiträge zu einer physisch-geographischen skizze des isthmus von Panamá. *Petermanns Geographische Mitteilungen* Ergä nzungsheftH. 5. Gotha: Justus Perthes.

—. 1862. Über einige wenig bekannte vulkane im tropischen Amerika. *Petermanns Geographische Mitteilungen*:408-20.

—. 1863. Die Provinz Chiriquí (West-Veragua) in Mittel-Amerika. *Petermanns Geographische Mitteilungen*:16-24.

—. 1870. *Naturwissenschaftliche Reisen im Tropischen Amerika*. Stuttgart: J.G. Cotta.

Wagner, R. 1975. *The Invention of Culture*. Englewood Cliffs: Prentice-Hall.

—. 1981. *The Invention of Culture*. Chicago: University of Chicago Press.

Wagner, W., and C. Scherzer. 1856. *Die Republik Costa Rica in Central - Amerika mit besonderer Berücksichtigung der Naturverhältnisse und der Frage der deutschen Auswanderung und Colonisation*. Leipzig: Arnold.

Wake, T. 2003. *Proyecto Arqueológico Sitio Drago: Prehistoric Subsistence and Society in Northwest Caribbean Panama, Phase 1: 2003 Archaeological Testing at Sitio Drago, Isla Colón, Bocas del Toro, Panamá.* Report presented to Patrimonio Histórico, INAC, Republica del Panamá.

—. 2004. *Proyecto Arqueológico Sitio Drago: Prehistoric Subsistence and Society in Northwest Caribbean Panama, Extended Phase 1: 2004 Archaeological Testing at Sitio Drago, Isla Colón, Bocas del Toro, Panamá and Preliminary Site Survey Results*. report presented to Patrimonio Histórico, INAC, Republica del Panamá.

—. 2006. Prehistoric exploitation of the swamp palm (raphia taedigera: arecacea) at Sitio Drago, Isla Colón, Bocas del Toro province, Panama. *Caribbean Journal of Science* 42 (1):11-19.

Wake, T., J. de Leon, and C. F. Bernal. 2004. Prehistoric Sitio Drago, Bocas del Toro, Panama. *Antiquity* 78:http://antiquity.ac.uk/ProjGall/wake/index.html.

Wallace, K. 2003. Characterization and descrimination of Holocene tephra-fall deposits, Mount Spurr volcano, Alaska. unpublished MS thesis, Northern Arizona University.

Ware, G., and J. Brady. 1999. "Multi-spectral analysis of ancient Maya pigments: implications for the Naj Tunich corpus," in *June 1998-May 1998: Record of Activities and Research Reports*, vol. 19, pp. 132-35. Washington, D.C.: National Gallery of Art, Centre for the Advanced Study of the Visual Arts.

—. 2001. "Las inscripciones de Naj Tunich: avances recientes de imagen multi-espectral," in *XIV Simposio de Investigaciones Arqueológicas en Guatemala*. Edited by J. Porte, A. Monzón de Suasnávar, and B. Arroyo. Guatemala City: Ministerio de Cultura y Deportes.

Wassén, S. H. 1936. An archaeological study in the western Colombian Cordillera. *Etnologiska Studier (Göteborg)* 2.

—. 1949. Some archaeological observations from Boquete, Chiriqui, Panama. *Etnologiska Studier* 16:140-192.

Wastegård, S., M. Rundgren, K. Schoning, S. Andersson, S. Björck, A. Borgmark, and G. Possnert. 2008. Age, geochemistry and distribution of the mid-Holocene Hekla-S/Kebister tephra. *Holocene* 18 (4):539-549.

Watson, P. J. 1983. "Foreword to the 1983 edition," in *A Study of Archaeology, by Walter W. Taylor*, pp. ix-xvi. Carbondale: Southern Illinois University.

Webb, S. 1997. "The great American faunal interchange," in *Central America: A Natural and Cultural History*. Edited by A. Coates, pp. 97-122. New Haven: Yale University Press.

Weber, M. 1993. *The Sociology of Religion*. Boston: Beacon Press.

Webmoor, T., and C. Witmore. 2008. Things are us! A commentary on human/thing relations under the banner of a 'social' archaeology. *Norwegian Archaeological Review* 41 (1):1-18.

Wegener, A. 1966 [1915]. *The Origin of Continents and Oceans (Translated from the 4th revised German edition by John Biram)*. New York: Dover.

Weiner, A. 1992. *Inalienable Possessions: The Paradox of Keeping-While-Giving*. Berkeley: University of California Press.

West, P. 2005. Translation, value, and space: theorizing an ethnographic and engaged environmental anthropology. *American Anthropologist* 107 (4):632-42.

—. 2006. *Conservation is Our Government Now*. *New Ecologies for the Twenty-First Century*. Durham and London: Duke University Press.

West, P., and J. Carrier. 2004. Ecotourism and authenticity: Getting away from it all? *Current Anthropology* 45:483-498.

West, P., J. Igoe, and D. Brockington. 2006. Parks and Peoples: The Social Impact of Protected Areas. *Annual Review of Anthropology* 35:251-294.

Weyl, P. 1968. The role of the oceans in climate change; a theory of the ice ages. *Meteorological Monographs* 8:37-62.

Weyl, R. 1980. *Geology of Central America*. Berlin: Gebruder Borntraeger.

White, L. 1959. *The Evolution of Culture*. New York: McGraw-Hill.

Whitely, P. 2002. Archaeology and oral tradition: the scientific importance of dialogue. *American Antiquity* 67 (3):405-415.

Whitford-Stark, J. L. 2007. *Volcanic Features on Stamps (cd-rom)*.

Whitley, D. 2005. *Introduction to Rock Art Research*. Walnut Creek, CA: Left Coast Press.

—. 2008. Archaeological Evidence for Conceptual Metaphors as Enduring Knowledge Structures *Time & Mind* 1(1):7-29.

Whittle, A., and V. Cummings. 2007. *Going Over: The Mesolithic-Neolithic Transition in North-West Europe*. *Proceedings of the British Academy 144*. Oxford: Oxford University Press.

Wilbert, J., and K. Simoneau. 1992. *Folk Literature of South American Indians: General Index*. Los Angeles: UCLA Latin American Center.

Williams, P. R. 2002. Rethinking disaster-induced collapse in the demise of the Andean highland states: Wari and Tiwanaku. *World Archaeology* 33:361-374.

Williams, R. 1980. "Ideas of nature," in *Problems in Materialism and Culture*. Edited by R. Williams, pp. 67-85. London: Verso.

Wilson, A. 1992. *The Culture of Nature: North American Landscape from Disney to the Exxon Valdez*. Cambridge, MA: Basil Blackwell.

Winckelmann, J. J. 1762. *Open Letter on the Discoveries of Herculaneum [Sendschreiben von den herculanischen Entdeckungen]*. Dresden.

Wing, E. 1980. "Aquatic fauna and reptiles from the Atlantic and Pacific sites," in *Adaptive Radiations in Prehistoric Panama*, vol. 5, *Peabody Museum Monographs*. Edited by O. Linares and A. Ranere, pp. 194-215. Cambridge: Harvard University Press.

Winichakul, T. 1994. *Siam Mapped: A history of the geo-body of a nation*. Honolulu: University of Hawaii Press.

Wood, D., and C. Shelton. 1996. New data from old collections: the 1949 Stirling collection from Panama in the National Museum of Natural History. *Museum Anthropology* 20:3-20.

Wylie, A. 2002a. "Ethical dilemmas in archaeological practice: The (trans)formation of disciplinary identity," in *Thinking From Things: Essays in the Philosophy of Archaeology*, pp. 229-246. Berkeley: University of California Press.

—. 2002b. ""Heavily decomposing red herrings": Middle ground in the anti-/postprocessual wars," in *Thinking From Things: Essays in the Philosophy of Archaeology*, pp. 171-178. Berkeley: University of California Press.

—. 2002c. "Introduction: Philosophy from the ground up," in *Thinking From Things: Essays in the Philosophy of Archaeology*, pp. 1-22. Berkeley: University of California Press.

Yoffee, N. 1993. "Too many chiefs? (or, Safe texts for the '90's)," in *Archaeological Theory: Who Sets the Agenda?* Edited by N. Yoffee and A. Sherratt, pp. 60-78. Cambridge: Cambridge University Press.

Young, P. D. 1971. *Ngawbe: Tradition and Change amoung the western Guaymí of Panamá*. *Illinois Studies in Anthropology, no. 7*. Urbana, Chicago and London: University of Illinois Press.

Zeidler, J. 2003. "Modeling human response to volcanic disasters in coastal Ecuadorian prehistory: A view from the Jama Valley," in *World Archaeological Congress 5*. Washington, D.C.

Zeldin, T. 1995. *An Intimate History of Humanity*. New York: Harper Collins.

Zihlman, A. 2001. *The Human Evolution Coloring Book*, 2nd edition. New York: HarperCollins.

Zilberg, J. 1986. "The Diquis petroglyphs: distribution, archaeological context and iconographic content," in *Prehistoric Settlement Patterns in Costa Rica*, vol. 14 (1-2), *Journal of the Steward Anthropological Society*. Edited by F. Lange and L. Norr, pp. 339-359.

Žižek , S. 2008. "Unbehagen in der natur," in *In Defense of Lost Causes*, pp. 420-461. London: Verso.

Zolitschka, B., F. Schäbitz, A. Lücke, H. Corbella, B. Ercolano, M. Fey, T. Haberzettl, S. Janssen, N. Maidana, C. Mayr, C. Ohlendorf, G. Oliva, M. M. Paez, G. H. Schleser, J. Soto, P. Tiberi, and M. Wille. 2006. Crater lakes of the Pali Aike Volcanic Field as key sites for paleoclimatic and paleoecological reconstructions in southern Patagonia, Argentina. *Journal of South American Earth Sciences* 21:294–309.

Zubrow, E. 1994. "Knowledge representation and archaeology: a cognitive example using GIS," in *The Ancient Mind: Elements of Cognitive Archaeology*. Edited by C. Renfrew and E. Zubrow, pp. 107-118. Cambridge: Cambridge University Press.

Zuidema, R. 1964. *The ceque system of Cuzco: The social organization of the capital of the Incas*. Leiden: E.J. Brill.

—. 1990. *Inca civilization in Cuzco*. Austin: University of Texas Press.

Appendices

Appendix A: Citations for geological and tephrochronological studies

Citations are divided by geographic area and can be found in the main bibliography:

Appendix A (1): citations for current understanding of isthmian area plate tectonics and volcanism

(Abratis and Wörner 2001, Alvarado 2000, Alvarado and Soto 2008, Alvarado et al. 1993, Bundschuh et al. 2007b, Carr et al. 2003, Coates 1997a, Coates et al. 2003, Coates et al. 2004, Cowan 1997, de Boer et al. 1991, de Boer et al. 1988, de Boer et al. 1995, Defant et al. 1987, Defant et al. 1992, Dengo 1985, Dickinson and Snyder 1979, Drummond et al. 1995, Forsythe and Nelson 1985, Gonzalez and Persson 1997, Gräfe et al. 2002, Gutscher et al. 2000, Harry and Green 1999, Herrstrom, Reagan, and Morris 1995, Hole 1988, Johnston and Thorkelson 1997, Kellog, Oguijiofor, and Kansakar 1985, Kellog and Vega 1995, Kirby, Jones, and MacFadden 2008, Leeman and Carr 1995, Lindholm et al. 2007, MacMillan, Gans, and Alvarado 2004, Mann, Rogers, and Gahagan 2007, Marshall 2000, 2007, Marshall, Fisher, and Gardner 2000, Marshall et al. 2003, Morell, Fisher, and Gardner 2008, Ramirez 1988, Rausch 2007, Rogers, Kárason, and van der Hilst 2002, Stitchler et al. in press, Stock and Lee 1994, Thorkelson and Taylor 1989, Tomascak, Ryan, and Defant 2000, Weyl 1980).

Appendix A (2): citations for tephra studies from Iceland and western Europe

(Barber, Langdon, and Blundell 2008, Chambers et al. 2004, Dugmore, Larsen, and Newton 2004, Dugmore and Newton 1999, Dugmore et al. 2000, Haflidason, Eiriksson, and van Kreveld 2000, Hall 2003, Hunt 2004, Kristjánsdóttir et al. 2007, Larsen et al. 2002, Margari et al. 2007, McGovern et al. 2007, Nowell, Jones, and Pyle 2006, Pyle et al. 2006)

Appendix A (3): citations for tephra samples from New Zealand

(Buck, Higham, and Lowe 2003, Byrami 2002, Darragh et al. 2006, Gehrels et al. 2006, Hogg et al. 2003, Horrocks et al. 2005a, Horrocks et al. 2005b, Horrocks et al. 2007, Kobayashi et al. 2005, Lowe et al. 1998, Lowe, Newnham, and McCraw 2002, Lowe et al. 2000, Lowe et al. 2008, Molloy, Shane, and Nairn 2008, P. Shane 2007, Platz et al. 2007, Shane 2000, Shane et al. 2008, Shane, Sikes, and Guilderson 2006, Smith, Shane, and Nairn 2005, Stollhofen et al. 2008, Turner et al. 2008)

Appendix A (4): citations for studies of tephras from Africa

(Chernet et al. 1998, Garcin et al. 2006, McDougall and Brown 2006, McHenry 2005, McHenry, Mollel, and Swisher 2008, Pyle 1999, Saylor, Poling, and Huff 2005, Stollhofen et al. 2008, Tryon 2003, Tryon et al. in press (accepted 2008), Tryon and McBrearty 2006a, Tryon and McBrearty 2006b)

Appendix A (5): citations for studies of tephra from Alaska

(Chernet et al. 1998, Garcin et al. 2006, McDougall and Brown 2006, McHenry 2005, McHenry, Mollel, and Swisher 2008, Pyle 1999, Saylor, Poling, and Huff 2005, Stollhofen et al. 2008, Tryon 2003, Tryon et al. in press (accepted 2008), Tryon and McBrearty 2006a, Tryon and McBrearty 2006b)

Appendix A (6): citations for studies of tephra from Asia

(Machida 1999, Nakada 2005)

Appendix A (7): citations for studies of tephra from eastern Europe/Eurasia

(Bourgeois et al. 2006, Fierstein 2007, Ponomareva et al. 2004)

Appendix A (8): citations for studies of tephra from Antarctica

(Harpel, Kyle, and Dunbar 2008, Hillenbrand et al. 2008)

Appendix A (9): citations for studies of tephra from the northwestern US

(Bacon and Lanphere 2006, Carter et al. 2006, Colman et al. 2006, Rose, Riley, and Dartevelle 2003, Strong and Hills 2005, Thouret 2005)

Appendix A (10): citations for studies of tephra from eastern and southern Europe

(Calanchi and Dinellis 2008, Harangi, Mason, and Lukacs 2005, Santacroce et al. 2008, Turney et al. 2008).

Appendix A (11): citations for studies of tephra from México

(Almelda-Lenero et al. 2005, Arce et al. 2005, Caballero et al. 2006, Davies et al. 2004, Espíndola et al. 2000, Lozano-Garcia and Vazquez-Selem 2005, Newton et al. 2005, Newton and Metcalfe 1999, Ortega-Guerrero and Newton 1998, Saucedo et al. 2005, Solleiro-Rebolledo et al. 2004, Telford et al. 2004).

Appendix A (12): citations for studies of tephra from the Andes and Patagonia

(Betrand, Castiaux, and Juvigné 2008, Daga et al. 2006, Gilli 2005, Haberle and Bennett 2004, Haberzettl et al. 2007, Hall et al. 2008, Isaacson and Zeidler 1998, Kilian et al. 2003, Le Pennec et al. 2008, Motoki 2006, Naranjo and Stern 1998, Rodbell et al. 2002, Samaniego et al. 1998, Thouret et al. 2005, Toms et al. 2004, Urrutia et al. 2007, Villarosa et al. 2006).

WW=USGS lab, β=Beta Analytic, I=Teledyne lab;
BC dates are indicated with a negative sign
Shaded rows indicate dates from archaeological or palaeoecological

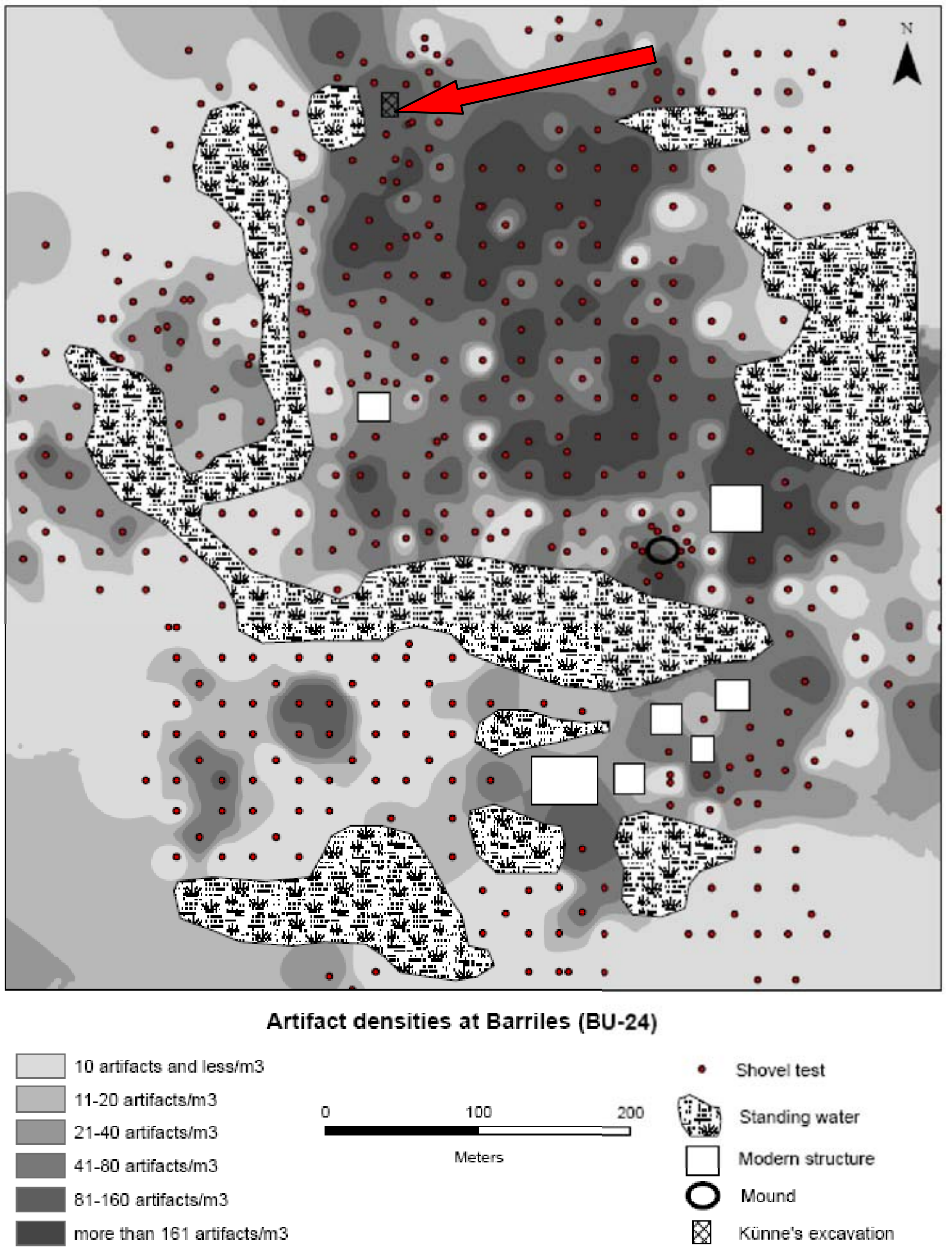
Appendix B: 14C dates associated with Barú eruptions (youngest to oldest)

*I calculated all calibrations using CALIB 5.0.0.2 and the INTCAL04.14C dataset (Reimer et al. 2004) and assume a -25 $^{13}C/^{12}C$

Lab #	Sample # if any	^{14}C age, year BP	±	1 or2 δ	# of ranges	cal AD/BC ranges* (lower)	(upper)	probability	(lower)	(upper)	probability	(lower)	(upper)	probability	(lower)	(upper)	probability	mean date*	citation and details
WW6166	RC-61-1	370	35	1	3	1453	1521	0.7	1578	1581	0.02	1591	1620	0.29				1519	Sherrod et al. (2007). charcoal
		370		2	2	1446	1529	0.55	1543	1634	0.45							1519	
WW6189	RC-2-3	420	30	1	1	1438	1476	1										1459	Sherrod et al. (2007). wood
		420		2	2	1427	1515	0.93	1599	1617	0.07							1459	
WW6162	S07-VB88-1	465	35	1	1	1423	1448	1										1436	Sherrod et al. (2007). charcoal
		465		2	1	1406	1476	1										1436	
β95496		500	60	1	2	1326	1343	0.15	1394	1451	0.85							1418	Behling (2000). Laguna Volcán. Mixed organic material. 42 cm depth. Base of the most recent Barú tephra
		500		2	4	1298	1371	0.24	1378	1496	0.74	1508	1510	0	1601	1615	0.01	1418	
β122556		540	50	1	2	1322	1348	0.35	1392	1433	0.65							1392	Clement and Horn (2001). Laguna Zoncho. Organic material. 118-122 cm depth. NOTE: this sample was 20 cm BELOW the most recent Barú tephra
		540		2	2	1300	1368	0.44	1381	1445	0.57							1392	
β150706		640	60	1	2	1286	1323	0.44	1346	1393	0.56							1343	Anchukaitis and Horn (2005). Laguna Santa Elena. Mixed plant material. 312 cm depth. Immediately above the most recent Barú tephra
		640		2	1	1272	1413	1										1343	
I-7236		740	150	1	1	1155	1401	1	1246										Linares et al (1975)
		740		2	1	988	1450	1	1246										

Lab #	Sample # if any	^{14}C age, year BP	±	1 or2 δ	# of ranges	cal AD/BC ranges*	(upper)	probabi	(lower)	(upper)	probabi	(lower)	(upper)	probabi	(lower)	(upper)	probabi	mean date*	citation and details
WW6165	RC-6E	855	35	1	3	1156	1225	0.98	1234	1237	0.01	1249	1250	0.01				1187	Sherrod et al. (2007). charcoal
		855		2	3	1047	1088	0.12	1122	1139	0.04	1149	1262	0.85				1187	
WW6171	S07-VB93	975	35	1	3	1019	1048	0.43	1087	1123	0.43	1138	1150	0.14				1085	Sherrod et al. (2007). charcoal
		975		2	2	997	1006	0.02	1012	1156	0.98							1085	
β95497		1020	60	1	4	902	916	0.07	967	1047	0.7	1089	1122	0.17	1139	1149	0.06	1015	Behling (2000). Laguna Volcán. organic material
		1020		2	1	894	1157	1										1015	
WW6169	RC-62-1	1100	35	1	2	896	923	0.38	939	986	0.62							943	Sherrod et al. (2007). charcoal
		1100		2	1	883	1017	1										943	
β145347		1240	40	1	4	689	752	0.52	761	783	0.18	788	815	0.2	843	859	0.1	771	Anchukaitis (2005). Laguna Santa Elena. Wood. 434 cm depth
		1240		2	1	680	882	1										771	
WW6168	RC-62-0	1345	30	1	1	651	683	1										668	Sherrod et al. (2007). charcoal
		1345		2	2	641	714	0.9	744	768	0.1							668	
β145348		1510	40	1	2	465	482	0.1	533	609	0.9							556	Anchukaitis (2005). Laguna Santa Elena. Charcoal. 530 cm depth
		1510		2	2	433	494	0.22	505	637	0.78							556	
β95498		1790	50	1	3	137	200	0.4	203	259	0.42	296	321	0.18				232	Behling (2000). Laguna Volcán. organic material
		1790		2	2	92	98	0.01	125	381	0.99							232	
WW6167	RC-62-2	3030	40	1	3	-1381	-1335	0.36	-1323	-1258	0.56	-1232	-1218	0.09				-1298	Sherrod et al. (2007). charcoal
		3030		2	3	-1407	-1191	0.96	-1177	-1161	0.02	-1143	-1132	0.02				-1298	
WW6161	SO7-VB56A	8340	30	1	3	-7481	-7447	0.36	-7434	-7424	0.08	-7413	-7358	0.56				-7416	Sherrod et al. (2007). charcoal
		8340		2	1	-7507	-7336	1										-7416	
WW6164	SO7-VB98-2	9825	30	1	1	-9295	-9266	1										-9282	Sherrod et al. (2007). charcoal
		9825		2	1	-9312	-9251	1										-9282	
WW6163	SO7-VB98-1	13315	40	1	1	-14018	-13663	1										-13851	Sherrod et al. (2007). charcoal
		13315		2	1	-14230	-13501	1										-13851	

Appendix C: Tephra sample set C (indicated by red arrow) in relation to the Palumbo (2008) work.



Appendix D: Tephra sample characteristics

	VOLC 1 (A 1)	VOLC 2 (A2)	VOLC 3 (A3)	VOLC 4 (A3?)	BOQ 1 (B1)	BOQ 2 (B1)	BOQ 3 (B2)	BOQ 4 (B3)	BAR 2 (C1)	BAR 5 (?)
Layer depth:	21-42	74-75.5	80-84	80-84	8-18	8-18	91-92	116-17	20-35	85-115
Loose feldspar size (mm):	0.5-2	0.5	0.5	0.5	1	1	1	1	0.5-1	0.5
Loose feldspar quantity (%):	40%	40%	50%	40%	40%	30%	50%	30%	30%	40%
Loose hornblende size (mm):	0.5-2	1	1	0.5	30%	0.5	0.5	0.25-1	1	0.25
Loose hornblende quantity (mm):	30%	30%	25%	30%	1	25%	25%	25%	15%	30%
Loose biotite size:	0.5	1			1%	1	0.5	1	1	1
Loose biotite quantity (%):	1%	1%				1%	1%	1%	1%	1%
z% of misc crystal:	1%	2%			5%	1%	2%			1%
% of overall sample comprised of juvenile clasts:	25%	25%	20%	20%	20%	40%	20%	40%	50%	10%
Juvenile fragment size (mm):	1.5-6	1-2	1	0.5	1-4	2-5	1	3-8	1-4	0.25-0.75
Juvenile fragment color #1:	Very white	White	Pure white	White	Yellow-white	Yellow-white	Pure white	Orange	White	Grayish white
Juvenile fragment color #2 (if bi-modal):	Gray	gray	Gray	Gray	Pure white	Pure white	Light orange-gray	White	Orange	Bright orange
Juvenile fragment color #3 (if tri-modal):	-	-	Amber	Amber	Light gray	Orange-brown	-	gray	Gray	
Shape of juvenile clasts (angular, rounded, sub-rounded):	Sub-angular	Sub-angular	Sub-angular	Sub-angular	Sub-angular to sub-rounded	Sub-angular	Sub-rounded	Sub-angular	Sub-rounded	Sub-angular
% of vesicularity of clasts:	25%	15%	15%	15%	20%	15%	10%	15%	20%	10%
Size of feldspar in juvenile clasts:	0.75	0.25	0.25	0.25	0.5	1	0.5	1	0.5	0.5
% of feldspar in juvenile clasts:	15%	40%	7%	7%	1%	2%	2%	2%	10%	2%
Size of hornblende crystals in juvenile clasts (mm):	0.5	0.5	0.5	0.25	0.5-1	1	0.5	0.5	0.5	0.25
% of hornblende crystals in juvenile clasts:	7%	25%	10%	3%	5%	7%	5%	7%	5%	10%
% of glass + vesicles	78%	35%	83%	90%	94%	91%	93%	91%	85%	88%
% of sample accounted for by composition categories:	98%	98%	95%	90%	96%	97%	98%	96%	96%	82%
Feldspar to hornblende ratio:	214.29	160	70	233	20	28.57	40	200	200	20

Appendix E: Extrapolated cemetery locations in the Boquete area

From descriptions by Bateman (1860), Osgood (1935), Linné (1936), and Wassén (1949). Locations are approximate.

Source	Location	# of graves	Description	Elevation	Description of the tomb construction (if any was provided)	N (approx)	W (approx)
Bateman (1860)	Bend in the Rio Caldera	300	6 miles from the entry of the Boquete valley where the Rio Caldera turns to the west (note that the stone artifacts presented to the Ethnological Society by G.M. Totten were from the same location. Only one grave contained gold (a figurine)	1890 m	circular	8.849429	-82.494611
Bateman (1860)	'behind' Barú	Not stated	12 acres covered with graves. Graves in the forest yielded a gold plate and a small figure of an ant eater. Round pillars marked the surface of this tomb.	2580 m	Graves are closely spaced. Dacite slabs line the sides and cover the top, though you also find river stones. In the forest nearby there are graves with basalt columns placed vertically, 30 inches apart, around the edges of the grave.	8.853359	-82.524239
Bateman (1860)	North of Barú	Not stated	No description given	2290 m		8.837534	-82.539545
Bateman (1860)	A mile from the 'north of Barú' graves		If the distances provided by Bateman (1860) are correct, this graveyard crosses out of the Boquete district and into the Bugaba district.		Tombs were marked with above ground basalt pillars. Graves extended in a line 2,000 feet long.	not possible from the information provided	Not possible from the information provided
Osgood (1935)	Bajo Mono	3	On Browne's finca on the Caldera River, 3.5 miles above Boquete, (this land is now owned by Dr. Esquivel in Boquete.[224]	1270 m [225]	rectangular	8.80137	-82.453900
Osgood (1935)	Alto Bajo Mono	40	High point overlooking the Caldera River valley, 5 miles above Bajo Mono at the headwaters of the Caldera River. Large number of stone adzes.	1970 m [226]	Rectangular. Dacite slabs used to cover the graves were exceptionally large. Graves were aligned N-S.	8.849384	-82.506172
Osgood	Horquete[227]	12	Horquete Creek valley (NE of the Bajo Mono valley)	1340 m	9 round graves	8.807984	-82.454348

[224] This site is very close to a basalt column outcropping, waterfall, and largest *ojo de agua* in Boquete.

[225] The elevation at the coordinate I have provided is very close to the elevation estimate provided by Osgood (1935) of 4200 feet (1280 m). If Osgood's elevation estimates were inaccurate, however, the site could be located further north but is most certainly west of the Caldera river, as a rock face prevents access to more than a strip of land to the east of the river and road in most areas of Bajo Mono.

[226] Osgood's elevation estimation of 4500 feet (1370 m) seems wildly inaccurate from the location he describes. I have therefore provided a location estimate based upon the anticipation that the 5 mile distance he notes was measured along the Caldera river and were measured from the Bajo Mono grave site rather than some central location in Bajo Mono. While the headwaters of the Caldera river extend approximately 2 km further west of the coordinates I provide, this location would not provide the view of the Caldera valley that Osgood notes.

Source	Location	# of graves	Description	Elevation	Description of the tomb construction (if any was provided)	N (approx)	W (approx)
(1935)							
Osgood (1935)	Quiel[228]	16	NW heights above Bajo Mono valley (upper Caldera River)	1760		8.826571	-82.489676
Osgood (1935)	Estrella	19	10 miles S of Boquete and 5 miles N of India Vieja	1700 m	9 round graves (no description of the others)	8.787408	-82.362781
Osgood (1935)	India Vieja[229]	19	15 miles S of Boquete.	730 m	4 round graves (no description of the others)	8.741643	-82.351342
Osgood (1935)	East India Vieja	3	1.5 miles E of India Vieja	1000 m	rectangular	8.740911	-82.331559
Osgood (1935)	Caldera	5	19 miles S of Boquete, on a small hill overlooking the Chiriqui River to the W. The high point in the Cordillera is directly E. The graves cover roughly 0.5 acre and are near a hot spring.[230]	280 m	rectangular	8.653850	-82.341747
Linné (1936)	Cerro Punta	1 of 50	This grave was in an area with roughly 50 others. The grave contained four ceramic vessels at varying heights. The grave was lined with dacite slabs along the sides of the grave and also covered with them.	2240 m	rectangular	8.883998	-82.581065
Wassén (1949)	Finca Lerida	3	Dacite slabs and basalt columns lined the edges of the graves. L*ajas* were found leaning at an angle; Wassén interprets this as disturbance. vertical wall supports.	1680 m	rectangular	8.814715	-82.480351

[227] Osgood (1935: 241) provides exceptionally little information regarding this location. I have placed it in the central area of the Horqueta district, though the Horqueta stream extends north of this location and the site could be in any of those locations. Osgood provided an approximate elevation of 4500 feet (1370 m).

[228] I question Osgood's grasp of Boquete districts in this listing, as the areas of Alto Quiel and Bajo Quiel are actually southwest of Bajo Mono. I have provided a coordinate that is a very approximate place holder of the actual site location.

[229] The area of India Vieja is only 5 miles southeast of the main center of Boquete on a map. Osgood's estimation of the distance seems accurate, however, if he is giving the distance by roads and if the contemporary roads are the same as those used at the time he visited (though this entails traveling south and then east, which he fails to note). If Osgood is providing travel distances rather than map distances, the distance of 5 miles north most likely indicated the distance travelled along the Los Valles river as no road exists in the area. I have chosen a coordinate in an area overlooking the river that is currently farmed for coffee, as many graves in Boquete were likely discovered inadvertently through agricultural activity. [note: I think Osgood may be referring to a site named India Vieja, not the current ridge by the same name].

[230] The proximity of the graves to the volcanic hot spring. In chapter 5 I discuss the large petroglyphs boulder at Caldera, known as the *Piedra Pintada.* The close association of these landscape features seems significant and worth further investigation and consideration.

Appendix F: Overview of site locations and fieldwork completed

Site #	site field name	elevation (m)	North	West	Est. area surveyed (km^2) *	# of stp units	# of test pits (1x1 m)	surface collection?	Interpreted site type
BE-11-KH	BEL	1680	8.79759	-82.4845	0.19	41		Y	Habitation/burial
BE-12-KH	GIO	1600	8.80982	-82.475	1.95	112	8	Y	Habitation/burial
BE-13-KH	LPN	1500	8.81092	-82.4457	0.1	13	-	Y	Habitation/burial
BE-14-KH	GON	1150	8.78764	-82.4319	0.19	-	15**	Y	Burial/rock art
BE-15-KH	GLY	1200	8.80179	-82.4304	0.26	-	-	Y	Burial
BE-16-KH	KOT	1300	8.80378	-82.4206	0.25	65	16**	-	Burial
BE-17-KH	PLM	920	8.71621	-82.4572	0.3	40	3	-	Habitation/burial
BE-18-KH	MAR	1240	8.77338	-82.42	0.03	25	3	Y	Habitation
BE-19-KH	JRC	1250	8.76621	-82.4152	0.04	-	3	Y	Lithic manufacturing
BE-20-KH	EST	1190	8.74799	-82.3791	0.77	1	2	Y	Lithic manufacturing
				TOTALS:	4.08	297	34		

*survey area was calculated from the area of a polygon drawn to incorporate all transects, test pits, and surface survey conducted at a particular site

**While most excavated pits were 1x1 m, a small number varied in size to accommodate the challenges of working around the construction site (KOT) and petroglyphs (GON).

Looted grave sites examined during fieldwork

id#	Elevation (m)	North	West
1	950	8.71621	-82.45717
2	970	8.72319	-82.42351
3	1390	8.76279	-82.36127
4	1280	8.7658	-82.41519
5	1130	8.78735	-82.43305
6	1130	8.78812	-82.43276
7	1210	8.80179	-82.43041
8	1240	8.80203	-82.4231
9	1250	8.80204	-82.42292
10	1250	8.80207	-82.42299
11	1260	8.80249	-82.42146

id#	Elevation (m)	North	West
12	1280	8.8031	-82.4214
13	1290	8.80368	-82.4202
14	1590	8.80912	-82.47413
15	1530	8.81069	-82.44612
16	1780	8.83323	-82.4847

Summary of artifacts recovered

site #	site field name	TOTAL # OF SHERDS	rims	bases/feet	adornos	handles	A	B	C	D	E	F	G	H	I	J	K	L	M	N	ground stone	chipped stone	carbon	'seeds'
BE-11-KH	BEL	132	14	2	0	7			17					4		7				1	2	2		
BE-12-KH	GIO	272	21	1	1	4			1					1 2		2				3	3	4	11	4
BE-13-KH	LPN	259	5		3	2	1							6		13				9	3	1		
BE-14-KH	GON	1996	138	7	12	13			17				1			1	1			13	50	15	14	
BE-15-KH	GLY	665	72	6	6	35														38				
BE-16-KH	KOT	2889	216	40	14	129		1						5	8	24	20	2 1	2	498	40	131	29	54
BE-17-KH	PLM	43	5		1				28	6	7	1		2							1		1	
BE-18-KH	MAR	1																			6	2	3	
BE-19-KH	JRC	933	89		12	21			492												17	61	5	
BE-20-KH	EST	164	14	1	7	5			61											4	18	145	9	7
		7354	574	57	56	216																		

A = Concepcion (300 BC-AD 400)
B = Bugaba Engraved (AD 200-600)
C = Cerro Punta Orange (AD 200-600)
D = Combed Bugaba (AD 200-600)
E = Cotito (AD 200-600)

F = Zoned Biochrome (AD 200-600)
G = Barriles Zoned (AD 300-500)
H = Valbuena/Isla Palenque Maroon (AD 400-800)
I = Foncho Red (AD 800-1500)
J = San Lorenzo (AD 700-1100)

K = Polychrome (AD 800-1500)
L = Carbonera Appliqué (AD 800-1500)
M = Silena Winged (AD 800-1500)
N = Bisquit (AD 1000-1500)

Appendix G: Boquete area ceramics classification

(adapted from Corrales 2000, Linares and Ranere 1980a, and Shelton 1984).

These are only some of the more common ceramics found in the Boquete area, and the dates are tentative. Dates given are the most inclusive possible in order to incorporate the different time spans assigned by various researchers. This is highly simplified and for use only to get a rough chronological fix on ceramic samples. It collapses many divisions within wares that would not alter the chronological placement of a type.

Ceramic period or phase	Type or ware	early date	Late date	Characteristics *Very diagnostic elements are italicized*	Descriptions or photos
La Concepcion		300 BC	AD 400	*Lots of incising alternating with red slipped areas.* Slip is similar to that of Cerro Punta Orange	Corrales 2000: 299-304, Linares 1980: 110 (photo), MacCurdy Plate XXVI (drawing), Shelton 1984: 295-9 (drawing) 
Bugaba	Cerro Punta Orange	AD 200	AD 600	*Thick orange to dark red slip. Groove (more than 2 mm wide) below lip very common, wide incising (1-2 mm), or narrow incising (<1 mm).* Is not polished (no striations from pebble), but still very shiny due to hematite in the very hard slip. temper has numerous gray, angular particles larger than a pinpoint, often with white, irregularly shaped inclusions evenly distributed in paste. Fire cloud is rare. Can leave unslipped area below lip (exterior). Pellets, appliqués (has "coffee beans", though so does Chiriqui ware)	Corrales 2000: 308-10, Linares 1980: 354-6 (photo p355 a-d), Shelton 1984:301-3 (drawing) 

	Plain Ware	AD 200	AD 600	No slip (could just be eroded off of C.Punta Orange) Buff colored. Smoothed usually, not polished. Exterior wall more carefully done than exterior. Can have lines, grooves, incisions, plain lobe appliqués	Corrales 2000: 325, Linares 1980: 358-9 
	Bugaba Engraved	AD 200	AD 600	Red, orange, or sometimes maroon slip. *Post-firing incising of thin lines by a sharp, pointed tool* (can be rectilinear, triangular, curvilinear, parallel lines, dots). Zoned biochrome at times. Low ring stands. Fire clouding rare.	Corrales 2000: 319, Linares 1980: 356-7 (photo p 355 i-l) 
	Zoned biochrome	AD 200	AD 600	*Slipped zones alternating with unslipped areas.* Slip can be red or orange. Geometrical motifs, incised lines delimit areas with red slip from unslipped areas	Corrales 2000: 322-3, Linares 1980: 357-8 (photo p 355 q-s) 
	Combed	AD 200	AD 600	Thick slip (orange, red, maroon). Slightly smoothed, rough in places. *Looks like someone ran a comb over the clay while wet*	Corrales 2000: 324-5, Linares 1980: 358 (drawing p 355 t-x)

	Cotito	AD 200	AD 600	Buff to dark gray. Smoothed, compact. Thick orange slip may turn black due to lack of oxidation or to possible smudging. *Tight parallel grooving or incising on exterior* Slip and polish on interior and exterior. Can have appliquéd lobes arranged in flower design or surrounded by round punctuations, superimposed on parallel lines	Corrales 2000: 321-2, Linares 1980: 355 (m-p) 
Valbuena/Isla Palenque Maroon		AD 400	AD 800	Clay is finer than C. Punta Orange generally. Smoothed surface, paste feels like sandpaper. *Dark red/maroon fugitive slip.* may cover completely or leave unslipped area below exterior lip. low ring stands, shallow bowls and s-shaped rim bowls are typical. Isla Palenque was found in Dolega so makes sense to find in Boquete (see Corrales 317), however, if very shiny is Chiriqui (Silena Winged or sangria red) see Corrales 2000: 355	Corrales 2000: 313-4, Linares 1980: 356 (photo of Valbuena p. 355, e-h), Shelton 1984: 304-6 (drawing of Valbuena) 

San Lorenzo		AD 700	AD 1100*	*Red painted bands/lines (can be bright rich red or leathery brown).* Sets of lines that meet and overlap, outside lines may have rows of dots. Horizontal band or set of thin lines with pendant triangles. *Set of thin parallel lines that meet each other at right angles and are separated by wide bands on the outside.* Red slip can cover just the interior and edge of lip "coffee-bean" eyes, appliqué strips in the form of a nose and two arms, pellets, fillets, Strap handles, some strap feet. Polished surfaces (this is a difference from Villalba Red Streaked, below). Buff, pale gray, to reddish brown surfaces [is a coastal ware, so obtained by trade if found in highlands]. *overlaps early and late phases (like Isla Palenque Maroon does) – could be heirlooms when find in later contexts??	Corrales 2000: 328-337, Linares 1980: 373 (photo), MacCurdy Plate XXV, p. 93, p. 94 (fig 160) (drawing)  
Chiriquí	Villalba Red Streaked	AD 800	AD 1500	Note: has red lines (as does San Lorenzo). Since San Lorenzo is 700-1100 AD, if can't tell the two apart you know at least the general time frame of the overlap. *Careless bright orange-red bands or streaks (thicker and more free-form than the San Lorenzo lines) make large loops or triangles.* Charcoal gray to black, buff to light gray. Round or strap handles. Unpolished, exterior smoothed, interior left almost untouched. *Tall hollow supports in the shape of a fish.* Interior of rim always covered entirely with red or w/wide red band. Found in a wide area.	Corrales 2000: 344, MacCurdy 1911: 77-78 (fig 123, 125), 79 (fig 128-9), 84 (drawings) 

	Bisquit ware	AD 1000	AD 1500	*Thin walls, graceful. unslipped usually, or slipped with the same color. hollow mammiform legs w/pellets inside* zoomorphic pots, short pedestal bases. small bits of pumice and magnetite (shiny, black, angular pieces) in temper. no fire clouds, exterior is smoothed but feels sand papery. all decoration is plastic (not painted): small appliqués (frogs, armadillos, squatting human figures w/head in hands, fillets, incision, "coffee beans"). are funerary offerings, don't often find in domestic contexts [were manufactured near David and exchanged throughout area and in to central C. Rica]	Corrales 2000: 338-9, MacCurdy 1911: 49-71 and plates X-XVI (drawings)  
	Foncho Red/Carbonera Appliqué	AD 800	AD 1500	Appliquéd band or strip around base of neck that is decorated with incision/punctuation. Red surface color Very common as funerary offerings in Chiriqui Tend to be tall vessels with out-flaring rims. Base can be round or ovoid. Twisted handles are most typical but can be various types. Tall hollow tripod legs can be shaped like fish or other anthropomorphic forms	Corrales 2000: 349-350, MacCurdy 1911: 80-92   
	Negative	AD 800	AD 1500	*Designs created by lack of paint in areas in geometric designs* [note: I did not identify any negative sherds in my samples]	Corrales 2000: 348, MacCurdy 1911: 104-121 (drawing)

	Polychrome	AD 800	AD 1500	*Painted designs in red, black, cream.* Designs based on a stylized alligator motif. Zoomorphic vessels, figurines, ocarinas (whistles). Found in tomb contexts only NOTE: THE BE-16-KH (KOT) RIM DISCUSSED IN THE TEXT AND SHOWN IN THE PHOTO IS DATED TO 700-900 CONTE.	Corrales 2000: 340-2, MacCurdy 1911: 133-8, 143-56, 165-8, 171, 172-7, 178-87, plate XXXIII - XXXIX, XL, XLVII (drawings) 
	Sangria red fine	AD 800	AD 1150	*Shiny red slip.* Highly polished. Red paste. In some cases on the bottom there are remains of negative painting (black on red). Is from the Diquís/Chiriqui coast [note: I did not identify any negative sherds in my samples]	Corrales 2000: 354
	Silena Winged	AD 800	AD 1000	Polished red slip. Red paste. Rims gradually thickened, lips are rounded or flattened. Coarse paste, friable and irregular fracture. Handles are trapezoidal plaques almost vertically attached to the rim (can be shaped to suggest an animal form). Has tripod legs but bowls are shallow and almost suggest a metate. [Has been found in Coto Brus, Costa Rica and Panama collections analyzed in Holmes (1888) and MacCurdy (1911) so likely to be in Boquete too]	Corrales 2000: 355-6, MacCurdy 1911: 91 (fig 153-4) (drawings) 

Appendix H: Diagnostic ceramic data (a-d)

The following appendix contains data collected for (a) ceramic rims, (b) ceramic bases and feet, and (c) ceramic *adornos* and handles for each site and context.[231] Section (d) provides bar charts divided by site and chronology of ceramics recovered in excavation. Detailed data are also available for the 7,431 sherds collected during the fieldwork, including size, thickness, temper inclusions, paste, slip, plastic decorations, and painted decoration. As the data are prohibitively long to include and the majority of sherds are eroded or plain, I have not included the data I collected for each sherd. When classifications of sherds was possible, these were included in the diagnostic ceramic count in Appendix E.

(a) Ceramic Rims

Key to Abbreviations:

A = site # [of BE-#-KH]
B = site name
C = context (s = surface)
class. = classification (if any)
# = quantity
D= thickness/width (mm)
E = diameter (cm)
R1 = rim shape (1=carinated, 2=rounded, 3=shelf, 4=curled, 5=plain)
R2 = rim thickening (0=no/simple; 1=to interior; 2=to exterior; 3=both sides)
R3 = rim tapering (y=yes; n=no)
R4 = rim direction (0=straight; 1=slightly out-flaring; 2=out-flaring; 3=slightly incurving; 4=incurving)
F = finish (1=polished; 2=smoothed; 3=combed)
G = slip location (0 = none; 1 = interior only; 2 = both sides; 3 = exterior only; 4 = indeterminate; 5 =banded)

[231] Note that the BE-16-KH (KOT) site included many items listed as 'surface' (s), though many of these were found from the tomb area by construction workers during their work in the construction pit. In the KOT contexts of J and K, when artifacts are listed without a numbered context this indicates that they were found during construction but left roughly in place for archaeological excavation. Their exact *in situ* context, however, was compromised.

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
10	EST	A.2		1	4.3	10							dark red inclusions	porous orangey paste		0
10	EST	B.1	CP Orange	1	10	22	1						tephra and magnetite		dark orange	2
10	EST	B.1	plain/no i.d.	1	10	20		1					hematite and white inclusions	buff-orange; black core		0
10	EST	B.1	plain/no i.d.	1	12	20		1					hematite and white inclusions. large red inclusions (jasper?)	buff-orange; black core	traces of dark orange slip	
10	EST	B.1	CP Orange	2	11.6	17	1								dark orange	2
10	EST	B.2	plain/no i.d.	1	10	10							white inclusions	buff		
10	EST	B.2	Valbuena/Isla Palenque	1	11	20		2								
10	EST	B.2	CP Orange	1	6.5	22	1			4			fine white inclusions		dark orange	
10	EST	B.2	CP Orange	1	8.5	22	1			4			hematite inclusions		dark orange	
10	EST	B.2	CP Orange	1	12.2	12		2								
10	EST	B.2	plain/no i.d.	1	8.5	16							lots of hematite			
10	EST	B.4	plain/no i.d.	1	7.8	18		1		4			many white inclusions	beige/light orange		
10	EST	B.4	plain/no i.d.	1	6.9	16		0		4				medium beige	dark orange	
11	BEL	s	Bisquit	1	8.5	28					2					
11	BEL	s	plain	1	7	20	1			1			many quartz inclusions	orange		
11	BEL	s	plain/no i.d.	1	10.8	36	2							blackened inside		0
11	BEL	s	plain/no i.d.	1	10.4	26	5									0
11	BEL	s	plain/no i.d.	1	9.6	30	5							very blackened, maybe by burning		
11	BEL	s	plain/no i.d.	1	12.8	24	5			1				buff		
11	BEL	s	plain/no i.d.	1	6.5	24						raised chevron appliqué		buff/gray		
11	BEL	s	San Lorenzo	1	7.8	18						dark red thin lines that meet in a series of 'v's' on top of each other			orange	1
11	BEL	s	Valbuena/Isla Palenque	1	10.3	19	5								dark red	2
11	BEL	s	Valbuena/Isla Palenque	1	9.1	28									dark red	4
11	BEL	s	Valbuena/Isla Palenque	1	7.9	21									dark red	2
11	BEL	s		1	10.2	20	4				1				dark red	2
11	BEL	s		1	8.8	24					2			reddish body		0
11	BEL	s		1	11.6	42									orange	1
12	GIO	A.1	Bisquit	1	5	20	4			1	2		coarse	very light orange		
12	GIO	A.2	Valbuena/Isla Palenque	1	4	8								blackened inside		2
12	GIO	A.3		1	10.4	22	2	0	n	1			small white inclusions	light orange paste	dark red brown	2
12	GIO	B.2		1	11.4	50	5	0	n	0			small white and orange inclusions	beige paste		0

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
12	GIO	B.2		1	9.3	30	5	2	n	0		interior slip extends to create band on exterior	very small white inclusions	buff paste	red orange	1
12	GIO	B.2		1	11.8	48	5	0	n	0			coarse poorly sorted white and beige temper	coarse beige paste		0
12	GIO	B.2		1	7.6	16	4	0	y	1			small white and tan inclusions	light brown paste		0
12	GIO	B.3		1	10.4	22	5	2	n	1		band on exterior created by extension of interior slip	small white inclusions	buff paste	dark red	1
12	GIO	B.3		1	11.9	22	5	0	y	1		red paint on exterior and interior rim	barely visible temper	beige paste		0
12	GIO	B.3		1												
12	GIO	B.3		1												
12	GIO	B.5		1	12.8	34	5	0	n	0			small white and gray inclusions	red orange paste	dark red brown	2
12	GIO	C.1		1	9.2	32	5	0	n			rim dark red, diagonal red lines (2mm) painted down from rim	very small white and red inclusions	compact beige/salmon paste	dark red	
12	GIO	C.5		1	7.4	14						severe angle to vessel like a V on its side. Slip was banded on exterior?	small white and orange inclusions	compact orange paste	dark red	3
12	GIO	D.1		1	11	30	5	0	n	1			small white inclusions	compact beige paste	dark red	2
12	GIO	D.1		1	11.2	22	5	0	n	n/a		dark red line on rim	very small white inclusions	buff paste	dark red	
12	GIO	D.2	Valbuena	1	7.3	16		1			2			compact beige paste	orangey -brown	
12	GIO	D.2		1	7.3	20	5	0		1		Interior is clearly slipped but exterior is dark and discolored			bright orange	
12	GIO	D.2		1	10	38	5	0			2		lots of well sorted temper	coarse orange paste		
12	GIO	G.1		1	11.8	26	1	0	n	3			small white and orange inclusions	light orange paste	orange red	2
12	GIO	GP2		1	14.3	20	2	0	n	2			poorly sorted white and gray inclusions	very blackened core		0
13	LPN	s		1	8.1	26	5	0	y	4		severe angle (like a V on its side) to vessel	very small white and orange inclusions	compact beige paste	dark red	2
13	LPN	s	Bisquit	1	4.9	20	5	0	n	0	2		very fine gray temper (not coarse like normal)	orange Bisquit		0
13	LPN	s	plain/no i.d.	1	10	25								coarse, buff	orange	
13	LPN	s	San Lorenzo	1	8	20	5					dark red band in inner lip				0
13	LPN	s	San Lorenzo	1	10	16								buff	red	1
13	LPN	s	San Lorenzo	1	9	20								buff. Very blackened inner core	red	1
13	LPN	s	San Lorenzo	1	9	16	3	3		2				buff	red	1
14	GON			1	13.4	20	3	0	y	1	1	slip stops at edge of 3	poorly sorted temper	compact paste, burnt	dark red	1
14	GON	A.1.1		1	9.8	16	5	0	n	0		incised lines with dots punched every 2-3 mm along line	lots of well sorted white inclusions	reddish paste	brown red	2
14	GON	A.1.4		2	8.6	20	5	0	n	0			magnetite and some red inclusions	very compact beige paste	dark red	1
14	GON	A.1.7		1	8.3	14	2	0	n	1		exterior lip has combed striations	well sorted white inclusions	beige paste	brown-red	1
14	GON	balk b/t H+K	Barriles Zoned	1	7.4	22	1	0	y			unslipped side incised while wet. Zone of unslipped crisscrossing parallel lines under slipped rim, slip continues below	moderately well sorted white inclusions	beige paste	dark brown red	5

A	B	C	class.	#	D	E	R1	R2	R3	R4	F	decoration	temper	paste	slip color	S1
												incisions				
14	GON	balk b/t H+K		1		14	5	0	n	1	1		moderately sorted white and gray inclusions	light orange paste, blackened core	dark red	2
14	GON	balk b/t J+M		1	10.1	28	5	0	n	0		might have had orange brown band on interior rim	well sorted temper of small red inclusions	porous buff paste		5
14	GON	balk II (K to petr)		1	10.5	46	5	0	n	0			lots of well sorted white inclusions	beige paste	dark red	2
14	GON	balk II (K to petr)		1	13.1	28	5	0	n	0		incised dashes below rim on unslipped exterior, dashes extend vertically	poorly sorted coarse gray temper, some magnetite	porous beige paste	dark red	1
14	GON	C.1.5		1	7.6	20	1	0	y	1		groove at nearly carinated rim, looks like could have vertical grooves w/paint running from exterior rim	lots of well sorted white temper	beige/light orange paste	dark red	
14	GON	C.1.7		2	7.9	18	5	0	n	0		unslipped side is combed	lots of poorly sorted white temper	brown paste	brown	1
14	GON	E.3		1	23.7	62		0		0			lots of well sorted white temper and some small magnetite	buff paste, very blackened core		0
14	GON	E.3		1	62	24	5	0	y	3	2		poorly sorted white chunks	beige paste, blackened core	red	5
14	GON	E.3		1	9.8	26	2	0	n	0		band of red paint below exterior rim	poorly sorted white temper	beige paste	red	5
14	GON	H.1		1	9.9	18	5	0	y	0		slip extends in band over exterior		compact beige paste	red	1
14	GON	H.1		1	7.8	16	5	0	n	0		might have slipped band on lip of rim, but might just be artifact of erosion	nearly invisible temper	compact buff paste	dark red	
14	GON	H.1		1	8	16	5	0	n	0		incised lines (pre-slip) on exterior rim	small white temper and bits of quartz, very well sorted	dark orange paste	dark red	2
14	GON	H.2		1	10.8	22	2	0	n	1		slip to edge of lip, unslipped on exterior	some white inclusions	buff paste, blackened core	red	1
14	GON	H.5		1	8.2	16	5	2	n	0					dark brown red	
14	GON	H/J/K feature		1	18.28	38	2	0	n	0			lots of poorly sorted white, red, quartz inclusions	orange brown paste, deeply blackened core		0
14	GON	H/J/K feature	Bisquit	2	3.7	16	2	0	n	3			lots of well sorted gray inclusions	light orange classic Bisquit		0
14	GON	I.2	CP Orange	1	8.3	14	1	0	y	3		slight groove at carination	poorly sorted white temper	beige paste	red orange	2
14	GON	I.2		1	13.4	32	5	0	n	1				beige paste with poorly sorted white temper, blackened core	red orange	1
14	GON	I.2		1	7.5	16	5	0	y	4			dark mineral inclusions	compact beige paste	dark red	2
14	GON	I.2		1	5.7	20	5	0	n	3			no visible temper	buff paste, very blackened core	dark red	2
14	GON	I.2		1	12.5	24	2	0	n	0			lots of well sorted white inclusions	buff paste	orange brown	

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
14	GON	I.2		1	16.4	26	2	2	n	0			well sorted white inclusions, some large red, quartz	beige paste	orange brown	2
14	GON	I.3		1	16.6	18	2	2	n	0		slip only extends over top exterior lip, unslipped band below	coarse white inclusions		red-orange	5
14	GON	I.3		1	22.9	24	2	2	n	1			lots of tephra inclusions	coarse, orange paste	buff	2
14	GON	I.3		1	7.4	16	2	0	y	3	1 ?		bits of hematite	compact buff paste, blackened core	dark red	2
14	GON	I.3		1	17	18	2	2	n	1			red mineral inclusions	porous beige paste		0
14	GON	I.4		1	9.2	16	5	0	n	3		slip extends to create only a band (14mm) on ext	poorly sorted, large white and red mineral inclusions	compact beige paste	dark red	1
14	GON	I.4		1	7.1	20	5	0	y	3			well sorted	compact buff paste	brown-red	2
14	GON	J.1	CP Orange	1	10.1	26	1	0	y	3		grooved at carinated rim	poorly sorted chunky gray and red temper	beige/light orange paste	orange red	2
14	GON	J.1		1	10.5	30	5	0	n	1		groove below rim on exterior, remnants of red paint on rim top	moderately well sorted white temper	beige paste		
14	GON	J.1		1	10.2	28	5	0	n	0			lots of moderately well sorted white inclusions	porous beige paste		0
14	GON	J.5		1	9.6	30	2	0	n	0			poorly sorted white and large (1.3mm) red minerals		red brown	2
14	GON	K.2		1	10.5	24	5	0	n	0			very small white inclusions and medium red chunks	beige paste	dark red	2
14	GON	K.2		1	22.9	44	2	3	n	0		slip eroded, could be both sides or could just extend over exterior lip	small white inclusions, well sorted	beige paste	orange brown	
14	GON	K.2		1	10.1	26	5	0	n	3			lots of poorly sorted large white inclusions	orange brown paste, fire clouded	dark red	2
14	GON	K.2		1	5.1	20	5	0	y	0			moderately well sorted white inclusions	orange red paste	red brown	1
14	GON	K.3		1	11.4	28	2	0	n	0			very small well sorted white temper, some red mineral	buff paste, blackened core	red orange	2
14	GON	K.3		1	14.6	22	2	2	n	0			very well sorted, small white inclusions, some small red mineral	beige paste		
14	GON	L.2		1	9	24	5	0	n	0		slip stops at top of rim	lots of well sorted white inclusions and some red mineral	beige paste	brown-red	1
14	GON	L.3	CP Orange	1	10.5	14	1	2	y	3		lots of quartz and magnetite, some white inclusions	orange paste		orange	1
14	GON	L.3		1	9.2	12	2	n	n	1			moderately well sorted white inclusions	coarse beige paste		
14	GON	L.3		1	9.6	22	5	0	n	0			very poorly sorted white and red mineral chunks	beige paste	dark red	4
14	GON	L.3		1	8	20	1	1	y	3		grooved at carinated rim	some white inclusions	very compact bright orange paste	orange-red	3
14	GON	L.4		1	9.5	56	5	2	y	1		remnants of red slip on interior below rim, could have been a band	well sorted white and magnetite inclusions	buff paste	red-orange	5
14	GON	L.4		1	20.4	26	4	0	n	2			lots of white inclusions	orange paste		1
14	GON	L.4		1	8.7	24	5	0	n	0	1		poorly sorted white inclusions	beige paste	red-brown	2

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
14	GON	L.4		1	16.2	28	2	2	n	1			well sorted white inclusions	beige paste	orange	1
14	GON	L.4		1	20	34	2	3	n	0			white inclusions	compact beige paste, blackened core	red	4
14	GON	L.4		1	5.7	32	5	0	y	1			very small well sorted white tephra and one big red mineral inclusion	very compact buff paste	red-orange	1
14	GON	M.1		1	15.8	20	2	2	n	0			some white inclusions	beige paste, blackened core	orange	2
14	GON	M.2	Bisquit	1	5.1	14	5	0	n	3			coarse gray and white inclusions	classic light orange Bisquit		0
14	GON	M.2		1	11.9	18	5	0	n	0			lots of small white inclusions, some large red and rectangular magnetite	beige paste	brown	2
14	GON	M.2		1	15.6	18	5	2	y	0			lots of medium sized moderately well sorted white inclusions		brown orange	1
14	GON	M.3		1	6.9	16	1	0	y	3		deep groove at carination and vertical ridges in body extending below groove	well sorted white inclusions, looks like tephra, small magnetite inclusions	beige/light orange paste	red orange	2
14	GON	M.3		1	21.6	46	2	3	n	0		groove below lip divides slipped and unslipped sides	very small, well sorted white inclusions	porous buff paste, blackened core	red orange	4
14	GON	M.3		1	15	16	2	2	n				well sorted white inclusions, some small magnetite	beige paste	brown red	2
14	GON	M.3		1	11.2	22	2	0	n	3		incised lines	well sorted white temper, some brown red inclusions (not the normal red mineral, more like brick color)	beige paste	dark brown red	2
14	GON	M.3		1	9.5	14	2	0	n	1			well sorted small white inclusions	beige paste, blackened core	orange	3
14	GON	M.3		1	14.4	30	5	0	y	0			small magnetite, brown red inclusions	buff paste	orange	1
14	GON	M.4	Bisquit	1	6.1	12	5	0	n	1				light orange/buff Bisquit paste		0
14	GON	M.4		1	9.5	44	2	0	n	0			well sorted white inclusions	buff paste	brown orange	4
14	GON	M.4		1	8.9	14	2	0	n	1	3		well sorted white temper	orange paste	brown red	1
14	GON	M.4		1	7.3	10	5	0	n	0	1		well sorted white temper	orange paste	brown red	1
14	GON	M.4		1	9.1	30	2	0	y	0	3		poorly sorted white and orange inclusions	orange paste, blackened core	brown red	1
14	GON	N.2		1	14.2	26	2	2	n	1	1		very well sorted white inclusions	beige paste	orange red	2
14	GON	N.2		1	12.9	36	5	0	n	0			poorly sorted red temper	buff paste	red	1
14	GON	N.4	CP Orange	1	11.2	34	1	2	y	3		groove (1.5mm) incised at carination. Interior slip stops below groove to create band of unslipped on exterior	lots of very small white inclusions	beige paste	red orange	1
14	GON	N.4		1	22.5	40	2	2	n	0		slip extends in band over exterior lip	poorly sorted white chunk inclusions of white, gray, red	porous buff paste	orange	1

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
14	GON	N.4		1	8.3	34	5	0	y	4	1	unslipped shelf on exterior below rim, interior fully slipped. Looks like a spaceship profile.	barely visible temper, some very small white inclusions	compact beige paste	red orange	5
14	GON	N.4		1	14.1	30	2	0	n	1			lots of poorly sorted red and white chunks	beige paste	dark red	2
14	GON	N.4		1	10.5	24	2	1	n	1		deep lines (2mm thick) incised in wet clay	moderately well sorted white inclusions	beige paste	light orange	1
14	GON	N.4		1	18.9	20	2	3	n	0	1		lots of small white inclusions, some quartz	buff paste	red orange	2
14	GON	N.4		1	15.5	28	2	0	n	0			lots of moderately well sorted white temper	buff paste, heavily blackened core		0
14	GON	N.5		1	8.2	12	5	0	n	3		shallow incised lines on unslipped exterior	small white and gray inclusions	light orange/salmon paste	red orange	1
14	GON	N.5		1	10.9	42	5	0	n	0			small gray inclusions	orange red paste	orange	2
14	GON	N.5		1	12.2	18	5	2	n	0			moderately well sorted inclusions	beige paste		0
14	GON	N.5		1	9.7	26	5	0	n	0		strip of red paint on top of rim. Combed and unslipped below exterior rim	moderately well sorted white and red inclusions	porous buff paste		0
14	GON	N.5		1	9	28	5	0	n	0				compact beige paste	dark brown	
14	GON	O.1		1	9.7	22	4	0	n	1		groove (5.2mm) under rim	lots of well sorted white inclusions	red brown paste		0
14	GON	O.3		1	6.9	24	2	0	n	1			poorly sorted white inclusions	light orange paste	orange brown	2
14	GON	O.3		1	8.5	14	1	0	y	3		incised dots along rim at carination line	very small white temper	buff paste	red orange	1
14	GON	O.3		1	9.9	14	5	0	n	3		incised lines made in wet clay along rim lip	poorly sorted white and gray inclusions	light orange brown paste		0
14	GON	O.3		1	21.1	34	2	3	n	0			lots of poorly sorted white inclusions	beige paste	red brown	2
14	GON	O.3		1	9.6	38	2	0	n	0		slip extends in band over exterior lip	very small well sorted temper	buff paste	red	1
14	GON	O.4		1	11.9	20	2	2	n	1			lots of moderately sorted white inclusions	beige paste	red brown	2
14	GON	O.4		1	9.7	16	2	0	n	0			poorly sorted white inclusions with large red mineral chunks	beige paste	dark red brown	2
14	GON	O.4		1	7.4	12	5	0	y	3			small white inclusions and long (1.4 mm) oblong magnetite inclusions		orange red	2
14	GON	s		1	18.5	28	3	3	n	0			small white inclusions	red paste	dark orange red	2
14	GON	s		1	9.5	12	2	2	n	1			small white inclusions	compact beige paste	very dark red	1
14	GON	s	CP Orange	1	11.4	28	1		y	3		thick groove at carination	well sorted temper	compact buff paste		
14	GON	s	CP Orange	1	15.2	32	2	3	n	0			well sorted white temper	very coarse beige paste	red-orange	2
14	GON	s		1	11.3	24	1	3	y	1		only slightly carinated, n groove	very well sorted white temper	orange-red paste		0
14	GON	s		1	7.6	20	1	0	n	3			well sorted white inclusions	compact buff paste	orange	1

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
14	GON	s		1	14.4	22	2	2	n	1		slip stops at top of rim			orange	3
14	GON	s		1	19.1			3	n					buff paste, blackened core		0
14	GON	s		1	16.6	19	2	2	n	0			poorly sorted red and white mineral	coarse buff paste	bright orange	2
14	GON	s		1	16.3		3	0	n	1			lots of well sorted white inclusions	blackened core	buff	2
14	GON	s		1	11.5	24	5	0	no	0		slip extends to interior rim	well sorted white inclusions	buff paste	red-orange	3
14	GON	s		1	10.4	22	5	0	n	1		band of red below ext rim and band inside interior rim	angular white inclusions	buff paste, blackened core	dark red	
14	GON	s	CP Orange	1	9.2	18	1	2		3			lots of white inclusions	compact beige paste	orange	2
14	GON	s	CP Orange	1	12	28	2	0	n	0			well sorted white temper and some small chunks of red mineral	beige paste	orange	2
14	GON	s	CP Orange	1	8.1	14	1	0	n	1			small white inclusions	beige paste	red orange	4
14	GON	s		1	8.2	18	5	0	n	0			well sorted temper	compact buff paste	dark red orange	1
14	GON	s		1	21.7	38	2	2	n	0			moderate amount of medium sized red mineral inclusion	buff paste, heavily blackened core		0
14	GON	s		1	10.7	30	5	0	n	0			poorly sorted gray and small white inclusions	beige/light orange paste	dark red	4
14	GON	s		1	20.4	42	2	2	n	0			poorly sorted small white and large red mineral inclusions	beige paste	red orange	1
14	GON	s		1	16.6	28	2	0	n	0				buff paste, heavily blackened core		0
14	GON	s		1	12	28	3	0	y	0			well sorted small white inclusions	beige paste	dark red	1
14	GON	s		1	27.9	40	2	2	n	0			coarse, poorly sorted white temper	light orange paste, heavily blackened core		0
14	GON	s		1	17.7	24	3	0	y	0			coarse, moderately well sorted white and gray inclusions	red brown paste		0
14	GON	s		1	10.1	22	1	3	y	1			moderately well sorted white temper	black/dark gray paste		0
14	GON	s		1	13.4	32	2	0	n	0			well sorted small white inclusions	beige/buff paste	dark red	2
14	GON	s		1	8.2	22	5	0	n	0			lots of small white inclusions, some magnetite	beige/light orange paste	orange red	4
14	GON	s		1	9	24	5	0	y				very well sorted white inclusions	beige/light brown paste		0
14	GON	s		1	9.8	22	5	2	n	0			white inclusions	beige paste	orange-red outside, dark red inside	2
14	GON	s		1	13.7	20	2	1	n	0			poorly sorted white temper	beige paste		0
14	GON	s	CP Orange	1	8	10	2	0	n	3		rectangular appliqué below exterior rim.		compact beige paste	red-	2

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
												Incised line below that. Could have unslipped area below exterior rim incision, or may be erosion			orange	
14	GON	s	CP Orange	1	10.2	18	1	0	y	3			very well sorted temper	compact buff paste	red-orange	2
14	GON	s		1	12	24	5	0	y	0			poorly sorted hematite and dead white inclusions	coarse beige paste	red-orange	2
14	GON	s		1	13	30	2	n	n	1			lots of dead white inclusions and some red mineral	beige paste, blackened core	0	
14	GON	s		1	8.3	16	2	n	n	1		elegant curve		compact buff paste, very thick blackened core	dark red	1
14	GON	s		1	12.1	38	2	2	n	2		very thick, deeply incised inverted V on exterior below rim	lots of well sorted white inclusions	compact beige paste		0
14	GON	s		1	5.5	12	1	0	y	3		grooved on exterior. Slip is either eroded below groove or had an unslipped band	moderately well sorted white inclusions	compact beige paste	red-orange	2
14	GON	s		1	11.4	30	5	2	n	0				buff paste	can't tell, maybe bit of orange?	
14	GON	s		1	13.9	30	2	2	n	2	2			buff paste		0
14	GON	s		1	11	28	2	0	n	0		seems to have a band of dark red-brown on top of rim	coarse, well sorted white temper			0
14	GON	s		1	12.9	22	2	0	y	1			well sorted white inclusions	buff paste		0
14	GON	s		1	19	52	2	0	n	1			lots of well sorted white inclusions	coarse buff paste		0
14	GON	s		1	17.7	44	3	0	0	2		slip only goes to ext tip	poorly sorted red and white mineral	coarse buff paste	dark red	1
14	GON	s		1	17.4	22	2	2	0	1		slip goes just over top of interior rim	coarse	coarse beige paste	dark red	1
15	GLY	s		1	5.1	38	5	0	y	2			coarse, poorly sorted white, gray, red inclusions	red brown paste, core is darkened		0
15	GLY	s		1	5.2	42	5	0	n	1			small gray and medium red inclusions	porous beige paste		0
15	GLY	s		1	7.9	38	5	0	n	1	2		medium sized, moderately well sorted white and gray inclusions	red brown paste		0
15	GLY	s		1	5.7	28	5	0	n	1			poorly sorted white and medium red inclusions	red brown paste		0
15	GLY	s		1	24.1	30	3	0	n	0		shelf and interior is banded with slip		compact beige paste	dark red	3
15	GLY	s		1	16	20	5	0	n	1			small well sorted white inclusions	orange paste, heavily blackened core		0
15	GLY	s		1	8.8		5	0	n				small magnetite, white, and very large (7mm) red inclusions	orange beige paste, blackened core		0
15	GLY	s		1	10.2	36	5	2	n	0	2		small white, medium red inclusions	porous orange paste		0
15	GLY	s		1	7.2	30	2	2	n	1			small white, medium red	orange paste		0

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
													inclusions, some pyrite			
15	GLY	s	Bisquit	1	5.2	28	5	0	n	1			coarse gray inclusions	classic light orange Bisquit		0
15	GLY	s		1	7.1	22	5	0	n	1			coarse white, gray, red inclusions, poorly sorted	red orange paste		0
15	GLY	s	Bisquit	1	5.7	14	5	0	n	1		has small round appliqués (5.5mm)	coarse gray temper	orange paste		0
15	GLY	s		1	9.9	24	2	2	n	0			coarsely sorted inclusions	light orange paste, heavily blackened core		0
15	GLY	s		1	19	20		2	n	1			moderately well sorted white and orange inclusions	orange paste	dark red	1
15	GLY	s		1	14.4	18	5	0	y	2			very fine white inclusions	blackish paste		0
15	GLY	s		1	6	16	5	0	n	4		paint/slip around appliqué tear drop on exterior	barely visible small white temper	very compact buff paste, heavily blackened core		1
15	GLY	s		1	16	26	5	2	n	1			coarse, moderately well sorted white inclusions	buff paste, fully blackened core	dark red	1
15	GLY	s		1	26	42	2	0	n	1			small white, well sorted inclusions	buff paste, heavily blackened core	dark red	1
15	GLY	s		1	12	50	5	0	n	0		grooved lines	small magnetite inclusions	buff paste, slightly blackened core	red	1
15	GLY	s		1	5	20	5	0	y	0		outside unslipped w/vertical grooved lines		fine, very compact beige paste	dark red	1
15	GLY	s		1	6.6	24	5	0	n	4		steep angle to vessel, like a V on its side. Band of slip on exterior. Vertical appliqué fillets on unslipped portion of exterior		beige paste, blackened core	dark red	1
15	GLY	s		2	5.4	24	5	0	n	1			coarse white and large (3mm) red inclusions	red paste		0
15	GLY	s		4		18							coarse, moderately well sorted white inclusions	red orange paste		0
15	GLY	s		17												
15	GLY	s		28	-	-	-	-	-	-			small white and large red inclusions (2mm)	light orange paste		
16	KOT	3.4	plain/no i.d.	1	8.6	26			y	1			tephra and white inclusions	dark gray	buff	
16	KOT	7.7		1	7.7	16							white inclusions	compact dark gray paste	red-orange	2
16	KOT	8.3		1	8	16							lots of white inclusions, tephra	dark red		
16	KOT	8.3		1	5.2	24		0		1		may have had some incising or prior attachment of appliqué below ext lip	lots of white inclusions, tephra	dark red		
16	KOT	A(ext).1		1	7.7	32	1			1			dead white inclusions	beige paste	brownish red	2
16	KOT	A(ext).2	Bisquit	1	4.2	12								classic light orange Bisquit		
16	KOT	A(ext).2	San Lorenzo	1	5.7	28				1						
16	KOT	A(ext).2		1	5.2	14				1				compact, reddish-brown		
16	KOT	A(ext).		1	8.2	20					2		coarse (.8 mm) inclusions	red brown paste		0

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
		2														
16	KOT	A.1		1	16	30		1	n					buff/beige	dark red	2
16	KOT	A.3		1	8	28				1		line of black paint below (15 mm) exterior lip		buff	buff	2
16	KOT	A/I(ext)balk. 2		1		14				3	2					0
16	KOT	B.1	Polychrome	1	10.8	24						ext unslipped. Interior slipped w/buff. Rim painted with wide dark leathery band. Lines inside radiate from it		reddish	buff	1
16	KOT	B.1	Polychrome	1	16	26	2			2		black band painted on ext below lip. Remnants or red on interior and top of rim		reddish	red	1
16	KOT	B.1		1	13.2	34	2	2				remnants of red paint on exterior		beige/dark gray	buff	2
16	KOT	B.1		1	12.3	36	2					remnants of red paint on interior, unpainted buff area below exterior lip and red paint band below that		beige-red	buff	
16	KOT	B.2		1	5.3	16	2	0		2			many inclusions	beige	brownis h-red	2
16	KOT	B.2		1	4.4	24						incised line under exterior rim. Could have had red paint?		beige		
16	KOT	B.2		1	5.8	20				1			many white inclusions, some red mineral		orange-brown	2
16	KOT	B.2		1	8.4	22	3			1				dark gray		
16	KOT	B.3		1	5.5	16						appliqué pieces on rim. Very dark red/brown paint interior and down rim to angle of vessel				
16	KOT	B.3		1	18.9	36		2						beige/buff paste	red	1
16	KOT	B.3		1	5.6	22								very thin, fine		0
16	KOT	B.3		1	5.2	26	3					seems to have a black band painted on flat top of lip		very thin, fine		0
16	KOT	C.1		1	19	36		3					white inclusions (.5 mm)	buff	red	1
16	KOT	C.1		1	7.4	34				1	2			buff	red	1
16	KOT	C.1		1	5.9	22						dark red slip/paint is only on exterior rim	red mineral inclusions	buff		
16	KOT	C.3	Bisquit	1	3.7	22		0						classic light orange Bisquit		
16	KOT	C.3		1	5.2	24			y					compact buff paste	dark red	2
16	KOT	D(ext) . 4		2	15.4	32	5	2	n	0			moderately well sorted white pieces	buff paste, blackened core		0
16	KOT	D(ext) .3		1	6.9	20	5	0	n	3			very small white inclusions	beige paste		0
16	KOT	D(ext) .3		1	8.9	22	5	0	n	0			small white and medium red inclusions	porous beige paste		0
16	KOT	D.1	Bisquit	1	4.9	22	5	0	n	0			coarse white and gray inclusions	classic orange Bisquit		0
16	KOT	D.1		1	7.8	24	2	0	n	0		dark red line along rim and diagonal down exterior	small white inclusions	compact beige paste		0
16	KOT	D.1		1	6.1	20	1	0	y	1		has an appliqué fillet coming off of rim	small quartz, medium red inclusions	brown orange paste, blackened core		0

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
16	KOT	D.1		1	17.1	46	2	2	n	0			poorly sorted white and red mineral inclusions	buff paste		0
16	KOT	D.2		1	12.5	46	5	1	y	2			inclusions same color as paste with a few large red minerals	buff paste	dark red	1
16	KOT	D.2		1	9.6	22	4	0	n	1				orange red paste		0
16	KOT	D.2		1	12.2	26		2	n	0			small white and red inclusions, well sorted	porous buff paste		0
16	KOT	D.3		1	10	16	4	0	n	1			moderately sorted white temper	beige paste	light orange red	2
16	KOT	D.3		1	6.8	22	5	0	n	0		red brown band extends from full slip on one side to rim band on other	no visible temper	fine beige paste	red brown	
16	KOT	E.2		1	9.7	30	5	0	n	1			small white inclusions	beige paste		0
16	KOT	E.3		1	10.3	22	5	0	n	1			small white and large red inclusions, some magnetite	orange brown paste		0
16	KOT	E.3		1	8.4	50	5	0	n	0			moderately well sorted white and gray inclusions	orange paste		0
16	KOT	E.3		1	9.4	30	2	0	n	1			small white and red inclusions	beige paste	brown red	1
16	KOT	E.4		1	23.1	32	2	1	n	1			small white and medium red inclusions	beige paste		0
16	KOT	F (ext).4		1	8.1	18	5	0	n	2	1			red beige paste		0
16	KOT	F (ext2)		1	9.7	32	5	0	n	2			small white, gray, red inclusions	beige paste		0
16	KOT	F(ext). 2		1	9.2	24	5	0	n	0			small white and medium red inclusions	beige paste	dark red	2
16	KOT	F(ext). 4		1	8.3	22	5	0	n	1	2		moderately well sorted white and red inclusions	beige paste		0
16	KOT	F(ext). 4		1	9.7	32	5	0	n	1			small white and large red mineral inclusions	porous beige paste		0
16	KOT	F(ext). 6		1	11.5	26	4	0	n	1						
16	KOT	F(ext2).1		1	7.5	32	5	0	n	1			small (.4) and large (1mm) beige inclusions	red brown paste, darkened core		0
16	KOT	F(ext2).1		1	6	42	5	0	y	1			small white (.3mm) and small magnetite inclusions, large (2mm) red inclusions	light red brown paste		0
16	KOT	F(ext2).1		1	4.7	18	5	0	n	0			small white and medium gray inclusions	light orange paste		
16	KOT	F(ext2).1		1	5.2	20	5	0	n	1			small white inclusions, medium red	brown red paste		0
16	KOT	F(ext2).1		1	7.9	20	4	0	n	1			small white inclusions	light orange paste		
16	KOT	F(ext2).3		1	15.7	12	3	0	0	1	2		poorly sorted white inclusions	brown paste		0
16	KOT	F(ext2).3		1	7.5	18	5	0	n	1			small gray and large red inclusions	red orange paste		

A	B	C	class.	#	D	E	R1	R2	R3	R4	F	decoration	temper	paste	slip color	S1
16	KOT	F(ext2).3		1	7.9	32	5	0	n	3	1	interior slip extends to create band on exterior	small, well sorted white inclusions	beige paste	dark red brown	1
16	KOT	F(ext2).3		1	8.7	34	5	0	n	0	2		small white and large (3mm) red inclusions	red brown paste		0
16	KOT	F(ext2).3		1	6.8	18	5	0	n	1			medium sized white inclusions	porous beige paste		0
16	KOT	F(ext2).4		1	12.2	8	2	3	n	3			small white and large red mineral inclusions	coarse orange/salmon paste		0
16	KOT	F(ext2).5		1	8.6	22	2	0	n	1		may have had black line painted along rim, or might be artifact of burning	small white inclusions	orange brown paste		2
16	KOT	F(ext2).6		1	5.8	30	5	0	n	0	2		coarse, moderately well sorted white and gray inclusions	classic thin light orange Bisquit paste		0
16	KOT	F(ext2).6		1	5.1	28	5	0	n	0			small white, red, gray inclusions, moderately well sorted	light orange paste		0
16	KOT	F(ext2).6		1	7.2	30	5	0	n	3		faint vertical scrapes in clay on exterior	very small white inclusions	compact buff paste, blackened core	red	1
16	KOT	F(ext2).7	Bisquit	1	4.6	24	5	0	n	0	2		medium sized coarse bray inclusions	classic orange Bisquit		0
16	KOT	F(ext2).7		1	6	22	5	0	n	1	1		small red and small white inclusions	orange brown paste	brown red	2
16	KOT	F(ext2).7		1	5.6	18	5	0	n	1			small white and medium red inclusions	orange brown paste		0
16	KOT	F(ext2).8		2	6.3	26	5	0	n	1			moderately well sorted white and poorly sorted red inclusions	brown orange paste		
16	KOT	F.1	Bisquit	1	5.7	22	5	0	n	2			coarse gray inclusions	light orange paste		
16	KOT	F.2	Bisquit	1	3.7	14	5	0	n	0	2		coarse gray inclusions	classic light orange Bisquit		0
16	KOT	F.2		1	4.4	52	5	0	n	0			coarse gray inclusions	classic light orange Bisquit		0
16	KOT	F.3		1	8.2	10	5	0	n	0			small gray and larger white tephra inclusions	orange paste		0
16	KOT	F.3		1	12.1	14						rim painted orange-brown. Vertical painted lines extend down from rim band	well sorted white temper	buff paste, blackened core	buff	
16	KOT	F.4		1	9.5	18	4	2	n	2			small white and large red mineral inclusions	beige paste, slightly blackened core, fire cloud		0
16	KOT	F.4		1	5.4	34	5	0	y	0			small white and large red mineral inclusions	light orange paste, blackened core		0
16	KOT	F-ext		1	9.1	20				2			ground ceramics and mineral chunks, poorly sorted	beige	orange	
16	KOT	F-ext		1	15.8	24								dark gray	red-orange	
16	KOT	F-ext	Bisquit	3	6.5	18				2		parallel vertical appliqué strips		light orange		0
16	KOT	F-ext (construct.)		1	9.3	34			y	2					dark red	2
16	KOT	G.1		1	5.8	28	5	0	n	0			small white inclusions	beige paste	thin red	2

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
															slip	
16	KOT	G.1		1	6.9	28	5	0	n	0			no visible temper	compact beige paste	dark red	2
16	KOT	H.1		1	8.1	32	4	9	n	1			small white inclusions, small magnetite bits	brown orange paste, blackened core		0
16	KOT	H.1		2	8.5	24	5	0	n	0		remnants of red lines on exterior	small well sorted white temper	buff paste, blackened core	red	3
16	KOT	H.2		1	5.3	14	5	0	n	4	1		small white inclusions	compact orange-brown paste	dark red	2
16	KOT	H.3	Bisquit	1	4.7	22	5	0	y	1			moderately well sorted coarse gray inclusions	light orange Bisquit		
16	KOT	H.5		1	11.3	34	3	0	y	2		faint groove under rim	small white inclusions	compact buff paste, blackened core		0
16	KOT	I(ext).2	Bisquit	1	5.3	26	5	0	n				coarse gray inclusions	classic light orange Bisquit		0
16	KOT	I(ext).2		1	13.2	30	3	0	n	0			small white inclusions	light orange paste	dark red	1
16	KOT	I(ext).3		1	12.56	26	2	2	y	1			small white and large red mineral inclusions	gray paste	thin orange slip (not shiny like CP orange)	3
16	KOT	I(ext).3		1	26.8	46	2	2	n	1		slip/paint extends from interior over lip of exterior	small white, well sorted inclusions	porous gray paste	dark red	1
16	KOT	I(ext).4	Bisquit	1	5.6	20	5	0	y	1			coarse gray temper	classic orange Bisquit paste		0
16	KOT	I(ext).4	Polychrome (Conte beige paste)	1	12.1	24	5	2	n	0		orange red band at rim. Orange red design outlined by black below	very small white inclusions	cream/buff paste		0
16	KOT	I(ext).4		1	5.2	22	5	0	n	3	2		small gray inclusions	slightly porous light orange paste		0
16	KOT	I(ext).5	Bisquit	4	4.1	20	5	0	n	0			small sized white and gray inclusions	very smooth orange Bisquit paste		0
16	KOT	I.1	Bisquit	1	5.5	24	5	0	n	4			moderately well sorted small gray inclusions	classic light orange Bisquit paste		0
16	KOT	I.1		1	15.3	28	2	3	n	1			poorly sorted white inclusion	pinkish orange paste, blackened core		0
16	KOT	I.1		1	9.8	28	5	0	y	2	1	exterior rim is unslipped	barely visible temper, some small red inclusions	compact light orange paste	red brown	1
16	KOT	I.2		1	7.9	24	5	0	n	4			small gray inclusions	compact light orange paste	dark red brown	2
16	KOT	I.2		1	10.6	16	5	0	n	2		clay deeply incised when wet on ext w/diagonal line	small white and medium-large red inclusions	red orange paste		0
16	KOT	I.4		1								incised at rim as well as with a deep V				0
16	KOT	I.4		1	18.4	34	3	0	n	1			very small white temper	buff paste, blackened core		0
16	KOT	I.5	Bisquit	2	7.1	10	5	0	n	1		appliqué design of 2 small (1.4mm wide, 9.2mm long) parallel lines	coarse gray temper	classic light orange Bisquit		0

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
16	KOT	J		1	5.3	18	5	0	n	3			small white inclusions	light orange paste		0
16	KOT	J		1	9.9	32	5	0	n	1			small white inclusions	beige paste		0
16	KOT	J		1	9.2	22	5	0	n	0	2		small white and medium red inclusions	brown red paste		0
16	KOT	J		1	7.4	28	5	0	n	0			small white and gray inclusions	light orange paste	orange red	3
16	KOT	J		1	5.5	22	5	0	n	1	2		small gray inclusions	orange paste		0
16	KOT	J		1	7.3	12	5	0	y	1				red paste		0
16	KOT	J	Bisquit	1	4.4	26	5	0	y	1			coarse white and gray inclusions	light orange paste, gray burnish inside		0
16	KOT	J	Bisquit	1	4.9	20	5	0	n	1		incised pellet appliqués below rim	coarse gray inclusions	classic light orange Bisquit		0
16	KOT	J		2	8.1	12	5	0	y	2	1		medium white and red inclusions	red paste		0
16	KOT	J		2	8.6	32	2	0	n	1			small white inclusions and medium red	red orange paste		0
16	KOT	J	Bisquit	2	5.1	24	5	0	y	0			small coarse gray inclusions	orange		0
16	KOT	J	Bisquit	2	4.6	22	5	0	y	0			some magnetite, coarse gray inclusions	red orange paste		0
16	KOT	J	Bisquit	5	4.8	18	5	0	n	1		angle to vessel below rim	small white inclusions, coarse gray	orange		0
16	KOT	J.3	Bisquit	1	5.2	16	5	0	n	1			coarse white/gray inclusions	gray Bisquit paste		0
16	KOT	J.3		1	7.5	28	5	0	n	1	2		small white inclusions	compact beige paste, blackened core		0
16	KOT	J.3		1	5.6	12	5	0	y	1			small white inclusions, some medium red	beige paste	dark red	2
16	KOT	J.3		1	7.4	22	5	0	n	1	2		medium white inclusions	light orange paste	dark red	1
16	KOT	J.3		1	7.4	22	5	0	n	1	2		medium white inclusions	light orange paste	dark red	1
16	KOT	J.3		1	9	22	4	2	n	1						
16	KOT	J.3		1	4.8	32	5	0	y	1			coarse gray inclusions	light orange paste		0
16	KOT	J.4	Bisquit	7	6.4	12	5	0	n	1			coarse gray inclusions	bright orange Bisquit		0
16	KOT	J.4 (cont)	Bisquit	1	5.2	28	5	0	n	1			coarse gray inclusions	light orange paste		0
16	KOT	J.4 (cont)	Bisquit	1	4.9	24	5	0	n	0			small gray and small magnetite inclusions	orange paste		0
16	KOT	J.4 (cont)	Bisquit	1	4.7	16	5	0	n				small gray and beige inclusions	gray paste		
16	KOT	J.4 (cont)	Bisquit	2	6.6	18	5	0	n	1			small white inclusions	orange paste		0
16	KOT	J.4 (under dacite slab)	Bisquit	2	5.1	22	5	0	n	1			coarse gray inclusions	classic light orange Bisquit		0
16	KOT	J.5	Bisquit	1	5.1	26	3	0	n	0			coarse gray inclusions	light orange paste		0
16	KOT	K		1	7.2	16	?	?	?	?		dark red paint on rim with incised lines and dots				
16	KOT	K	Bisquit	21	5.9	18	5	0	n	0						
16	KOT	s	Bisquit	1	5.7	20				1				classic orange Bisquit		

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
16	KOT	s	San Lorenzo	1	17.7	24		2		2			small (.4) dead white inclusions	light orange	maroon	1
16	KOT	s	San Lorenzo	1	14.5	28					2	slip on interior up to top of lip. Ext plain	lots of dead white inclusions	light orange	dark red	1
16	KOT	s		1	11.5	18	2			1				compact beige paste, oxidation line	orange	2
16	KOT	s		1	8.2	16	5			3				light orange	dark red	1
16	KOT	s	plain/no i.d.	1	8.3	20				1			large (3 mm) red mineral chunks	beige/light orange		0
16	KOT	s	San Lorenzo	1	16.8	40			y	1		remnants of red paint on interior lip		buff		
16	KOT	s	San Lorenzo	1	11.3	16	3			1				compact orange paste	dark red	1
16	KOT	s	San Lorenzo? Valbuena?	1	15.8	34		2					fine paste w/lots of red mineral inclusions	buff		
16	KOT	s		1	6.2					3				dark gray	light orange	
16	KOT	s	Bisquit	1	3.1	26			y	1				classic light orange Bisquit paste		
16	KOT	s	Carbonera Appliqué (?)	1		28					2					0
16	KOT	s	Carbonera Appliqué	1	5.5	8	3			2		incised pellets. Vertical stripe down handle is NOT slipped, so almost like zoned biochrome in a sense			dark orange-red	2
16	KOT	s	Foncho Red	1	6.4	20						strips of clay attached in thin lines around neck				
16	KOT	s		1	18.32	30		2		2	1				orange	2
16	KOT	s		1	33	26			y	2				buff		0
16	KOT	s		1	41	5		0	n	3	2			dark red paste		
16	KOT	s	Carbonera Appliqué	1	6.7	28	3			2						
16	KOT	s	Foncho Red (?)	1										black/dark gray paste	red	
16	KOT	s		1	4.1	18				1			gray inclusions			
16	KOT	s	plain/no i.d.	1	9.2	28		2							buff	
16	KOT	s	plain/no i.d.	1	18.3	28	2	2			1		tephra inclusions	coarse beige paste		
16	KOT	s	Silena Winged?	1	9.6	10		3		1	1			coarse beige paste	red	2
16	KOT	s	Valbuena	1	7.2	30			y	2		painted red band on unslipped		light orange, compact	red	
16	KOT	s	Valbuena ?	1	10.2	18					1	polished		coarse beige paste	dark red	2
16	KOT	s	Bisquit	5	3.8	16				1				classic light orange Bisquit		
16	KOT	UN-A.1		1	9.1	14	4	0	n	0			small white and moderately red inclusions	beige paste		
16	KOT	UN-B.2		1	5.7	20	5	0	n	1			poorly sorted white and some red inclusions	red paste		0
16	KOT	UN-C.2		0.2									small white inclusions	light orange paste		0
16	KOT	UN-C.2		1	41	1							small white and medium red inclusions	light orange brown paste		
16	KOT	UN-		1	5.7	8	5	0	n	3			small white and medium red	beige paste		0

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
		C.2											inclusions			
16	KOT	UN-.1		1	6.2	20	4	0	n	0			small white and moderately red inclusions (some large red - 2mm)			
16	KOT	UN-A.2		1	7.1	48	5	0	n	3			small white and quartz inclusions	beige paste, blackened core		0
16	KOT	UN-I C.2		1	10.3	10	3	0	n	2			lots of moderately well sorted white inclusions, some medium red	orange brown paste		
17	PLM	4.3		2	7.5	22							well sorted, lots of angular white pieces	bright orange, compact paste	dark-orange red	
17	PLM	s	Cotito	1	6.5	18						incised lines. Parallel lines on either side of a T	coarse inclusions of tephra (.7)	dark gray		
17	PLM	s	Cotito	1	6.3	14					2			dark gray		
17	PLM	s	Zoned Biochrome	1	8.5	16									orange-red	
19	JRC	1.1		1	6.9	36	5	0	n	0		plastic circles and circular holes	coarse, poorly sorted white and orange inclusions	beige paste		0
19	JRC	1.1		1	9.5	20	1	0	n	3		incised lines, eroded appliqué	small white and orange inclusions	beige paste	dark red orange	1
19	JRC	1.1		1	14.1	24	1	0	n	3		groove at carination point	small white and orange inclusions	light orange paste	dark red brown	2
19	JRC	1.1		1	20.3	44	2	3	n	0			coarsely sorted white and orange inclusions	coarse beige paste		0
19	JRC	1.1		1	14	30	2	0	n	1			coarse white and orange inclusions	light orange paste		0
19	JRC	1.1		2	15.5	28	5	2	n	1			small white inclusions	beige/light orange paste	dark orange red	2
19	JRC	1.1		8	14											
19	JRC	1.2		1	8.6	24	5	0	n	3		unslipped exterior is combed	small white inclusions, well sorted	compact beige paste, blackened core	dark red	
19	JRC	1.2		1	13.2	24	5	0	n	3			lots of small white inclusions	beige paste	dark red orange	2
19	JRC	1.2		1	20.7	44	2	2	n	0			small white inclusions	porous beige paste	red orange	2
19	JRC	1.2		1	12.2	18	2	2	n	1	1		very small well sorted inclusions	light orange paste	bright orange	2
19	JRC	1.2		1	13.3	50	2	0	n	1		some comb lines (eroded) on exterior	very small beige inclusions	beige/light orange paste	dark red	1
19	JRC	1.2		1	13	20	2	0	n	3		small appliqué pellet on interior	small orange inclusions	beige orange paste, blackened core	dark red brown	2
19	JRC	1.2		1	13	18	5	1	n	4			small white inclusions	light orange paste	dark red	
19	JRC	1.2		1	18.1	26	2	2	n	0			small white inclusions	light orange paste	dark orange brown	1
19	JRC	1.2		1	11.8	24	2	0	n	1			small white, well sorted	beige paste		1

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
													inclusions			
19	JRC	1.2		1	11.5	26	2	0	n	1			small white and small orange inclusions	light orange paste	dark red	?
19	JRC	1.2		1	9.8	12	2	0	n	0			small white and gray inclusions	compact light orange paste	red orange	2
19	JRC	1.2		10	10.5	n/a	2	0	n	1		exterior has combed/dragged lines	light orange paste/blackened core		dark red	1
19	JRC	2.2		1	13.3	42	2	2	n	1		band of slip/paint on rim	small white inclusions, large orange and red (2mm) inclusions	light orange paste	dark red	5
19	JRC	3.1		1	19.8	34	2	2	n	1			small white and orange inclusions	coarse beige paste		0
19	JRC	3.1		1	13.2	28	5	0	n	4		eroded adorno figure/handle points upwards and extends higher than rim			dark red	2
19	JRC	3.1	Zoned Incised???	1	13.3	20	1	2	y	3		unslipped area below grooved rim has incised series of marks in a line	small coarse white and red inclusions	beige paste	red	5
19	JRC	3.1		1	16.6	24	2	2	n	0			very small white inclusions	orange paste	dark red	1
19	JRC	3.1		1	19.8	36	5	3	y	1			very small white inclusions	beige paste	dark red	2
19	JRC	3.1		1	16	20	2	2	n	0			very small white inclusions	orange/salmon paste	red orange	2
19	JRC	3.1		1	9.1	10	1	0	y	4	1		very small white inclusions	compact beige paste	orange red	2
19	JRC	3.1		1	10.1	20	1	0	y	4		1mm groove	very small gray and white inclusions	beige paste		2
19	JRC	3.1		2	13.5	n/a	2	0	n	0		unslipped side is combed	small white and red inclusions	beige paste	thick red	1
19	JRC	3.1		2	8.6	12	2	2	n	1		interior slip extends to create band on exterior	very small white inclusions	compact buff paste	red orange	1
19	JRC	3.1		3	13	26	5	0	n	1			small, coarse white temper	beige/light orange paste	dark red	1
19	JRC	3.1	CP Orange	4	8.5	16	1	0	n	3			moderately well sorted white inclusions	beige paste	orange-red	2
19	JRC	3.2		1	11.5	30	5	0	n	0	3		small white well sorted inclusions	porous red paste	orange brown paste	1
19	JRC	3.2		1	10.8	10	5	0	n	3			small white and orange inclusions, well sorted	beige paste		1
19	JRC	3.2		1	16.9	24	1	0	n	4	1	upturning adorno handle. Zoned. No slip where have incision designs in rim	small white and beige inclusions	beige paste, blackened core	red orange	2
19	JRC	3.2		1	12.1	22	1	0	y	4	1		small white and orange inclusions, well sorted	beige paste	red orange	2
19	JRC	3.2	CP Orange	2	9.8	20	1	0	n	3	1		small white inclusions	beige paste	red orange	2
19	JRC	3.3		1	9.5	12	5	0	n	0		combed in wavy line on unslipped exterior	small white inclusions	light orange paste	dark red	1
19	JRC	3.3		1	12.8	22	5	0	n	0		deeply combed irregular lines	small white and orange inclusions	beige/light orange paste		0
19	JRC	3.3		1	10.7	12	5	0	n	0		grooved lines on unslipped exterior	small white and orange	light orange	red	1

A	B	C	class.	#	D	E	R 1	R 2	R 3	R 4	F	decoration	temper	paste	slip color	S 1
													inclusions			
19	JRC	3.3		1	16.4	14	3	0		1			small white and orange inclusions	light orange paste	orange red	
19	JRC	3.3		1	13.6	16	5	0	n	4		has adorno handle of appliqué fillets	small red, white, and gray inclusions	orange paste	red	2
19	JRC	3.3		3	12.5	42	5	0	n	1		grooved lines on unslipped exterior	small white inclusions	beige paste, blackened core	dark red	
19	JRC	3.3		3	13.4	34	5	0	n	0		combed exterior is unslipped	small white and orange inclusions	beige paste	dark red	1
19	JRC	3.4		1	13.9	14	5	2	n	0			small white inclusions	beige paste	orange	2
19	JRC	3.4		1	10.5	24	5	0	n	0			small white and lots of medium orange inclusions	beige paste	orange red	2
19	JRC	3.4		1	10.4	30	5	0	n	1			small white inclusions	beige paste	red	1
19	JRC	3.4		1	9.8	52	5	0	n	0			small white inclusions	beige paste	dark red	2
19	JRC	3.4		1	12.7	24	5	0	y	4		groove at top of rim	small white and orange and some very large (5mm) red inclusions	light orange/beige paste	dark red	2
19	JRC	3.4		1	8.8	18	5	0	y	3	1	groove at rim	small orange inclusions	orange paste	dark red	2
19	JRC	3.4		1	14.3	16	5	2	n	0			small white and orange inclusions	buff paste	orange red	2
19	JRC	3.4		2	9.8	16	1	0	y	0			small white inclusions	beige paste	dark red	2
19	JRC	3.4		3											dark red	
19	JRC	3.4		4	13	28	2	2	n	0		combed on unslipped side	small white and orange inclusions	light orange paste	dark red orange	1

(b) Ceramic bases and feet

Key to abbreviations:

A = site # [of BE-#-KH]
B = site name
C = context (s = surface)
class. = classification (if any)
# = quantity
D = thickness/height (mm)
E = diameter or width (mm)
F = finish (1=polished; 2=smoothed; 3=combed)
S1 = slip location (0=none; 1=interior only; 2=both sides; 3=exterior only; 4=indeterminate)

A	B	C	class.	#	D	E	description	F	temper	paste	slip color	S1	reference
	GLY	stream collection (bag 2)		3		14	simple base (not raised or ring)		small white and large (2.5mm) red inclusions	orange red paste		0	
11	BEL	s		1	16.1	16	coarse, 2.5 mm inclusions of pumice, fire cloud inside, completely flat (not raised at all)						
11	BEL	s		1	18.7	13		2			light orange		
12	GIO	A.1	plain/no i.d.	1		11	appears to be a fragment of a base						
14	GON	A.1.4		1		10	low ring stand, unslipped underneath and exterior		large red mineral inclusions, magnetite, white inclusions	beige paste	dark red/brown	1	
14	GON	balk b/t J+M		1			plain. Either forgot to put in spreadsheet (so have no details) or is mislabeled somewhere else. Is from photo list						

A	B	C	class.	#	D	E	description	F	temper	paste	slip color	S 1	reference
14	GON	fill around petr 6		1	75	29	solid tripod foot. shaped like a bullet						
14	GON	M.4		1	15.2	6	entire round base, split in half. Low ring stand. Red slip interior		well sorted, lots of red and white temper	buff paste	red	1	
14	GON	N.2		1	30.9	20	fragment of a solid tripod foot		lots of poorly sorted gray temper	orange paste	red orange	2	
14	GON	surface		1	21.4	8	simple circular base		.6mm, white	compact buff paste, blackened core	dark red	1	
14	GON	surface		1	35.3	22.5	solid tripod foot. 10mm at tip	2	lots of dead white inclusions, moderately well sorted	red-brown paste		0	
15	GLY	stream collection (bag 1)		1		80	is a plain round base (not a ring stand)		small white inclusions	orange paste, blackened inside		0	
15	GLY	stream collection (bag 1)		1		60	plain round base		moderately well sorted white inclusions	orange red paste		0	
15	GLY	stream collection (bag 4)		1	7	10	very low ring stand. Barely raised above level of plane base		small white inclusions	buff paste	orange	1	
16	KOT	A(ext).2	San Lorenzo	1	70	16	14 mm thick. Simple base (not a ring stand)						
16	KOT	A.1		1	35	19.5	tip is 13.2. small solid tripod foot		well sorted white inclusions	gray	red-orange		
16	KOT	C.2		1	49	10	flat base, 12 mm thick. heavily burnt interior		white inclusions	Orange-red			
16	KOT	C.2		1	38	19	7mm thick. Maybe is fragment of a ring stand? Handle?			buff paste	dark red	4	
16	KOT	construction	Bisquit	1	67	31	15 mm at tip. Is straighter shape and not "inflated"						
16	KOT	construction		1	40	26	10 mm at tip. Solid tripod leg with slit sloppily done (not hollow, no pellet). Slightly curved				reddish brown		

A	B	C	class.	#	D	E	description	F	temper	paste	slip color	S 1	reference
16	KOT	construction		1	43		29 mm at tip. Solid, straight tripod leg.				eroded red paint or slip		
16	KOT	construction		1	35	51	not really sure if it is a handle or leg attachment.		white inclusions, some red mineral chunks (.5-1.8)				
16	KOT	construction	Silena Winged	1	42	21	piece attached to leg is 76x65. leg is 6 mm thick		lots of inclusions	dark beige	maroon	2	similar to leg on MacCurdy plate VI:a but body is closer to MacCurdy: 58 fig 77-8 or p 53 fig 67
16	KOT	construction	Valbuena or San Lorenzo	1	43	20	low ringstand (12 mm high)			fine beige, dark line at core	dark red	2	
16	KOT	construction		1	75	6	solid ring stand			orange			
16	KOT	construction		1	64	14	solid ring stand. carbonized material crusted to interior.						
16	KOT	construction		1	45	35	tip is 18 mm. Sloppy mammiform leg w/pellet (9 mm diameter)		dead white inclusions	dark beige. Blackened core			
16	KOT	construction	Bisquit	3	69	41	tip is 12 mm. Hollow mammiform legs with pellets. Slightly "inflated" shape						
16	KOT	D.1		1	18.6	10	fragment of low ring base		very small white inclusions	compact beige paste	dark red	1	
16	KOT	F(ext).6		1	0	18	fragment of round base from bottom of vessel (12mm thick)		small white and gray inclusions	brown red paste			
16	KOT	F.4		1	15.7	6		2	very well sorted white inclusions	buff paste	red	1	
16	KOT	F-ext (construct.)		1	62	12	simple (not a ring stand). burnt interior	2, exterior		red			
16	KOT	F-ext (construct.)		1	54	10				coarse beige paste	red-orange	2	
16	KOT	I(ext).1		1	18	22	fragment of round, low ring base		small red and magnetite inclusions	compact light orange paste	dark red	1	

A	B	C	class.	#	D	E	description	F	temper	paste	slip color	S1	reference
16	KOT	I(ext).4		1	50.3	42	fragment of solid tripod foot. Deeply incised lines and appliqué adorno		coarse gray temper	light orange paste		0	
16	KOT	I(ext).5	Bisquit	1	35.3	22	small, solid tripod foot		coarse gray inclusions	classic bright orange Bisquit paste		0	
16	KOT	I(ext).5	Bisquit	1	39	24	fragment from tripod foot, might have been hollow		moderately well sorted gray and white inclusions	classic light orange Bisquit paste		0	
16	KOT	J	Bisquit	1	53.6	33	hollow mammiform tripod foot		coarse gray temper	light orange paste		0	
16	KOT	J		1	49	27	crudely made hollow tripod leg. Smoothed rectangular "windows"		moderately sorted white inclusions	light orange paste		0	
16	KOT	J		1	28		fragment of hollow foot. Slits on both sides. Probably had pellet. incised lines at bottom ("toe") of the foot		coarse gray inclusions	pinky orange paste		0	
16	KOT	J	Bisquit	1	50.2	29.3	hollow tripod leg. Slit down middle nubbin at bottom (plain). Pellet missing		coarse gray temper	classic light orange Bisquit		0	
16	KOT	J	Bisquit	1	73.4	47.8	mammiform tripod foot w/pellet (14.8mm diameter). 18.5 diameter at tip		coarse gray inclusions	classic light orange Bisquit		0	
16	KOT	K	Bisquit	1	58.7	33	hollow mammiform leg. Pellet is rough, 13 mm diam. Ball nubbin at toe				classic orange Bisquit	0	
16	KOT	K	Bisquit	2	51	30	hollow mammiform legs. Pellets are 8.6 mm diam. Round nubbin at toe. seems to match with the 18 cm diameter rim sherds from this context				classic orange Bisquit	0	
16	KOT	surface	Carbonera Appliqué	1	49.4	20	thick (12.7 mm base),slightly ovoid		lots of white inclusions	gray	orange-red	2	
16	KOT	surface	Bisquit	2	55	34.7	21 mm thick. Matching tripod legs.						similar to MacCurdy 1911:58 fig.78

A	B	C	class.	#	D	E	description	F	temper	paste	slip color	S 1	reference
16	KOT	surface #1	Bisquit	1	73.9	42.8	width at narrow tip is 13.2. complete tripod mammiform leg w/pellet (11.7 mm diameter) inside						
16	KOT	surface #1		1	43	20	paint on interior. 12 mm thick. Could be polychrome b/c red paint on buff body						
16	KOT	surface #2	Bisquit	1	46	32	3.9 thickness to wall. Mammiform tripod leg with pellet (7.6 mm)						
16	KOT	UNACHI C.2		1	35.7	24.2	very small hollow tripod foot (or possibly adorno? slip might just be paint?		small white inclusions	light orange paste	orange red	2	
20	EST	B.1		1	32	30	solid tripod foot			dark beige paste			

(c) Ceramic adornos and handles

Key to abbreviations:

A = site # [of BE-#-KH]
B = site name
C = context (s = surface)
Class. = classification (if any)
#a = quantity of *adornos*
#h = quantity of handles
D = width (mm)
E = diameter or width
F = finish (1=polished; 2=smoothed; 3=combed)
G = slip location (0=none; 1=interior only; 2=both sides; 3=exterior only; 4=indeterminate; 5=banded)

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
11	BEL	s	San Lorenzo		1	8.2	33	strap handle fragment		faint trace of dark red lines					
11	BEL	s	San Lorenzo		1	12.3	40.3	strap handle, tapered to one end		faint red paint		buff			
11	BEL	s	San Lorenzo		1	55	27	strap handle fragment							
11	BEL	s			1	49.3	52.7	strap handle, tapered to one end		thick red bands painted on ext in parallel lines					
11	BEL	s			1	46	47					buff		0	
11	BEL	s			1	26.6	27.7	could be a solid tripod foot. Round. Some orange slip/paint							
11	BEL	s			1			attachment base only. 2 parallel incised lines on opposite sides. No slip but may have eroded							
11	BEL	s		1		17.2	33.7	plain but orange slip likely eroded off. 3 round pellets surrounded by rectangle of fillets							

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
12	GIO	A.1	Valbuena/ Isla Palenque		1	87	142	large urn (?) rim and slit round handle. Base of neck to lip is 55 mm.	2, 1 inside		large chunks of red jasper		orange-red	2	
12	GIO	A.2			1			twisted round handle				blackened inside		2	
12	GIO	C.2			1		7	strap handle					reddish orange	3	
12	GIO	C.3			1	28	25	fragment of strap handle			red mineral inclusions (1 mm)				
12	GIO	s	Valbuena	1		31	37	is 17 mm thick. Looks like Adapt Rad 355: e. made of pellets					reddish orange		
13	LPN	s	Bisquit		1			fragment of tripod foot attachment			small white inclusions	orange Bisquit paste		0	
13	LPN	s			1	34	38	fragment of strap handle			small white and large (3.3 mm) red inclusions	light orange paste		0	
13	LPN	s	Bisquit		1			is just the connection for a tab handle	2					0	
13	LPN	s			1	38	30	strap handle fragment. 12 mm thick		large dark band inside			orange		
13	LPN	s	Bisquit	1		22.9	25.9	figurine head			small coarse gray inclusions	orange Bisquit			MacCurdy Plate X: d, c
13	LPN	s		1		28	30	flattened fillet					orange		
13	LPN	s	Bisquit	2		10	29	appliqué fillet fragments				orangey clay with hematite		0	
14	GON	E.2		1		14.8	34.7	figurine fragment with pellets incised with 3 lines			small white and large red mineral inclusions	red brown paste	red brown	1	
14	GON	H.2			1	22.6	25.9	attachment for round handle	1		lots of small white inclusions, some large red	very red paste	dark red	1	
14	GON	H.4			1	14	18	small strap handle w/pellet adorno			small white inclusions	reddish orange paste			
14	GON	H.4			1	8.9	41.6	tab handle, sort of like a mammal foot with extra toes			poorly sorted white and red-brown mineral inclusions	beige/light orange paste	red orange	2	

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
14	GON	H/J/K feature		1		26.6	49	figurine on top of solid tripod leg (31 mm diameter). Looks as though has 2 bullet belts over chest. Coffee eyes. Could be a bird? A frog?			large, poorly sorted white inclusions	beige paste, almost a pinkish tone		0	
14	GON	H/J/K feature		1		21	23.2	Oval with two holes in center			poorly sorted white and large red minerals	beige paste		0	
14	GON	I.3			1	7.8	42.8	attachment for handle			.5 white inclusions	buff paste, blackened core	red-orange		
14	GON	I.3			1	15	38	fragment of strap handle			.7, white, well sorted	buff paste	dark red	1	
14	GON	I.3		1		7.5	36.7	tab handle w/3 pellets, like foot of an animal			well sorted, lots of white	coarse buff paste	bright orange	2	
14	GON	K.2		1		23.1	24.9	is a loop of clay, likely a handle. Small pellet appliqué at top			many small white inclusions	orange paste		0	
14	GON	K.3		1		10.7	20			incised dashes and one main line on appliqué	lots of well sorted white inclusions. Some light red mineral	light orange paste, blackened core	red		
14	GON	L.4			1	8.3	23.5	tab handle. Well smoothed. Oval			white inclusions	gray paste	dark brown-red	2	
14	GON	L.4			1	9.3	20.4	small crude tab handle (rectangular)			lots of white inclusions	beige paste	orange		
14	GON	L.5		1		33	1	24mm thick, eroded adorno tab handle on rim (22cm diameter) w/incised lines below lip. Unslipped below exterior rim			lots of well sorted white inclusions and red mineral	coarse red-brown paste	dark red	1	
14	GON	N.4		1		13.4	13.4	round nubbin (not a pellet appliqué)			lots of well sorted white temper	beige paste	red brown	2	
14	GON	O.3		1		3.9	21.7	unslipped curly q on angular section of vessel	1		no visible temper	very compact buff paste	red	2	
14	GON	s			1	14.9	33.2	round handle, 3 incised lines meet parallel double lines		either red paint or slip in band at top of handle	well sorted white inclusions	compact gray paste	red		

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
14	GON	s			1	25.3	58.3	thick, tapered handle fragment			lots of mineral inclusions	buff	some red slip?		
14	GON	s			1	57.7	40.1	16.8 mm thick strap handle			lots of well sorted white inclusions	buff paste, heavily blackened core		0	
14	GON	s			1	8.5	27	fragment of a tab handle			coarse, poorly sorted	buff paste	red		
14	GON	s			1	41	27	fragment of a strap handle			well sorted white inclusions	light orange		0	
14	GON	s			1	64	56	16mm thick. Fragment of a strap handle		unslipped top and bottom and slipped on sides of handle	very small bits of quarts, well sorted	buff	red-orange		
14	GON	s		1		12.7	27.8	tab handle attachment			coarse white inclusions	dark red		0	
14	GON	s		1		25.6	39	squiggly fillets of clay			lots of moderately sorted white temper	orange red paste	dark red	1	
14	GON	s	Cerro Punta Orange	1		21.6	28.7	is an appliqué figure (eroded) on grooved rim (22 cm diameter)			coarse, poorly sorted white inclusions	buff paste	red-orange	2	
15	GLY	s			1	37	31	strap handle fragment			poorly sorted white and red inclusions	red brown paste		0	
15	GLY	s			1	37	40	tab handle. Concave underneath and little grooves on underside edge			moderately well sorted coarse white and gray temper	red orange paste	red orange		
15	GLY	s			1	26.3	45	doubled round handle, together basically create a bifurcated strap. Come directly off of 24 cm diameter rim			small white and large (1.6mm) inclusions	red orange paste		0	
15	GLY	s			1	40	50	strap handle, comes directly off of rim (34 cm diameter)			coarse white inclusions	orange paste		0	
15	GLY	s			3	76		attachments for round handles, at least one (25mm) incised and twisted			coarse white inclusions	red orange paste		0	body sherds are 7 mm thick

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
15	GLY	s			3	61					coarse white and medium red inclusions	orange paste		0	
15	GLY	s			4	79	190	round/incised handles that come directly off of rim			coarse, moderately well sorted white inclusions	red orange paste		0	
15	GLY	s			5			fragments of round, twisted handles							
15	GLY	s			2	71		attachment for tab handle			small white and large (2mm) red inclusions	red orange paste		0	
15	GLY	s			6			various eroded fragments of handle attachments			coarse white inclusions	beige paste			
15	GLY	s			8	221		round handles, twisted handles							
15	GLY	s		1		36	60	is a figure (frog? Man? Turtle?). Incised lines. Coffee eyes.			coarse white inclusions	red orange paste		0	
15	GLY	s		1		24	33	figurine. Is like a turtle with arms wrapped around itself			coarse white inclusions	orange paste		0	
15	GLY	s		4				incised appliqué fillets			small white and medium red inclusions	reddish paste		0	
16	KOT	5.5		1		15	21	very eroded, anthropomorphic			buff				
16	KOT	7.6	Foncho Red/Carbonera Appliqué	1		39.7	34	5.8mm thick. Could be top of an adorned tripod leg? Some form of creature is on top							similar to the tripod leg at MacCurdy 1911 fig 134
16	KOT	8.8		1		14.6	29	Zoomorphic/anthropomorphic figure. Has his head in his hands (under chin).				red		0	Similar to MacCurdy 1911:plate XIX: d but with a potbelly
16	KOT	A(ext). 2			1	30	39	7.4 mm thick. Is either an attachment for a handle OR a low ring stand (9 mm tall)				buff/light orange, compact	maroon	1	
16	KOT	A(ext). 2			1	12	28	strap handle attachment				dark beige, coarse		0	

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
16	KOT	A.1	Foncho Red		1	11.8	32	delicate twisted handle, comes directly off lip	1				red	2	
16	KOT	A.1			1	54	63	wide, tapering strap handle (smaller end is 34 mm)				reddish-orange, porous		0	
16	KOT	A/I(ext)balk.2		1		37	20	7.7 thick. Part of adorno or strap handle fragment. Deeply incised (multiple lines) pellet appliqué makes seem was part of larger figurine				bright orange paste		0	
16	KOT	A/I(ext)balk.3		1		31	46	15 mm thick. Zoomorphic/anthropomorphic figure on handle w/head in hands			coarse white and tephra (.9) inclusions	buff/beige		0	see MacCurdy 1911: Plate XIX: 19 e/f for similar
16	KOT	B.2			1	5.5	16	attachment for round handle				reddish brown			
16	KOT	C.1		1		12.5	35	12.7mm thick. Burnt appliqué strip w/incised and punched holes			tephra and red mineral inclusions	dark red			
16	KOT	C.2			1	15	27	6.6mm thick. Fragment of narrow strap handle			white inclusions	buff paste		0	
16	KOT	C.4			1	36	28	9.7 thick. Burnt attachment for a round handle			red mineral and white inclusions				burnt
16	KOT	D.1			1	38.1	39.8			dark red orange paint bands on edges of strap handle fragment	well sorted small white inclusions and some large red inclusions	compact buff paste		0	
16	KOT	D.1			1	32	33.5	strap handle w/punched round adornos, looks like octopus tentacle covered in suction cups			some magnetite, lots of moderately well sorted white inclusions	red orange paste		0	
16	KOT	E.1			1			includes one 36mm long/26mm wide tab handle	1	small white and large (2mm) red inclusions	orange brown paste, blackened core			0	some pieces burnt and crusted with carbon
16	KOT	E.2	San Lorenzo?		1	40	37	tab handle. Appliqués with incisions. Red painted lines			small red and small white inclusions	beige paste		0	

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
16	KOT	E.2			1	36	52	fragment of tab handle			small white and small orange inclusions	beige paste		0	
16	KOT	E.3			1	29.2	19.4	u shaped handle, flattened to vessel rim (24 cm diameter)			small white inclusions	beige paste		0	burnt exterior
16	KOT	F (ext).2			1	21.4	51	incised rope handle			small white, small magnetite, large (2mm) red mineral inclusions	porous beige paste		0	crusted with carbon
16	KOT	F (ext2). 5			1	28	34.9	strap handle, comes directly off of rim. Slipped with paste material???			moderately well sorted white inclusions	pinkish orange paste		0	
16	KOT	F (ext2). 7			1	17.4	32.8	split round handle (division b/t the 2 is visible). Handle comes directly off the rim (17 cm diameter)	1 inside		small white and medium red inclusions	light orange paste		0	
16	KOT	F (ext2). 7			1	26.2	28.3	fragment of split round handle with division b/t split visible			lots of small white inclusions	bright orange paste		0	
16	KOT	F (ext2). 8			1	22		includes sherd with attachment for round handle (22 mm diameter)			small white and medium red inclusions	brown red paste		0	fire cloud interior/ext erior.
16	KOT	F.3		1		26.6	42.6	fragment of a figurine. Looks like leg and foot of animal/anthropomorph?			small white temper	reddish brown paste		0	
16	KOT	G.4			1	18		attachment on one of the sherds			small white and gray inclusions	beige paste		0	
16	KOT	H.1			1	27	70	incised round handle, comes directly off of rim			small white and small magnetite inclusions	light orange paste, blackened core		0	
16	KOT	H.2			1	15.3	43	twisted, incised rope handle. Comes directly off of rim			coarse white inclusions, some small red	brown red paste		0	
16	KOT	H.2			1	33	38	flat tab handle			small white inclusions, moderately well sorted	brown red paste		0	
16	KOT	H.3			1	14	26.9	twisted double rope handle, comes directly off of rim (14 cm diameter)			barely visible small white temper	porous beige paste		0	

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
16	KOT	I(ext). 5		1		7.3	8.9	pellet incised with 3 lines on exterior. interior slip/body is black, may be burnt							
16	KOT	I.1			1	35.9	16.3	12.4mm thick handle, red-orange band on each side			small white and medium red inclusions	light orange paste	red orange	5	
16	KOT	J(ext). 2+3 mixed		1		12.5	8.4	is like a conical breast, looks like it came off the base of a tripod foot			small white inclusions	beige paste	red	2	
16	KOT	J.1		1		21.5	32.7	incised circles as though made by hollow reed. Incised fillets. Maybe was a handle?			well sorted coarse gray temper	bright orange paste		0	
16	KOT	K			1	20	55.3				small white inclusions	orange paste		0	
16	KOT	K			4	14	0	includes 4 handle attachments (14.7mm). burnt exterior and interior. Very round vessel shape	1	unslipped band on exterior below banded area, red band at rim w/handle attachment	very small white inclusions	compact beige paste	dark red brown	5	
16	KOT	s			1	16.5	31	Round handle comes directly off lip				dark gray	light orange		sloppily crafted
16	KOT	s			1	31	67	strap handle	2		white inclusions	dark beige/gray paste	red-brown	2	
16	KOT	s			1	56	56	9 mm thick. Length/width are for whole piece, not just handle attachment.			white inclusions	dark beige	dark red	2	
16	KOT	s			1	29	41	10.8 mm thick. Strap handle fragment			tephra inclusions	dark gray			
16	KOT	s			1	23	58	round handle			very chunky		red-orange		
16	KOT	s	Carbonera Appliqué (?)		1	65	77	37 mm thick. Strap handle attached directly to lip (common in Carbonera Appliqué)	2					0	
16	KOT	s	Carbonera Appliqué		1			incised pellets for decoration		incised pellets. Vertical stripe down handle is NOT slipped, so almost like zoned biochrome in a sense			dark orange-red	2	
16	KOT	s	Carbonera Appliqué		1	20	72	strap handle parallel to rim and covered in double incised pellets							

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
16	KOT	s	Foncho Red (?)		1	19	32	delicate strap handle that comes directly off of outflaring rim. Rim piece is 66 mm long and 43 mm wide				black/dark gray paste	red		
16	KOT	s	Foncho Red (?)		1	27	54	twisted round handle and rim, handle comes directly off of rim. Piece is 55 mm wide and the body is 6.7 cm thick							
16	KOT	s			1	32	46	7.8 mm thick. Handle attachment for what looks like was a round handle				beige paste	reddish-orange	2	
16	KOT	s	San Lorenzo	1		47	69	is really a neck, minus rim. Lip outflares to make small shelf.		slip goes to ext/int division of lip		dark gray, compact	red-orange	1	most like Caco Red Slipped - Corrales p 330
16	KOT	s		1	84	20	47				white inclusions	dark gray	light orange		
16	KOT	s		1	84	20	47				dead white inclusions	dark gray	light orange		
16	KOT	s		1		33	40	5.1 mm thick. Looks like broken attachment for a delicate handle (28 mm wide) OR appliqué	2		coarse white inclusions (.6 mm) and some large pieces of pebble (5.2 mm)	dark orange-red			
16	KOT	surfac e		1		39	61	12.9 mm body thickness, 35 mm w/handle. Bottom part of large handle (arc has a 27 cm diameter)				buff	orange		
16	KOT	UN-A.2			2	23.4	0	attachments for round handles						0	
16	KOT	UN-B.2			1	14		includes round handle attachment			moderately well sorted white inclusions	porous buff/salmon paste		0	
16	KOT	UN-C.1			1			strap, slightly twisted. Remnant of leathery brown on ridge							
16	KOT	UN-C.3			1	9.3	20.1	attachment for tab handle			small white and medium red inclusions	beige paste		0	
17	PLM	s		1		23.2	27.5	indistinguishable figure (animal? human?)		punctuation marks			dark red		

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
19	JRC	1.1			1	51	41.3	fragment of strap handle			small white and gray inclusions	beige/light orange paste		0	
19	JRC	1.1			1	40	35				very small white inclusions	bright orange red paste		0	
19	JRC	1.2			1	44	66	strap handle, begins 19 mm below rim			lots of small white inclusions	beige paste	dark red orange	2	
19	JRC	2.3		1		28	17	incised dashes on nubbin handle			small white inclusions	red orange paste	red orange	2	
19	JRC	3.1			1	47	23	tab handle			small white and orange inclusions	beige/light orange paste	orange red	3	
19	JRC	3.1			1	72	51	fragment of huge strap handle			coarse white, orange, and huge red (5mm) inclusions	beige/light orange paste		0	
19	JRC	3.1			1	33	29	strap attachment w/fragment of handle			small white and orange inclusions	beige paste	dark red orange		
19	JRC	3.1			2			strap fragments							
19	JRC	3.1			4			fragments of tab handles			poorly sorted white, red, orange inclusions	orange brown paste	red orange		
19	JRC	3.1		1		8	19	appliqué fillet on exterior of neck			very small white and beige inclusions	beige/light orange paste	dark red orange	2	
19	JRC	3.1		2		13	18	2 incised appliqués on sherd			small white inclusions	orange brown paste	dark red	1	
19	JRC	3.2			1	12	36.2	small tab handle (is unslipped but sherd is slipped all around)			small white and orange inclusions, well sorted	light orange paste	dark red brown	2	
19	JRC	3.2			1	13.7	40	round (1/2 circle) tab handle			small white and orange inclusions	orange		0	
19	JRC	3.2			3			fragments of tab handle attachments							
19	JRC	3.2		1		36.6	20.8	incised bulb of clay, fragment of a figurine			small white inclusions	porous beige paste	orange brown paste	2	

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
19	JRC	3.2		1		14.6	21	fillet and punched ball appliqué			coarse white and orange inclusions	beige paste	orange brown paste	2	
19	JRC	3.2		1		17	16	appliqué fillets			small white and orange inclusions, well sorted	light orange paste		2	
19	JRC	3.3			1	31	14.6	tab handle, edges more squared than often see			small white inclusions, lots of oblong magnetite	light orange paste	red orange		
19	JRC	3.3		1		25.2	29.3	bumble bee sort of adorno created by appliqué pellets			barely visible white inclusions	compact orange paste	red orange		
19	JRC	3.4			1	41	59	large strap handle			small white and orange inclusions	red brown paste		0	
19	JRC	3.4			1	26	57.5	upward slanted strap handle			small white inclusions	red orange paste	red	1	
19	JRC	3.4			1	41	18	eroded tab handle			small white and gray inclusions	light orange paste		0	
19	JRC	3.4		1		6.5	17	appliqué pellet			small white and orange inclusions, blackened core	light orange paste	dark red	0	
19	JRC	3.4		1		8.3	15.6	appliqué pellet			small white inclusions	beige paste	dark red		
19	JRC	3.4		2		21	28	round appliqué bulges with incisions			small white inclusions	light orange paste	dark red	1	
20	EST	A.2			1	20.3	29.5	tab handle. 3 prongs				buff			
20	EST	A.2			1			eroded handle/adorno. Two prongs.			large (1.7 mm) inclusions of white and red	reddish body			
20	EST	A.3	Bisquit	1		7	27	decorative fillet				reddish-orange.		0	
20	EST	B.1		1		30	32					dark beige paste			
20	EST	B.1		1		28	39	2 triangular points, look like breasts but were likely repeating decoration? are 17 mm out and 13 mm wide each					eroded orange slip	2	
20	EST	B.1		1		20	29	fragment of either adorno or handle			rough with lots of tephra	orange			

A	B	C	Class.	# a	# h	D	E	description	F	decoration	temper	paste	slip color	G	reference
20	EST	B.1		1		23	27	fragment of either adorno or handle			rough with lots of tephra	orange			
20	EST	B.2			1	21	33	tab handle. Finger sized groove underneath to make easier to grab			coarse	light orange		0	
20	EST	B.2			1	31	27	eroded fragment. Thicker version of other tab handle from same context			coarse	reddish-orange			
20	EST	B.2			1	27	21	strap handle fragment (4 cm diameter)							
20	EST	B.2		1							uniform temper size	light orange paste	dark orange		
20	EST	B.2	Cerro Punta Orange	1		24	27	incised nubbin				beige	orange		

(d) Diagnostic ceramic counts

Charts are not provided for the following sites and reasons:

BE-15-KH (GLY) - all identified ceramics were Bisquit (AD 1000-1500)
BE-18-KH (MAR) - only a single sherd was retrieved, which was plain
BE-19-KH (JRC) - all identified ceramics were Cerro Punta Orange (AD 200-600)

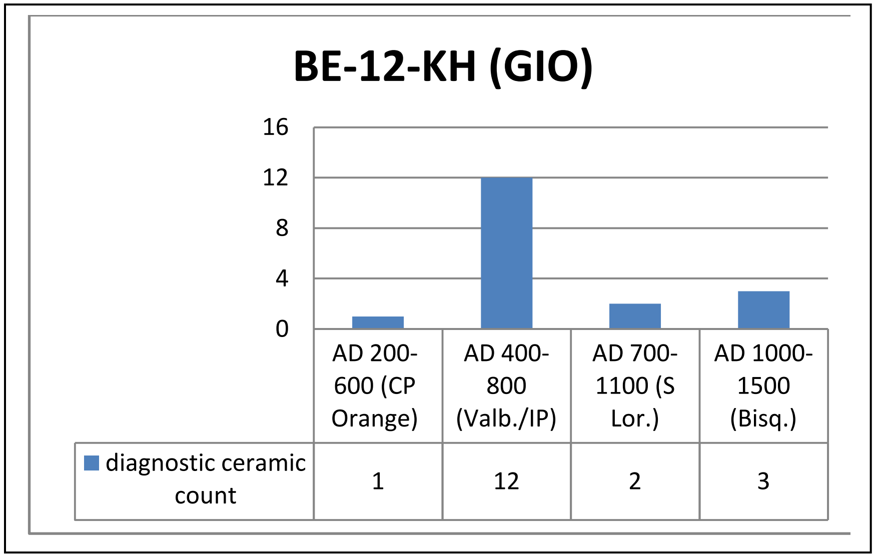
Note that the ceramic chronology of the Barú area likely needs to be shifted somewhat, particularly in reference to the end of the Cerro Punta Orange span, as its termination at AD 600 was linked to a catastrophic eruption of the Volcán Barú. This eruption more likely occurred closer to AD 1100-1300 according to recent palaeoecological studies (see Chapter 2). For total sherd counts from each site see Figure 3-8 (p. 42) of Chapter 3.

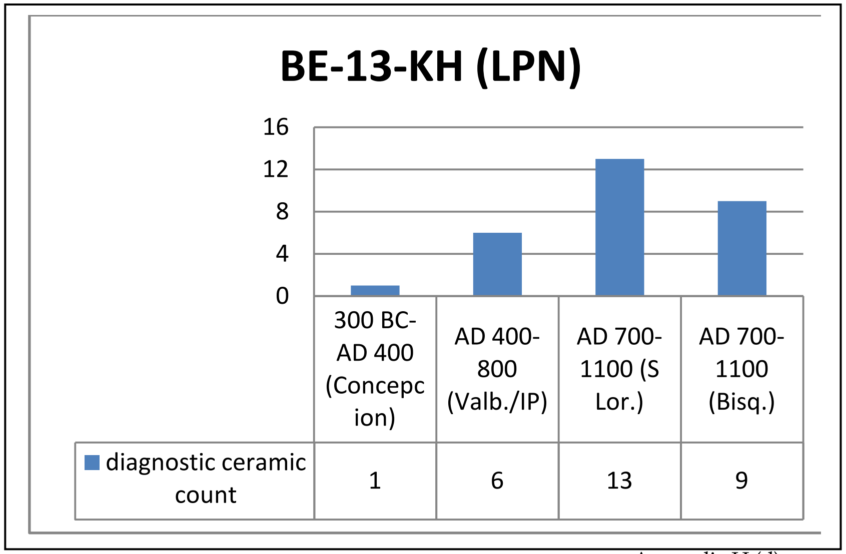
Abbreviations used in the charts:

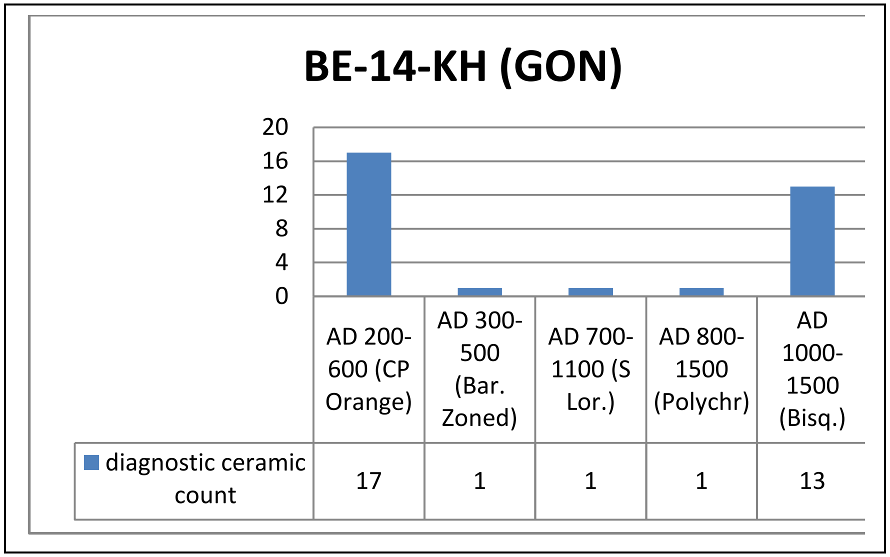
Bisq. = Bisquit
CP Orange = Cerro Punta Orange
S Lor. = San Lorenzo
Valb/IP. = Valbuena/Isla Palenque Maroon

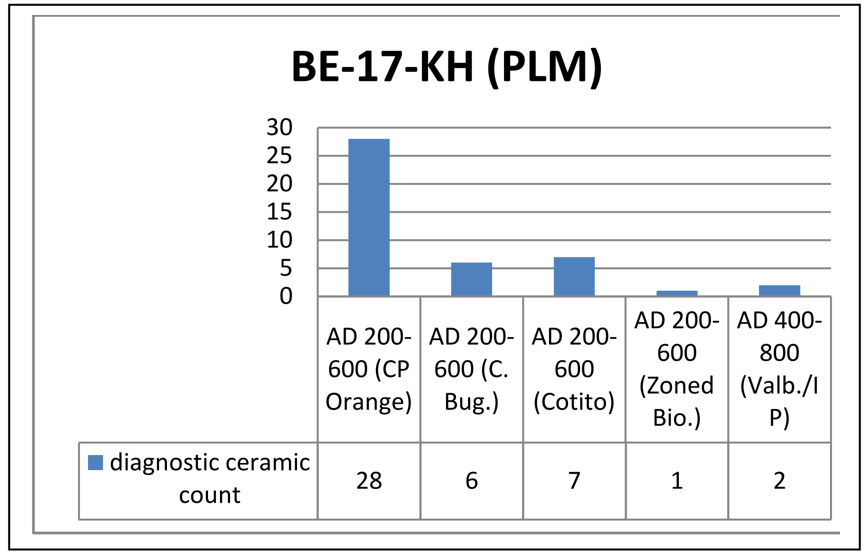
Bar. Zoned = Barriles Zoned
Zoned Bio. = Zoned Biochrome
C. Bug. = Combed Bugaba
Bug. Eng. = Bugaba Engraved

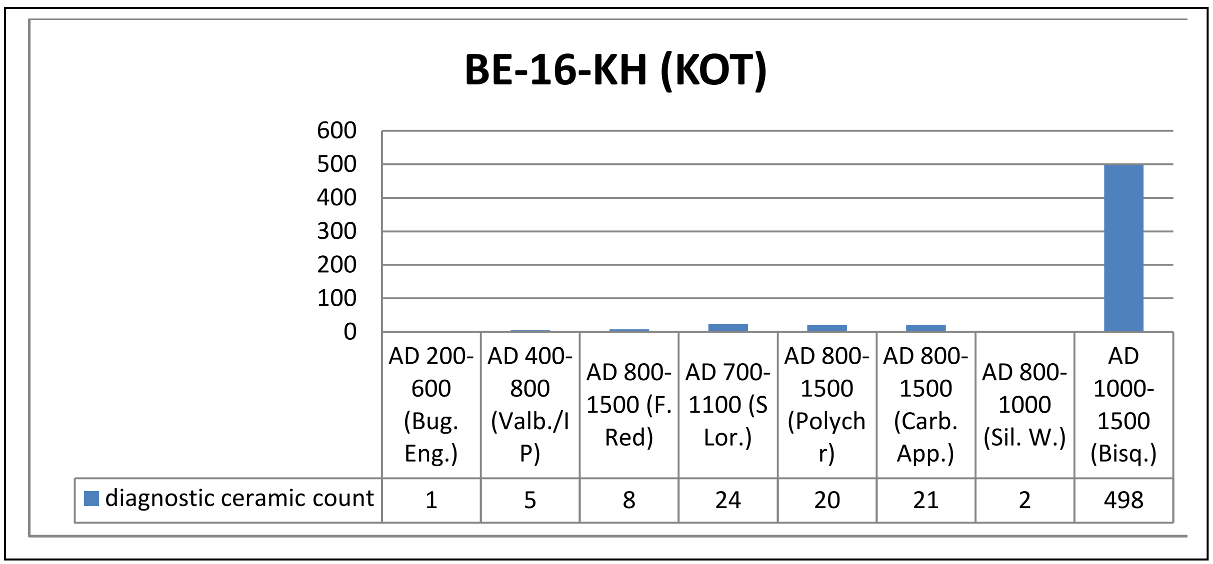
F. Red = Foncho Red
Polych = Polychrome
Carb. App. = Carbonera Appliqué
Sil. W = Silena Winged

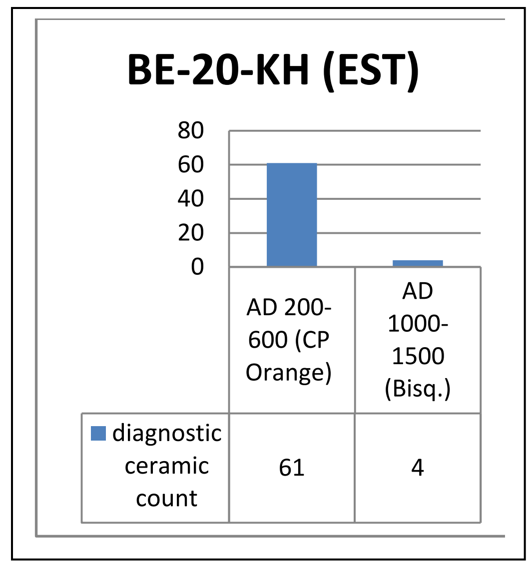





BE-14-KH (GON)
20
16
12
8
4
0
AD 200-600 (CP Orange)
AD 300-500 (Bar. Zoned)
AD 700-1100 (S Lor.)
AD 800-1500 (Polychr)
AD 1000-1500 (Bisq.)
diagnostic ceramic count
17
1
1
1
13


BE-17-KH (PLM)
30
25
20
15
10
5
0
AD 200-600 (CP Orange)
AD 200-600 (C. Bug.)
AD 200-600 (Cotito)
AD 200-600 (Zoned Bio.)
AD 400-800 (Valb./I P)
diagnostic ceramic count
28
6
7
1
2


BE-16-KH (KOT)
600
500
400
300
200
100
0
AD 200-600 (Bug. Eng.)
AD 400-800 (Valb./I P)
AD 800-1500 (F. Red)
AD 700-1100 (S Lor.)
AD 800-1500 (Polych r)
AD 800-1500 (Carb. App.)
AD 800-1000 (Sil. W.)
AD 1000-1500 (Bisq.)
diagnostic ceramic count
1
5
8
24
20
21
2
498


BE-20-KH (EST)
80
60
40
20
0
AD 200-600 (CP Orange)
AD 1000-1500 (Bisq.)
diagnostic ceramic count
61
4

* description: 1=whole; 2=nearly whole; 3=fragment; 4=debitage
**reference for similar: Mac=MacCurdy (1911); AR=Linares and Ranere (1980)

Appendix I: Lithic counts and descriptions

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-11-KH	BEL	surface	1	1	anvil	1	5B 5/1 (medium bluish gray)	148.2	62.1	-	49.8	super heavy volcanic rock. End battered - used as a hammer. Edges worked. Top pitted. Profile like scraper plane but way too heavy a material. Profile of an anvil. Merrill says is good as a wood plane, heavy, fits in hand	AR: 456-7
BE-11-KH	BEL	surface	1	1	whetstone	1	N7	55.1	41.9	27.1	21.2	soft porous sandstone (medium grained). Seems to have been held in left hand (fits fingers). Arc depression made from use	AR: 483 b
BE-11-KH	BEL	surface	1	2	point made on blade	1	10 YR 6/6 (dark yellowish brown)	55.2	22.1	12.7	9.2	very compact material. Bottom ('b') very flat. Tanged. Heavily worked	AR: 447 s
BE-11-KH	BEL	surface	1	2	flake scraper	1 or 2	5B 7/1 (light bluish gray)	40.3	50.2	10.7	9.8	wear has created arc pattern on one side. Light feeling andesite	AR: 418 f,i
BE-12-KH	GIO	3.4	1	2	flake	4	5Y 4/1 (olive gray)	39.7	22.8	-	6.5	thing, medium grained stone, light colored inclusions	
BE-12-KH	GIO	3.4	1	3	Dacite slab	3	5Y 6/1 (light olive gray)	106.7	46.8	-	24.9	dacite piece. No visible working (but presence alone significant if tomb related)	
BE-12-KH	GIO	8.9	1	2	scraper plane fragment	3	5Y 8/1 (yellowish gray)	81.1	64	-	37.5	sandstone? Lightweight	
BE-12-KH	GIO	A.7	1	1	whetstone ?	1	10 YR 7/4 (grayish orange)	60.9	49.2	-	21.1	from description sounds like 2nd one in AR 461. one end has polish, used all way across. Other end used at an angle. Lightweight coarse stone with many magnetite inclusions. All of 'a' surface smooth. 'b' rough and slightly concave.	
BE-12-KH	GIO	C.2	1	1	finger pounder	1	5Y 6/1 (light olive gray)	58.9	42.6	-	25.3	coarse grained, vesicular volcanic stone w/black inclusions. Mano fragment reused as a small pounder/pecker? Chipped to fit fingers, thumb goes where put "1b". Pounding surface is to the left of that on side 'b'. Pounding surface only 30mm long and 17mm wide	
BE-12-KH	GIO	C.2	1	1	pebble polisher	1	5 YR 7/2 (grayish orange pink)	18.9	10.5	-	8.9	very soft, small. Highly smoothed. Fits thumb and 1st finger	
BE-12-KH	GIO	C.2	1	2	flake scraper plane	1	5B 7/1 (light bluish gray)	39.9	28.5	-	16.1	heavily worn bit (to 8mm mark). Light, fine grained stone is cracking. Not highly durable	AR: 417 j
BE-12-KH	GIO	C.2	1	2	flake scraper	2	5Y 4/1 (olive gray)	74.6	66.7	27.4	16.4	very light, jagged material. "ice scraper" shaped. Flake from celt production? Though is a strange material for that. Used on 'b' side only (2mm use wear line). Like was hafted from shape? Has a tang.	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-12-KH	GIO	tarp hole just south of A	1		flat stone	1	10 YR 8/6 (pale yellowish orange)	92.5	95.1	-	22.5	mixed with N6. super heavy coarse, flat stone. Lots of coarse inclusions and small stones. Could this be a welded tuff?	
BE-13-KH	LPN	surface	1	1	Hammer stone	1	5B 5/1 (medium bluish gray)	44.1	44.2	-	36.4	super hard, dense volcanic stone. Super round. Has V notch in bottom - intentional or from pounding?	AR: 457 f
BE-13-KH	LPN	surface	1	1	grinder/pounder	1	5 GY 8/1 (light greenish gray)	36.8	33.9	25.9	29.2	soft sandstone/siltstone. Light greenish. Fits fingers. Wear on 2 bottom sides ('b') (irregular)	
BE-13-KH	LPN	surface	1	1	metate (slab)	3	10 R 5/4 (pale reddish brown)	-	-	-	-	very heavy and dense volcanic rock. Rectangular from work. Could also be a fragment of a slab metate.	AR: 424 b2
BE-13-KH	LPN	surface	1	2	flake knife	3	5Y 6/1 (light olive gray)	65.3	32.5	-	13.1	fragile feeling light stone. Retouched all around edges. Could have been a thin celt?	
BE-14-KH	GON	A.1.3	1	1	Hammer stone	1	5Y 6/1 (light olive gray)	53.7	40.4	-	31.9	small, fits in fingers. Bottom edge pecked and battered ('b')	
BE-14-KH	GON	A.1.3	1	2	flake knife	2	5 YR 4/1 (brownish gray)	29.5	43.5	-	9.5	andesite. Working edge is a slightly serrated arc	AR: 418 m
BE-14-KH	GON	A.1.3	1		?	3	10R 5/4 (pale reddish brown)	38.2	25.2	-	13.4	chunk of soft, slightly vesicular, super light stuff (sandstone?)	
BE-14-KH	GON	A.1.4	1	1	?	3	5 YR 6/1 (light brownish gray)	41.2	47.7	-	12.7	dacite w/lots of magnetite inclusions. Rounded and smoothed one side and concave other. Fragment of mano? Fragment of palette or stone bowl?	
BE-14-KH	GON	A.1.4	1	2	blade	3	N4 (medium dark gray)	52.1	35.2	-	11.1	fragment. Very light, sand papery, dark vesicular volcanic material	
BE-14-KH	GON	A.1.4	1	3	?	3	5Y 8/1 (yellowish gray)	24.9	38.9	-	11.9	chunk of dacite. Rounded edge	
BE-14-KH	GON	A.1.4	1		?	3	5R 8/2 (grayish pink)	56.2	32.6	-	16.6	light pink (sandstone?). Rounded edge. Could have been worked or could be natural	
BE-14-KH	GON	A.1.7	1	1	mano	3	5Y 8/1 (yellowish gray)	55.9	45.9	-	30.4	could also be fragment of a metate? Is a smoothed corner of vesicular dacite	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-14-KH	GON	balk b/t H+K	1	1	Hammer stone	1	10 YR 6/2 (pale yellowish brown)	62.3	51.9	-	40.1	marked for fingers. Battering on 2 work sides. Porphyritic, dense material w/large whitish phenocrysts	
BE-14-KH	GON	balk b/t H+K	1	1	grooved stone	3	10 RY 6/2 (pale yellowish brown)	78.7	43.3	16.7	32.1	is split. Appears to have crossing marks from hafting cord both lengthwise and width. Porphyritic with large white phenocrysts	
BE-14-KH	GON	balk b/t H+K	1	2	core	1	5 YR 4/1 (brownish gray)	63.2	39.3	-	23.5	fine grained andesite. Flakes taken off in irregular manner	
BE-14-KH	GON	balk b/t H+K	1	2	flake scraper	1	N4 (medium dark gray)	45.1	35.5	14.1	6.2	has "ice scraper" shape. Andesite, but not as fine grained as core in same context	
BE-14-KH	GON	balk b/t J + M	1	1	hammerst one	1	can't tell with dirt (didn't wash)	74.6	49.2	-	45.4	vesicular. Unwashed (originally in case of residue analysis/phytoliths). Fitted to fingers, underside worn and pitted	
BE-14-KH	GON	balk b/t J + M	1	1	pumice polisher	1	10R 5/4 (pale reddish brown)	29.7	24.1	-	16.8	fits fingers. Bottom worn from use	
BE-14-KH	GON	balk b/t J + M. 40 cm	1	1	milling stone	1	5 YR 6/1 (light brownish gray)	152.3	129.4	-	59.1	dacite. Sub-rounded. Obvious wear from grinding on 'c' (is concave and some pitting from use as hammer at tip). Hands fit comfortably at narrow edge to grind on bottom. Narrow edge could have also been used due to pitting, though that could also be from chipping to fit hands?	AR: 423 h,i
BE-14-KH	GON	balk II	1	1	pounding/ mashing stone							rough hacks taken out of river cobble (vesicular, dense). Perhaps by a machete as are very distinct. Is like notches were hacked, then never smoothed like generally see. Working edge pitted and smoothed (marked w/arrows for photo)	AR: 456 c
BE-14-KH	GON	balk II	1	1	hammerst one	1	5Y 7/2 (yellowish gray)	45.9	42.5	-	38.7	fits fingers. Working surface concave from wear. Is a very rough (sandstone) medium grained material	
BE-14-KH	GON	C.1.1	1	2	?	?	5Y 2/1 (olive black)	33.2	15.2	-	8.7	pyramid, like found from other GON context. Pyramid/corner on top, concave on bottom. Is a dark, sharp, super light volcanic rock. Like pumice but hard. Find grained, super airy	
BE-14-KH	GON	D.1.2	1	1	whetstone ? Palette? Rectangul ar mano?	3	5Y 8/1 (yellowish gray)	99.4	57.9	-	49.9	super smoothed, very fine grained stone. Is a perfect corner	
BE-14-KH	GON	D.3.1	1	1	pebble polisher/s mall hammerst one	1	10R 5/4 (pale reddish brown)	45.5	24.6	-	16.9	smoothed. Notched to fit in fingers. Is a dense stone w/some magnetite inclusions. Pecked/worn on bottom. Could have been used for pigments and hence the reddish brown color? Where scraped looks like a normal yellowish gray dacite	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-14-KH	GON	D.3.1	1	1	misc ground fragment	3	5Y 8/1 (yellowish gray)	77	50	-	25.2	vesicular. Has a rounded horse shoe shape. Is a ground stone fragment, but can't tell the original form	
BE-14-KH	GON	E.2	1	2	blade	3	5Y 8/1 (yellowish gray)	111.4	35.9	-	15.6	vesicular, porphyritic material. Soft, jagged. Could be a natural fracture	
BE-14-KH	GON	F.2	1	1	Hammer stone fragment?	3	5 YR 6/1 (light brownish gray)	73.4	43.9	-	8.7	dacite. Lots of magnetite sherds. Split flat cobble? Edges are battered/worn. Perhaps split from work? Fire split?	AR: 457 e
BE-14-KH	GON	fill around KHP-12	1	2	scraper knife	4	N5 (medium gray)	36.9	32.8	-	5.3	andesite. Signs of use and retouch	
BE-14-KH	GON	fill around KHP-12	1	2	scraper knife	4	N5 (medium gray)	54.6	36.3	-	11.1	andesite. Signs of use and retouch	
BE-14-KH	GON	H.4	1	1	pebble polisher	1	5YR 6/1 (light brownish gray)	34.9	26.4	-	11.7	sandstone. Fits fingers. Work edge worn from use beside 'a', but also worn on edge by 'b'	
BE-14-KH	GON	H.4	1	1	pebble polisher	1	5 RP 6/2 (pale red purple)	17.6	14.9	-	12.2	perfectly rounded purple pumice. Super rough and light. Fits fingers. Working edge (top of 'b') is flattened	
BE-14-KH	GON	H.4	1	1	Hammer stone	2	5Y 8/1 (yellowish gray)	28.5	26.9	-	24.8	coarse grained, light dacite? Smoothed oval w/ battered end ('b'). Pecked to provide finger holds. Is split and fractured from use ('a')	AR: 457
BE-14-KH	GON	H.4	1	2	notched stone	3	5 PB 7/2 (pale blue)	29.6	28.2	-	19.1	broken, light weight coarse grained material. 2 V notches	AR: 459
BE-14-KH	GON	H.4	1		?	?	5YR 6/1 (light brownish gray)	78.1	56.1	32.3	14.9	slightly vesicular dacite. Magnetite inclusions. Rounded perfect triangle. Split cleanly so 'b' side looks shaved off	
BE-14-KH	GON	H.5	1	1	pumice polisher	1	5Y 8/1 (yellowish gray)	29.6	15.1	-	14.7	small, smoothed piece of pumice (cylindrical). Surfaces smoothed from use, one w/striations that almost look like was used to sharpen something	
BE-14-KH	GON	H.5	1	1	Mano, cylindrical	3	5Y 8/1 (yellowish gray)	60.4	63.8	-	56.8	coarse grained igneous rock. Working side flattened from use	AR: 426 d
BE-14-KH	GON	H.5	1	1	polisher?	3	5Y 8/1 (yellowish gray)	51.5	32.6	-	31.4	dense, smoothed dacite. Bottom polished from use. Appears to have a notch on 'a' side by point, which fits fingers	
BE-14-KH	GON	H.5	1	1	smoothed pebble	1	5Y 8/1 (yellowish gray)	47.3	41.3	-	34.3	vesicular. Seems to have been used to grinding or at least 2 surfaces were. 'b' surface concave like used for nutting. Could be a smooth handstone?	AR: 427 c d

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-14-KH	GON	H.5	1	1	smoothed pebble	1	5 YR 6/1 (light brownish gray)	75.8	42.1	-	33	vesicular. 'b' side flattened from grinding and some pecking. Wedge shaped	
BE-14-KH	GON	H.5	1	1	Hammer Stone or smoothed pebble	1	5 PB 7/2 (pale blue)	97.5	51.4	-	31.8	long, almost rectangular. Tips could be pecked from use (tip furthest from 3a label). Also tip by 3a could have some grinding wear?	
BE-14-KH	GON	H.6	1	1	finger pounder	1	5Y 8/1 (yellowish gray)	45.1	27.5	-	22.1	stone w/lots of red and gray inclusions, vesicular. Smoothed and polished to fingers. 'b' side concave and battered from pounding	
BE-14-KH	GON	H/J/K feature	1	1	edge ground cobble	1	5 YR 7/2 (grayish orange pink)	144.8	63.9	79.8	-	vesicular igneous rock. Worn on bottom. Top fitted to hand. Fire burnt	
BE-14-KH	GON	H/J/K feature	1	1	stone bowl?	3	5Y 8/1 (yellowish gray)	235	216.9	-	13.4	porphyritic. Thin chunk curved on bottom, slightly concave on top. Large phenocrysts	
BE-14-KH	GON	H/J/K feature	1	1	whetstone	1 or 2	5Y 8/1 (yellowish gray)	23.2	21	-	19.4	tabular. Fine grained sandstone. Concave impressions on 4 sides. Can be held in fingers on 'b' side	AR: 483 b
BE-14-KH	GON	H/J/K feature	1	1	finger pounder? Palette?							vesicular volcanic material, heavy. Seems to have been used in several ways. 'a' side slightly concave, as is 'c'. If hold in hand to grind w/ 'c' find good finger grips. Also find if grind w 'd', which is worn. Marks from pounding on 'e'. Or could be a palette (fits left hand and depression on 'a' could be from use and pecking on 'e'. is created for thumb hold and not from pounding?	
BE-14-KH	GON	H/J/K feature; stones from fire pit	1	1	whetstone	1	5Y 8/1 (yellowish gray)	33.8	35.4	-	29.3	concave, smooth working surfaces on at least 4 sides. Vesicular, medium grained igneous rock w/phenocrysts	AR: 483 b
BE-14-KH	GON	H/J/K feature; stones from fire pit	1	1	pounding/ mashing stone	1	10 YR 6/2 (pale yellowish brown)	61.6	34.3	-	43.8	fitted to fingers. Very coarse - sandstone? 'b' side worn from grinding and pitted by some pounding. Some black mica/quartz phenocrysts (not normal oblong magnetite)	
BE-14-KH	GON	H/J/K feature; stones from fire pit	1	1	hammerstone	1	10 YR 4/2 (dark yellowish brown)	83.3	55.4	-	30	strange triangular wedge (smoothed) shape w/profile like a stingray. Edge used for grinding/mashing and finger holed pecked out	AR: 457 c
BE-14-KH	GON	H/J/K feature; stones	1	1	finger pounder	1	N8 (very light gray)	35.8	32.1	-	17.9	smooth, vesicular. Seems more like dacite than usual sandstone. 2 concave work surfaces almost make seem like a whetstone, but there are pecked finger positions and very worn edge from mashing/pounding	AR: 483 b

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
		from fire pit											
BE-14-KH	GON	H/J/K feature; stones from fire pit	1	2	notched stone	1	5Y 8/1 (yellowish gray)	47.3	29.4	-	15.5	piece of sandstone, notched on either side, battered. Or rough dacite?	AR: 459 g
BE-14-KH	GON	H/J/K feature; stones from fire pit	1		?	?	10 YR 5/4 (moderate yellowish brown)	27.9	22.3	-	28.9	super vesicular - like a sponge. Pumice like but very hard - is this scoria? Is like a little tabular tip. Looks like brain coral	
BE-14-KH	GON	I.3	1	1	ground stone fragment	3	5 YR 8/4 (moderate orangish pink)	55.2	40.6	-	15.3	coarse, vesicular igneous fragment of stone bowl or metate?	
BE-14-KH	GON	J.5	1	1	finger pounder?	1	5Y 8/1 (yellowish gray)	82.9	39.8	23.4	25.1	curved oblong dacite w/oblong magnetite inclusions. End and sides battered. 2 edges worn from grinding. Could possibly have been hafted? Could not define as edge ground cobble, no?	
BE-14-KH	GON	J.5	1	1	mano (bar)	3	5Y 8/1 (yellowish gray)	59.1	56.9	-	33.8	very smoothed rectangular chunk. 'b' side concave from use. End is battered from pounding. Dense stone, dacite?	AR: 457 c, AR: 455 d
BE-14-KH	GON	J.5	1	1	finger pounder							very smoothed sub-round stone. Has natural vesicles. Fits fingers (thumb on 'a', 1st finger on front of 2 holes, 2nd finger on side 'b'. Ground and flattened from wear on bottom only	
BE-14-KH	GON	K.2	1	2	tang	3	5 YR 4/1 (brownish gray)	50.5	34.8	-	12.7	very dark, fine grained light material (andesite?). Possibly from a celt, though very thin so more likely was a blade	
BE-14-KH	GON	K.5	1	1	finger pounder	1	5Y 8/1 (yellowish gray)	48.6	37	-	14.5	dacite pebble w/oblong magnetite inclusions. Ground on bottom ('b') and worn in arc on tip/bit. Wear on both sides of arc (to 6mm mark on 'a') OR was finger pounder (thumb fits well on 'a') and was used to chip/pound w/bit tip. 'b' side fractured off, not worn down [this interpretation more likely]	
BE-14-KH	GON	L.4	1	1	whetstone	3	5Y 8/1 (yellowish gray)	32.2	36.7	-	33.8	tabular medium grained sandstone? (but is more vesicular and less sandy feeling than what have been calling sandstone, could be dacite?). Curved wear marks on at least 3 sides	AR: 483 c
BE-14-KH	GON	L.4	1	1	metate fragment?	3	5 YR 6/1 (light brownish gray)	37.9	41.6	-	16	Vesicular, volcanic, light weight coarse grained material. Fragment of metate foot?	
BE-14-KH	GON	L.4	1	2	flake scraper	1	5 YR 4/1 (brownish gray)	57.9	30.5	-	21.6	super light volcanic material. Could be an arc shaped wear pattern on 2 sides, or could be natural fracture. No retouch	
BE-14-	GON	L.4	1	2	flake scraper/ta	1	N7 (light gray)	45.5	25.3	-	11	is a light gray chalcedony. Wear on both sides of piece and both working edges	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH					b wedge?								
BE-14-KH	GON	L.4	1	2	chisel/celt tip	3	N4 (medium dark gray)	86.7	39.9	-	24.3	andesite. Smoothed w/rounded ridge on 'a'. Rough chipped and flatter on 'a'. Tip may be worn from use as a chisel, but also could be just broken. 'b' side almost seems like wasn't finished and has original cortex?	AR: 451 e (chisel) or AR: 421 f (celt)
BE-14-KH	GON	L.5	5	3	dacite flakes	4	5Y 8/1 (yellowish gray)	100	45	-	13	oblong magnetite inclusions. Very thin, fractured pieces	
BE-14-KH	GON	M.4	1	1	pebble polisher	1	5 RP 6/2 (pale red purple)	34.8	26.1	-	24.9	light pinkish pumice. Fits the fingers, bottom surface flat from grinding	
BE-14-KH	GON	O.1	2	2	flakes	4	5 YR 4/1 (brownish gray)	37.3	26.5	-	8.2		
BE-14-KH	GON	O.4	1	1	pounding/ mashing stone	1	10 YR 8/2 (very pale orange)	87.2	78	-	68.7	pitted like a nutting stone on 'b' side. Chips on 'a' fit first 3 fingers	AR: 456 c
BE-14-KH	GON	surface	1	1	hammer stone	2	5YR 6/1 (light brownish gray)	73	98.5	-	37.5	irregular shape of light colored rock smoothed out by use. Chopped surface heavily damaged. Fits thumb perfectly.	
BE-14-KH	GON	surface (close to river)	1	1	grooved cobble	1	5Y 6/1 (light olive gray)	111.7	83.7	-	78.5	vesicular igneous rock. Heavily marked with hafting cord grooves that bisect both the middle and ends of the oval piece. Mid and tip battered and has a hold as though used as a nutting stone	
BE-14-KH	GON	surface close to KHP-16	1	1	mano (oval)	1	N8	127.6	70.6	-	48.7	elongated oval made from dacite (lots of magnetite inclusions, light gray). Grinding surface flat.	AR: 425; AR: 426 c
BE-14-KH	GON	surface close to KHP-16	1	1	ovoid handstone	1	N8	100.9	95.8	-	61.4	ovoid dacite stone. Grinding surface shows some pecking and lines, potentially made by machete? Marks for fingers and thumb to grind/chop	
BE-14-KH	GON	surface close to KHP-16	1	1	metate (small legged)	3	5 YR 6/1 (light brownish gray)	171.9	107.9	-	-	leg 42.8mm tall. Coarse grained material, vesicular, igneous. Table slightly concave	AR: 425 f; AR 424
BE-14-KH	GON	surface close to KHP-16	1	1	metate	3	N7 (light gray)	210.6	148	-	32.3	coarse vesicular igneous material. Remnant of a very large (97mm long, 69mm wide) leg. Interesting wear pattern in arc by where have written 'a' - was re-used after broke for some smoothing/grinding/sharpening purpose?	
BE-14-KH	GON	surface, piles of rocks by KHP-16	1	1	mano	2	5Y 6/1 (light olive gray)	166.1	91.4	-	64.4	ropy lava piece, vesicular w/interesting striations. Polished and smoothed on bottom from grinding. Thumb fits in to depression below '1a' mark. Is situated in natural setting of rings/striations	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-14-KH	GON	surface, piles of rocks by KHP-16	1	1	Mano, cylindrical	3	5 GY 8/1 (light greenish gray)	82.9	54.9	-	60.6	grinding on 2 sides (b+c). Coarse grained, heavy igneous rock	
BE-14-KH	GON	surface, piles of rocks by KHP-16	1	1	stone bowl?	3	5Y 6/1 (light olive gray)	97.3	59.9	-	20.5	fragment w/smoothed corner and underside, concave top surface. Fragment of stone bowl?	
BE-15-KH	GLY	stream collection	1	1	metate foot	3	5 YR 8/4 (moderate orangish pink)	35.3	53.9	-	77.4		
BE-15-KH	GLY	stream collection	1	2	scraper plane	1	5 YR 4/1 (brownish gray)	94.6	46.9	18.4	25.3	b' side is flat. Is beautifully shaped. 'a' side has central ridge. Butt rounded. Bit is worn and chipped. Could just be a type B celt?	
BE-15-KH	GLY	stream collection	1	2	palette	1	5 YR 8/4 (moderate orangish pink)	66.3	57.9	-	23.4	b' side has indentions for 3 fingers of right hand. 'a' side worn, concave	AR: 423 g; edge of 'a' slightly battered
BE-15-KH	GLY	stream collection	1	2	blade	2	5R 3/4 (dusky red)	67.3	32.6	14.2	10.3	beautiful red jasper. Tanged. Worked both sides. Fully asymmetrical as 'b' side is flat like a scraper	
BE-15-KH	GLY	stream collection	25	2	flakes/blades	3 or 4	N3 (dark gray)	-	-	-	-	dense igneous stone	
BE-16-KH	KOT	1.5	1	2	celt	1	5Y 4/1 (olive gray)	87.4	45.7	24.6	31	heavily and crudely retouched on bit, butt, and one side. Not ridged. Dense andesite	
BE-16-KH	KOT	1.6	1	2	perforator	1	5B 5/1 (medium bluish gray)	62.6	30.3	5.2	10.6	porphyritic granite like material	
BE-16-KH	KOT	5.5	1	2	chisel bit?	1 or 2	10 YR 7/4 (grayish orange)	26.2	16.9	10.9	7.2	coarse, sand papery material. Concave wear on 'b' side. Could have been hafted on smaller end and larger end was used for scraping? (hence NOT a chisel)	
BE-16-KH	KOT	5.6	1	2	palette? Slab metate?	3	N7 (light gray)	92.4	41.7	14.9	20.6	flat piece of dense, slightly porphyritic rock. Rounded rectangular corners, concave work surface ('a')	
BE-16-KH	KOT	5.6	1	3	dacite slab	3	5Y 7/2 (yellowish gray)	33.7	46.7	-	10.5	thin blade fragment w/central ridge on 'a' side	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-16-KH	KOT	6.1	1	2	?	1	10Y 8/2 (pale greenish yellow)	114.8	43.9	13.7	24.4	rough greenish stone. Flat and ground on 'b' side. Smoothed ridge on 'a'. Comes to a point. Possibly shows signs of hafting at base (close to where wrote 1a)	
BE-16-KH	KOT	7.9	1	1	palette	1 or 2	5B 7/1 (light bluish gray)	62.1	57.3	-	20.4	concave and pitted on 'a' side. Tabular shape. Somewhat porphyritic but medium fine grained material	AR: 423 f
BE-16-KH	KOT	8.2	1	2	chisel or perforator ?	2	5Y 8/1 (yellowish gray)	59.6	24.7	10.9	11.8	long, pointed piece w/parallel sides	
BE-16-KH	KOT	8.2	1	2	?	3	5Y 6/1 (light olive gray)	85.4	60.1	-	22.1	super dense, fine grained. Could be a core. Pieces knocked off side. Bottom rough but doesn't seem to be from use	
BE-16-KH	KOT	8.2	1	3	pumice sculpture?	3	10 YR 7/4 (grayish orange)	31.6	27		13.3	smoothed, worked. Round hole appears drilled	
BE-16-KH	KOT	8.5	1		?	3	5Y 6/1 (light olive gray)	113.1	60.6	44.3	23.9	porphyritic, medium grained, dense. Smoothed and concave one side ('a'). Pitted and rough on 'b'	
BE-16-KH	KOT	8.9	7	2	flakes	4	5B 5/1 (medium bluish gray)	43	24	-	-	assorted blade like pieces, chunks of medium grained porphyritic material	
BE-16-KH	KOT	A(ext).2	1	2	chisel point	2	5G 6/1 (greenish gray)	34.9	9.4	-	6.6	soft greenstone/siltstone. Narrow parallel edges lead to point	
BE-16-KH	KOT	A(ext).2	1	2	rasp	3	10 YR 6/2 (pale yellowish brown)	77.7	53	-	13.4	triangle shaped. Seems to have a thumb impression on 'b' side. 1st 2 fingers on 'a'. Used as cutter/smoother?	
BE-16-KH	KOT	A(ext).2	1	2	?	3	N3 (dark gray)	16.6	10.2	-	7.7	mixed w/10 R 7/4 (moderate orange pink). hard, fine grained stone. Seems to have high iron content. Perfect little tab shape. Dusted almost with rust.	
BE-16-KH	KOT	A(ext).2	1	3	dacite slab	3	10 YR 6/2 (pale yellowish brown)	166.9	115.2	-	13.9	no obvious use or function	
BE-16-KH	KOT	A(ext).4	4	3	dacite slab	4	5Y 6/1 (light olive gray)					not sure if intentionally or naturally fractured. 2 potential flakes	
BE-16-KH	KOT	A(ext).6	1	3	?	?	5Y 6/1 (light olive gray)	103.5	54.7	-	11.7	dacite slab. Could be a puncture tool (has a distinct point) or could just be a very strange natural fracture	
BE-16-KH	KOT	A(ext).7	1	2	?	?	N6 (medium light gray)	144.8	114.5	43.1		*massive* "tang". Perhaps the tip end was the working end? Is worn underneath and edge. No clue what this is. Material is super heavy, moderately fine grained. Would fear is poured cement, but way too heavy.	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
												Could it be a broken off leg for a truly massive metate? stone is way denser than usually use	
BE-16-KH	KOT	A.1	1	1	pounding/ mashing stone	1	5Y 6/1 (light olive gray)	117.6	56.8	34.2	31.2	oblong cobble, fitted to hand. Ground and concave grinder surface. End pitted from use as hammer/pounder	
BE-16-KH	KOT	A.1	1	1	?	3	5 GY 6/1 (greenish gray)	71.8	51.9	31.2	14.8	highly porphyritic w/large gray phenocrysts in yellowish matrix. Ground stone fragment of some sort. Split	
BE-16-KH	KOT	A.1	1	2	celt	3	5B 7/1 (light bluish gray)	57.3	42.9	-	23.2	slightly vesicular porphyritic stone w/dark gray phenocrysts. Type A celt bit. Smoothed, symmetrical	type A
BE-16-KH	KOT	A.1	1	2	whetstone ?	?	5B 7/1 (light bluish gray)	44.3	36.2	-	25.8	tab shape. Lightly concave both ends. Lots of yellowish phenocrysts and inclusions in material. Heavy and dense	
BE-16-KH	KOT	A.4	1	1	stone bowl	3	5B 7/1 (light bluish gray)	48.1	35.3	18.9	5.7	curved shallow rim piece. Very rough. Porphyritic stone. Light	
BE-16-KH	KOT	A.4	1	2	blade	1	5Y 7/2 (yellowish gray)	117.8	21.3	-	7.4	dacite. Could be a natural fracture but is perfectly curved blade. Some possible use wear on edge	
BE-16-KH	KOT	A.4	1	2	chipped fragment	3	5B 7/1 (light bluish gray)	46.9	23.1	-	11.7	unidentifiable fragment. Snapped. Light weight. Obviously purposefully shaped in to round arc	
BE-16-KH	KOT	A.4	1		strange s-shaped stone	?	5B 7/1 (light bluish gray)	39.9	30.1	18.2	13.1	flat. Greenstone? Shaped like an s or z. no clear signs of use or wear	
BE-16-KH	KOT	A.4	1		?	?	5B 7/1 (light bluish gray)	77.3	29.4	-	17.3	hard bluish rough material. 'a' side curved as though used for a slab	
BE-16-KH	KOT	A/I ext balk. 28 cm	1	2	point	1	5B 7/1 (light bluish gray)	58	23.4	6.3	7.2	chalcedony point w/tang and serrated edge. Imported ready made? See AR 447	AR: 447 m,t
BE-16-KH	KOT	A/I ext balk. 70 cm	1	1	whetstone ?	?	5Y 8/1 (yellowish gray)	38.1	19.3	-	20.6	steeply concave interior surface. Hard, strong stone	
BE-16-KH	KOT	B.1	1	1	notched stone	1	10 YR 8/2 (very pale orange)	46.4	33	-	22.4	smoothed pebble. Distinct notch, doesn't seem to be from front mashing/grinding	AR: 459 h
BE-16-KH	KOT	B.1	1	2	blade point/perfo rator	1 or 2	N3 (dark gray)	50.3	29.5	-	15.1	sharp point on andesite	
BE-16-KH	KOT	B.2	1	1	hammerst one	1	5B 7/1 (light bluish gray)	59.5	50.7	-	44	very roughly hewn, as though was a core. Dense material. Fits fingers. 'b' working edge rough and pitted from pounding	
BE-	KOT	B.2	1	1	nutting	1	5B 7/1 (light	46.7	42.6	-	21.5	super small, thin version of a nutting stone. Pitted from use on 'b'. Soft green	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
16-KH					stone		bluish gray)					siltstone? Hole 2-3mm deep	
BE-16-KH	KOT	B.2	1	1	ground fragment	3	10 YR 8/2 (very pale orange)	70.6	28	-	33.8	mano/metate/stone bowl fragment. Dacite. Rounded edge	
BE-16-KH	KOT	B.2	1	2	blade point	1	5 YR 4/1 (brownish gray)	58.3	23.7	-	10.4	andesite? Has white inclusions and not as dense as often see. "tanged" only on right side, which curves slightly	AR: 447 p,t
BE-16-KH	KOT	B.2	2	2	scraper flake	1	5 YR 4/1 (brownish gray)	33.4	26.8	-	5.7	andesite	
BE-16-KH	KOT	B.2	1	2	tabular wedge	1	5B 5/1 (medium bluish gray)	36.1	28.4	-	6.9	light material. Bluish green. Siltstone? Worn in an arc on edge	
BE-16-KH	KOT	B.2	1	2	wedge? "spatula"?	2	5B 7/1 (light bluish gray)	62	47.7	-	8.2	very flat. Bit wide as entire body, small broken tang at back for hafting? Sort of like a spatula. Working edge wear is 9.3mm on 'a' side. 27mm on 'b'	
BE-16-KH	KOT	B.2	3	2	chisel pieces	3	5B 7/1 (light bluish gray)	51	25.2	-	12.8	moderately soft (siltstone?) flat pieces. 2 have points	
BE-16-KH	KOT	B.3	12	2	flakes/blades	4		36	25	-	6.7	andesite flakes and blades. Some show retouch/use	
BE-16-KH	KOT	B.5	1	2	curved blade	1	N7 (light gray)	107.6	22.9	9.2	14.8	porphyritic gray blade. Medium coarse grained. Notch at base potentially for hafting. Retouch on cutting edge. Is like a wedge of melon, thick one side and narrow other. Wear to 6 mm mark exterior. Tip shows wear, perhaps for perforating? Chipping?	
BE-16-KH	KOT	B.5	1	2	blade point	1	5B 7/1 (light bluish gray)	65.1	18.4	9.3	10.8	possibly a natural fracture, though tip shows some signs of wear	
BE-16-KH	KOT	B.5	1	2	chisel bit?	1 or 2	5 GY 6/1 (greenish gray)	50.5	13	-	10.3	greenstone? Wear on tip to 6mm mark. Soft feeling stone	
BE-16-KH	KOT	B.5	1	3	pumice sculpture?	1	10 YR 8/6 (pale yellowish orange)	39.4	37	-	24.9	piece of super light consolidated material. 2 perfect holes drilled in to. Marking suggests maybe was hafted around 'b' side. Sharpening tool?	
BE-16-KH	KOT	C.1	1	2	blade	3	N4 (medium dark gray)	33.5	14.9	-	4.9	retouched. Very sharp. Andesite	
BE-16-KH	KOT	C.1	1	2	celt	3	N6 (medium light gray)	53.3	48.5	-	23.5	not the usual andesite. Is medium grained porphyritic igneous rock. Could be butt end, depending on original shape	
BE-16-	KOT	C.1	1	3	dacite slab	3	5Y 6/1 (light olive gray)	189.8	93.3	-	31.1	is broken w/an almost perfect arc on one side	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH													
BE-16-KH	KOT	C.2	1	2	blade	3	5 YR 4/1 (brownish gray)	27.9	25.2	-	3.8	thin, fine andesite	
BE-16-KH	KOT	C.3	1	2	scraper plane	2	5Y 8/1 (yellowish gray)	98	35.8	27.1	27.1	long triangular tab. Severe ridge. Flattened work surface. Line along one edge. Dense. No chance this is cement? Nah, too heavy	AR: 417 d
BE-16-KH	KOT	C.3	1	2	chisel bit/tang	3	5B 7/1 (light bluish gray)	41.4	19.5	5.6	7.9	super light, fine grained material. Could also be a steeply tapered tang?	
BE-16-KH	KOT	C.3	2	2	flakes	4	5 YR 4/1 (brownish gray)	35.8	21	-	3.2	andesite	
BE-16-KH	KOT	C.4	1	1	pounding/ mashing stone	1	10 YR 8.2 (very pale orange)	108.6	77.9	-	46.9	heavy porphyritic cobble. Fitted to fingers. Smoothed working surface concave from use. Front tip pitted from pounding	
BE-16-KH	KOT	C.4	1	2	celt	1	5 YR 4/1 (brownish gray)	76.1	37.1	19.2	21.6	working edge heavily worn. Marks on tip could be from hafting or could have been re-used as chisel?	
BE-16-KH	KOT	C.4	1	2	blades	2	5B 7/1 (light bluish gray)	79.9	25.4	-	9.7	greenstone/soft blue stone	
BE-16-KH	KOT	C.4	1	2	perforator	3	5B 7/1 (light bluish gray)	30.1	18.7	-	5.4	coarse, hard porphyritic material. Slightly curved point. Could also be a tang of a blade?	
BE-16-KH	KOT	C.4	4	2	scraper flake	4	5 YR 4/1 (brownish gray)	37.2	26.1	-	5.9	at least one shows signs of wear (arc shaped pattern on two sides). Same material as celt from same context	
BE-16-KH	KOT	C.6	1	1	hammer stone	1	5Y 8/4	39.5	31.8	-	28.7	small porphyritic cobble. Fitted to fingers. Heavily battered from use on 'b' side	
BE-16-KH	KOT	C.6	1	1	stone bowl	3	5B 7/1 (light bluish gray)	71.3	66.9	-	23.6	somewhat similar to the mysterious pyramid tops w/concave bottoms found in other KOT contexts, but appears to have been small triangular bowl	
BE-16-KH	KOT	C.6	1	2	chisel tip	2	5 GY 6/1 (greenish gray)	42.2	17	12.4	11.2	same lightweight gravelly material as chinking stones. Fits fingers on "tang". Use to push/smooth? Greenstone?	
BE-16-KH	KOT	C.6	22	3	chinking stones	4	5B 7/1 (light bluish gray)					gravelly	
BE-16-KH	KOT	close to pot in wall of construction	1	2	scraper?	3 or 4	N3 (dark gray)	84.7	52.7	-	7.7	snapped. Very smooth andesite. Edge worn from use	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-16-KH	KOT	close to pot in wall of construction	1	2	perforator	3 or 4	5 YR 4/1 (brownish gray)	53.2	23.3	9	2.9	flake w/tip worn from use. Andesite	
BE-16-KH	KOT	close to pot in wall of construction	1	2	?	3	N5 (medium gray)	41.3	30.4	-	15.1	lump of heavy volcanic material. May have been a tang? May have been used as is, somewhat fits finger for scraping	
BE-16-KH	KOT	construction	1	1	scraper plane/ metate fragment	3	5B 7/1 (light bluish gray)	102.4	65.6	-	41.2	perhaps is fragment of a large scraper plane? Concave work surface. Working edge of bit worn, or perhaps is fragment from steeply angled metate (or part of leg and bowl of metate)	
BE-16-KH	KOT	construction	1	2	celt	3	5B 7/1 (light bluish gray)	48.9	56.8	43.7	35.6	super smoothed type A. dense, fine grained porphyritic material. Symmetrical both sides	
BE-16-KH	KOT	construction	1	2	scraper plane	3	5B 7/1 (light bluish gray)	82.6	33.6	-	27.2	possible tang w/hafting marks, though bottom totally flat and concave from wear. Were there hafted scraper planes?	
BE-16-KH	KOT	construction	1	2	? Perforator ? Blade knife?	1	5B 7/1 (light bluish gray)	35.9	20.3	-	4.5	distinct point on one side, wear on other from scraping. Soft porphyritic rock	
BE-16-KH	KOT	construction	1	2	blade knife	3	N5 (medium gray)	44.5	29.5	-	3.5	andesite, but w/white inclusions. Is either a tang or is worn/bitten away in arc pattern on both sides	
BE-16-KH	KOT	construction	1		?	?	10R 6/2 (pale red)	55.3	49.2	38.9	18.8	super flat bar. One end seems worn in arc, though might be natural fracture?	
BE-16-KH	KOT	construction	1		tab	3	N4 (medium dark gray)	39.3	15.8	-	12.9	hard andesite, tab like for chisel? Or could be a natural fracture	
BE-16-KH	KOT	construction	1	2	celt	3	N3 (dark gray)	79.8	63.9	-	31.8	smooth, super heavy volcanic material. Looks like snapped at haft, then re-used either for flakes or as a hammer?	
BE-16-KH	KOT	construction trench 8 m W of KOT-G	1	2	? perforator	2	5B 7/1 (light bluish gray)	59.5	27.6	7.5	15.6	soft light greenstone/siltstone. Comes to a point at end of curving blade	
BE-16-KH	KOT	construction trench	1	2	scraper plane	2	5B 7/1 (light bluish gray)	145.3	46.6	-	37.1	blade-like, 3 sided. Heavy	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
		8 m W of KOT-G											
BE-16-KH	KOT		1	2	blade	4	5 YR 6/1 (light brownish gray)	72.4	28.9	-	2.9	very fine shaved piece of dacite. No clear evidence of work. construction trench 8 m W of KOT-G	
BE-16-KH	KOT		1	1	edge ground cobble	1	5Y 8/1 (yellowish gray)	92.8	88.3	35	58	coarse vesicular igneous material. Almost perfectly symmetrical. Wear on 2 sides. C from grinding - is concave. D from pounding - is pitted, including a nutting stone type depression. construction wall on other side of KOT-A, assoc w/dacite slab. 50 cm	AR: 31
BE-16-KH	KOT	D(ext).1	1	1	?	?	10 YR 6/2 (pale yellowish brown)	55.2	27.2	-	22.2	can't tell what this was - used as was or is broken bit of something else? Rounded tab, like cross section of a cylindrical mano. Concave bottom	
BE-16-KH	KOT	D(ext).1	1	1	?	?	5B 7/1 (light bluish gray)	56.1	29.6	16.3	13.4	softer stone than #1, but similar to it	
BE-16-KH	KOT	D(ext).1	1	2	scraper	4	5B 5/1 (medium bluish gray)	38.6	33.4	-	7.4	dark andesite, square. Worn on working edge	
BE-16-KH	KOT	D.1	1	1	pebble grinder	1	5Y 6/1 (light olive gray)	25.2	20.9	-	19.7	coarse grained vesicular material. Shaped to fingers. Concave grinding surface ('b'). Slightly pocked "front" where used to pound. In photo pocked area is just above 1b and white inclusion	
BE-16-KH	KOT	D.1	1	1	pebble grinder	1	10R 6/2 (pale red)	32	16.9	11.9	12.9	coarse pink stone. Fitted to fingers. Bottom smoothed and pocked from grinding and pounding. Wear on bit like teeny tiny scraper plane	
BE-16-KH	KOT	D.1	1	2	blade	3	N3 (dark gray)	23.8	28	-	4.5	snapped fragment. Edges worked/worn	
BE-16-KH	KOT	D.1	1	2	flake	4	N3 (dark gray)	36.8	27.9	-	2.9	shows possible use on end by bulb as a scraper. Medium coarse grained rough stone (not celt material)	
BE-16-KH	KOT	D.1	2	3	dacite slab	4	5Y 8/1 (yellowish gray)	107	73.7	-	19.9	no signs of work or obvious use, though obviously brought here from elsewhere	
BE-16-KH	KOT	D.1	1		?	?	5Y 6/1 (light olive gray)	38.7	21.9	-	19.2 (height)	strange "corner". Forms an L of 5mm thick walls. Medium coarse grained gray rock. Granite? Not really but similar?	
BE-16-KH	KOT	D.3.1	1	1	Hammer stone	1	10 YR 6/2 (pale yellowish brown)	37.9	35.8	-	23.3	fits fingers. Pecked on 'b' side from use	
BE-16-	KOT	D.3.1	1	1	notched stone?	?	10 YR 7/4 (grayish	63.6	63.5	-	43.5	sandy, soft feeling fine grained cobble. Jagged fracture could be intentional?	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH					Hammer stone?		orange)						
BE-16-KH	KOT	D.3.1	4	2	flakes	4	5 YR 4/1 (brownish gray)					andesite flakes	
BE-16-KH	KOT	D.3.1	9	3	chinking stones	4						light gray gravelly material. Includes one blade of same material	
BE-16-KH	KOT	D.6	1	1	notched stone	1	5Y 8/1 (yellowish gray)	44.1	31.5	-	19.8	soft, smoothed greenstone/siltstone. Notch out of one side	AR: 459 h
BE-16-KH	KOT	D.6	1	1	nutting stone	1	5Y 4/1 (olive gray)	71.2	64.1	-	40.5	super heavy stone. Seems to have lots of iron. 20mm wide hole on tip, 3mm deep	AR: 485 d
BE-16-KH	KOT	D.6	1	2	scraper plane	3	5B 7/1 (light bluish gray)	88.9	68	-	20.5	seems like broken off, only lightly used bit/butt of scraper. May go w/#4 from context (same material), though bottom of 4 much more worn	
BE-16-KH	KOT	D.6	1	2	tabular wedge	4	5B 5/1 (medium bluish gray)	35.3	34.6	-	8.5	alternately could be a blade fragment. Andesite	
BE-16-KH	KOT	D.6	1	2	flake knife	4	N4 (medium dark gray)	35.6	22	-	9.3	use has worn a chink out of side. Andesite	
BE-16-KH	KOT	D.6	14	3	chinking stones	4	5B 7/1 (light bluish gray)	53.2	25.9	-	8.8	little bits of gravel wedged in tomb construction	
BE-16-KH	KOT	D.6	1	3	pumice sculpture?	?	10 YR 8/6 (pale yellowish orange)	28.3	23.4	-	8	that strange fluorescent orange stuff again. Odd little shape	
BE-16-KH	KOT	D.6	1		?	?	5B 5/1 (medium bluish gray)	79.5	50.1	-	43	weird triangle/pyramid corner and concave bottom. Have seen in several other contexts as well	
BE-16-KH	KOT	D.6	1		?	?	5B 7/1 (light bluish gray)	77.2	64	-	35.2	dense porphyritic, soft feeling material. Flat on bottom. Top has 4 flat planes. Fragment of scraper plane?	
BE-16-KH	KOT	D.6	1		L shaped tab	?	10 YR 7/4 (grayish orange)	75.9	26.4	-	15.9	strange flat piece w/curved corner to it	
BE-16-KH	KOT	E.4	1	2	chisel bit/perforator	2	N5 (medium gray)	52.3	16.3	-	9.6	long tapered. Not usual andesite of celts, chunky gray stone	
BE-16-KH	KOT	E.4	1	2	planer	3	5 YR 4/1 (brownish gray)	50.7	51.6	-	7.8	andesite, thin. Work edge worn 5 mm. Bottom curved	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-16-KH	KOT	E.5	1	2	scraper plane	3	5Y 6/1 (light olive gray)	112.7	55.7	-	27.5	ugly rough porphyritic rock. Bottom worn from use, top has eroded central ridge	
BE-16-KH	KOT	E.5	14	3	chinking stones	4	5B 5/1 (medium bluish gray)	53	21	-	10	gravel pieces	
BE-16-KH	KOT	E.6	12	3	chinking stones	4	5B 7/1 (light bluish gray)	47	24	-	12	gravel like	
BE-16-KH	KOT	E.7	1	1	pounding/ mashing stone	1	10 YR 8/2 (very pale orange)	79.6	45.6-	-	35.4	cobble ground on one side and battered from hammering/pecking on other	
BE-16-KH	KOT	E.7	1	1	? Pounding tool?	1	5 YR 5/6 (light brown)	65.2	30.6	-	11	small, lightweight. Sand papery feeling stone. Nearly a perfect flat triangle	
BE-16-KH	KOT	E.7	1	2	blade	1	5B 7/1 (light bluish gray)	86.7	27.7	-	16.9	rough porphyritic stone. Blade comes to point. Appears worked on sides	
BE-16-KH	KOT	E.7	1	2	scraper plane	3	5B 7/1 (light bluish gray)	68.6	41.8	-	18.8	heavy tab, nearly a perfect rectangular shape. Ground on bottom	
BE-16-KH	KOT	F(ext).3	1	2	blade knife	3	N4 (medium dark gray)	47.4	36.1	-	5.5	andesite. Retouched and worn from use all sides	
BE-16-KH	KOT	F(ext).3	4	3	chinking stones	1	5Y 6/1 (light olive gray)	26.6	20.2	-	9.7	coarse grained. Granite? Find shoved in spaces b/t columnar joints/dacite slab in tomb construction	
BE-16-KH	KOT	F(ext).7	1	2	perforator	1	10 YR 6/2 (pale yellowish brown)	60	13.7	5.6	1.7 tip, 5.9 butt	dacite. Very finely made. Curved slightly	
BE-16-KH	KOT	F(ext).7	1		notched stone	1	10 YR 7/4 (grayish orange)	74.8	45.4	-	25.9	coarse grained rock, jagged edges w/notched bottom. AR 459 mentions possible use as weights for fishing. Roughly battered bottom ('b'). 2 big notches on 'a'	
BE-16-KH	KOT	F.1	1	2	scraper plane	3	N7	94.9	44.6	-	21.1	porphyritic. Steep central ridge. Work edge very slightly concave from use	AR: 417 d
BE-16-KH	KOT	F.1	1	3	dacite slab	3	5Y 6/1 (light olive gray)	64.5	44.6	-	12.9	no clear signs of work	
BE-16-KH	KOT	F.1	1		notched stone	1	10 YR 7/4 (grayish orange)	46.3	34.7	-	26.7	heavily notches pebble	
BE-16-	KOT	F.1	1		notched stone	1	10 YR 7/4 (grayish	54.1	36.3	-	22.9	porphyritic. Banded at notch where cord was	AR: 459

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH							orange)						
BE-16-KH	KOT	F.1	1		blade	3	5Y 4/1 (olive gray)	38.7	19.6	7.9	4.1	andesite. Could be a puncture tool/chisel on blade or tang of a blade?	
BE-16-KH	KOT	F.3	1	1	polisher	1	10 YR 6/2 (pale yellowish brown)	39.1	29.4	-	14.8	tab shaped pebble. Working edge ground to 13.5mm plane. Pecked slightly on one side	
BE-16-KH	KOT	F.3	2	2	flakes	4	5 YR 4/1 (brownish gray)	-	-	-	2.8	thin, andesite	
BE-16-KH	KOT	F.3	1		notched stone	1	10 YR 8/2	46.6	27.2	-	28.9	2 notches in smoothed pebble. Largest notch is 23mm	AR: 459 h,i
BE-16-KH	KOT	F.4	1	1	pebble polisher	1	10 YR 6/6 (dark yellowish brown)	23.1	15	-	13.9	two working surfaces ground down. Entire pebble smoothed	
BE-16-KH	KOT	F.4	2	2	flakes	4	N4 (medium dark gray)	30	18	-	2.7	two different materials. Both same color. One coarser grained and w/white inclusions	
BE-16-KH	KOT	F.4	1	2	chisel? Perforator ?	?	N6 (medium light gray)	43.2	29	8.5	6.6	very light stone, vesicular. Could be very thin tang, but doesn't seem strong enough	
BE-16-KH	KOT	G.1	1	1	pebble polisher	1	5Y 4/1 (olive gray)	18.8	17.9	-	15.1	fits fingers. 'b' side worn from pecking. Smooth gray material	
BE-16-KH	KOT	G.1	1	1	hammerst one	1	10 YR 7/4 (grayish orange)	53.5	22.2	-	15.6	very oblong, fits in fingers. Porphyritic w/white and gray phenocrysts	
BE-16-KH	KOT	G.1	1	2	blade tang	3	5 YR 4/1 (brownish gray)	24.7	17.6	11.3	2.1	very fine, thin andesite chip, appears to be snapped tang	
BE-16-KH	KOT	G.1	1	2	-	3	10 YR 8/2	68.3	37	-	15.4	broken bit to celt? Is a split piece with smooth rounded edge	
BE-16-KH	KOT	G.1	1	2	tab wedge	4	N3 (dark gray)	27.9	28.8	-	13.5	highly worn both sides. Fine grained andesite	
BE-16-KH	KOT	G.1	1	2	flake	4	N5 (medium gray)	23.7	27.6	-	3.9	light andesite with lots of small white inclusions/phenocrysts	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-16-KH	KOT	G.1	1	3	pumice sculpture?	3	10 YR 8/6 (pale yellowish orange)	32	23.8	-	24.4	super bright, almost fluorescent orange pumice. Is like a little thimble head. Like dark red one from other KOT context that looked like brain coral. Looks like has eroded marks for a face?	
BE-16-KH	KOT	G.2	1	1	whetstone ?	?	5B 5/1 (medium bluish gray)	62.9	46	27.3	36.1	very strange. Volcanic rock. Sits upright. Steep curve	
BE-16-KH	KOT	G.2	2	2	flake knives	3	5 YR 4/1 (brownish gray)	34.1	23	-	2.2		
BE-16-KH	KOT	G.2	1	2	perforator	?	5Y 4/1 (olive gray)	36.9	31.6	-	9.2	strange flat piece of vesicular stone w/pointed piece sticking up	
BE-16-KH	KOT	G.2	1	3	Dacite slab	3	10 YR 6/2 (pale yellowish brown)	110.2	80.9	47.4	19.3	flat dacite slab. no obvious signs of work/use.	
BE-16-KH	KOT	G.2	1		notched stone	?	N4 (medium dark gray)	32.1	19.1	-	9.6	dense, dark material. V cut in to top	
BE-16-KH	KOT	G.3	1	1	pebble polisher	1	10 YR 8/2	46.5	19.2	-	17.5	oblong pebble. Bits knocked off to allow finger grips	
BE-16-KH	KOT	G.3	1	2	blade	3	5 YR 4/1 (brownish gray)	39.9	22.9	-	4.2	fine, thin andesite blade. Retouched finely both sides	
BE-16-KH	KOT	H.1	1	2	celt	3	10R 4/2 (grayish red)	53.3	23.4	-	15.5	is highly smoothed sliver of a beautiful type A celt. Very unusual maroon stone. Super fine grained and light andesite. Can imagine it being very special to the owner	
BE-16-KH	KOT	H.1	1	2	flake knife	4	N6 (medium light gray)	47.9	42.7	-	5.1	light, medium grained stone. White inclusions	
BE-16-KH	KOT	H.2	1	1	pebble polisher	1	5B 7/1 (light bluish gray)	38.1	28.8	-	16.6	labeled the finger positions and work surface for the photo. Work surface ground flat.	
BE-16-KH	KOT	H.3	5	2	flakes	4	N4 (medium dark gray)	28	22.4	-	3	andesite	
BE-16-KH	KOT	H.4	1	2	scraper flake	4	5 YR 4/1 (brownish gray)	37.2	23.4	-	4.8	andesite	
BE-16-KH	KOT	H.5	1	2	scraper	4	5 YR 4/1 (brownish gray)	37.5	32.9	-	4.2	andesite. Appears snapped off	
BE-	KOT	H.6	1	1	pounding/	1	5B 7/1 (light	65.5	58.9	-	53.6	very rough cobble, dense. Gravelly green stone material. Working edge	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
16-KH					mashing stone		bluish gray)					flattened and slightly concave.	
BE-16-KH	KOT	I(ext).5	1		?	?	5G 6/1 (greenish gray)	44.2	42.1	-	26.7	pyramid of greenish stone, smoothed perfect edges. 'b' side concave. Fragment of metate or milling stone?	
BE-16-KH	KOT	I.1	1	1	Hammer stone (small)	1	5Y 8/1 (yellowish gray)	35.4	29.9	-	27.3	fitted to fingers. Coarse grained material w/lots of quartz inclusions. Working edge pitted from use ('b')	AR: 457 b
BE-16-KH	KOT	I.1	3	2	flake scrapers	4	N$	26.3	22.9	-	5		AR: 418 g-j
BE-16-KH	KOT	I.1	1		?	3	5Y 8/1 (yellowish gray)	80.2	57.8	21.6	18.7	coarse, slightly vesicular igneous material (dacite?). Smoothed from use. Split	
BE-16-KH	KOT	I.2	1	1	pounding/ mashing stone	1	5Y 6/1 (light olive gray)	92	46.9	-	44.7	long (like a short scraper plane). Worn on bottom from grinding and some pounding. Front tip worn from pounding	
BE-16-KH	KOT	I.2	1	2	scraper plane	3	5B 7/1 (light bluish gray)	79.6	46.3	-	17.3	looks like could have been hafted. Flat and eroded from use. Very large white phenocrysts.	
BE-16-KH	KOT	I.3	6	2	blades	3	5 YR 4/1 (brownish gray)					includes one tang. Andesite. Some show use	
BE-16-KH	KOT	J.1	2	1	flakes	4	N4 (medium dark gray)	53	33	-	10.1	andesite. One may be blade fragment	
BE-16-KH	KOT	J.5	1		anvil?	?	5B 5/1 (medium bluish gray)	129.9	131.9	91.3	39.7	super heavy, dense volcanic material. Flat platform w/strange notching around sides. Mixed with 10 YR 8/6 (pale yellowish orange)	
BE-16-KH	KOT	J.6	1	3	chinking stones	1 or 2	5 GY 6/1 (greenish gray)	52.4	23.5	12.7	10.6	from under dacite slab. Soft greenstone/siltstone. Has a notch in side. Looks like could have been shape of a chisel tab	
BE-16-KH	KOT	pot	1	1	pounding/ mashing stone	1	10 YR 7/4 (grayish orange)	54.4	41	-	42.9	heavy vesicular cobble. Fitted to fingers. Concave from grinding use. Some pecking from pounding	
BE-16-KH	KOT	pot	1	2	blade	3	N6 (medium light gray)	62.6	28.3	-	6.9	curved. Flat. Could be natural fracture? Could be worn or snapped on end. Porphyritic medium grained material	
BE-16-KH	KOT	pot	1	2	scraper flake	4	5Y 6/1 (light olive gray)	48.4	32.6	-	4.9	dacite. Shaped like an "ice scraper". Worn on edge to 9 mm mark	
BE-16-KH	KOT	surface	1	1	pounding/ mashing stone	1	5Y 6/1 (light olive gray)	75	56.6	-	58.3	vesicular, porphyritic heavy cobble. Lots of black magnetite. Smoothed for fingers. Wear from grinding on 2 sides ('b')	
BE-	KOT	surface	1	2	celt	3	5 GY 8/1	107.2	56.1	-	37.3	dense stone, not usual andesite. Slightly porphyritic. Is the butt end, shows	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
16-KH							(light greenish gray)					evidence of hafting 58mm from tip and 32 mm from tip	
BE-16-KH	KOT	surface	1	2	celt	3	5 YR 4/1 (brownish gray)	75.9	51.5	-	32.3	tapered butt. Very dense, fine grained material (not usual andesite). Central ridge both sides gives diamond shape. 21 mm band from hafting visible on 'b' side, especially beginning 42mm from tip	
BE-16-KH	KOT	surface	1	2	celt	3	5B 7/1 (light bluish gray)	64.7	54.3	-	32.4	tapered butt. Central ridge on 'a' side. Notch suggests hafting in 11mm band	
BE-16-KH	KOT	surface	1		?			56.5	22.3	14.3	13.2	porphyritic. Greenstone? Profile has clear V wedge cut in to it (most visible in 'a' side). 'b' side has working edge of 7mm ground by use	
BE-16-KH	KOT	Tomb B	1	1	pounding/ mashing stone	1	5Y 8/1 (yellowish gray)	83.5	80.9	-	56.2	roughly oval, battered. Heavy greenstone. Hole from where used like a nutting stone ('c')	
BE-16-KH	KOT	Tomb B	1	1	hammerst one/finger polisher	1	5 GY 8/1 (light greenish gray)	42.7	40.9	-	35.8	small greenstone ball. Fits in fingers (have marked on stone). 'b' side ground and battered from use	
BE-16-KH	KOT	Tomb B	1	2	flake	4	5 YR 4/1 (brownish gray)	43.9	28.3	-	3.8	curved, light andesite. Possible use wear on one edge	
BE-16-KH	KOT	Tomb B	1		?	3	N5 (medium gray)	44.4	25.6	-	23	small andesite chunk	
BE-16-KH	KOT	UNACH I A.1	1	2	scraper flake	4	N4 (medium dark gray)	38	25.4	-	8.5	use edge extends 8 mm	
BE-16-KH	KOT	UNACH I B.1	1		?	3	N2 (grayish black)	53.9	46.7	-	34.6	ugly, heavy consolidated mass. Could be gravel and tar?	
BE-16-KH	KOT	UNACH I B.2	1	2	flake knife	3	5B 7/1 (light bluish gray)	71.4	41.7	-	3.8	serrated edge put on flake. Smooth andesite	
BE-16-KH	KOT	UNACH I C.2	1	2	flake knife	1	N4 (medium dark gray)	41.2	37.8	17.4	5.1	made from flake. Shows wear pattern in a round arc to left of tip on side 'a'. Very fine grained, coarse stone	
BE-16-KH	KOT	UNACH I C.2	1	3	Dacite slab	3	5Y 6/1 (light olive gray)	90.8	55.5	38.4	20.9	flat dacite slab fragment. No sign of work	
BE-17-KH	PLM	2A	1	1	misc ground fragment	3	5Y 8/1 (yellowish gray)	68.8	53.1	-	35.1	dense sandstone/siltstone. Some magnetite inclusions. Side 'a' has rounded corner. Side 'b' has depression as though used for grinding/pounding. Is fragment from milling stone? Palette?	
BE-17-	MAR	surface	1	2	hammer	1	5Y 8/1 (yellowish	70.5	66.1	-	30.4	end battered. Dense but light stone. Smoothed to contour of the hand. collected by Marie (returned to her)	AR: 345 I

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH							gray)						
BE-17-KH	MAR	surface	1	2	hammer	1	5Y 7/6 (moderate yellow)	66.6	57.4	-	40.1	very smoothed, like river cobble. Peck marks from battering on end. collected by Marie (returned to her)	AR: 457 f
BE-17-KH	MAR	surface	1	2	adze	1	10 YR 6/6 (dark yellowish brown)	105.9	48.9	22.3	25.9	very smooth/dull. Plano-convex. collected by Marie (returned to her)	AR 480 d
BE-17-KH	MAR	surface	1	2	hafted axe	1	5Y 6/1 (light olive gray)	119.2	72.3	47	28.9	bit edge worn and battered. See polish to 14 mm mark on 'b' side. collected by Marie (returned to her). t better formed than the example in the AR photo	AR: 339 g
BE-17-KH	MAR	surface	1	2	anvil	1	5 YR 6/1 (light brownish gray)	97.4	48.4	-	87.4	notched "shelf". Battered from being used as a hammer or tool production. Alternately could be a "notched" stone as described AR 459. collected by Marie (returned to her)	AR: 458 f; AR: 456 D
BE-18-KH	MAR	5.2	1	1	whetstone	3	N6 (medium light gray)	67	34.3	-	14.3	tabular fragment. Concave working surface. Medium grained sandstone. Curved (so used on chisels, adzes, small celts?	AR: 483 c
BE-18-KH	MAR	C.1	1	1	pebble polisher	-	-	-	-	-	-	smoothed, dense stone. Fitted to fingers ('a'). Worn edge ('b')	AR: 483 a
BE-18-KH	MAR	surface	1	1	pounding/ mashing stone	1	N7	95.1	64.4	-	81.5	smooth, fitted to fingers and right hand. Worn at bottom from grinding/chopping. collected by Marie (returned to her)	AR: 456 C, AR 458 g-i
BE-18-KH	MAR	surface	1	1	pounding/ mashing stone	1	5Y 7/2 (yellowish gray)	200.1	93.4	50	80.6	very phallic. Mashing surface on bottom, which is fairly round and flat. Some pitting/battering so used for pounding, not just grinding, even though very heavy to lift. collected by Marie (returned to her)	AR: 456 c; AR: 457 g-i
BE-18-KH	MAR	surface	1	1	metate (slab)	3	5 YR 5/2 (pale brown)	170.6	109.1	-	32.5	dense, pitted volcanic stone w/some magnetite, very smooth. Very flat, ground smooth both sides. No indention in center. collected by Marie (returned to her)	AR: 423 d
BE-18-KH	MAR	surface (close to A)	1	1	nutting stone	1	5Y 6/1 (light olive gray)	84.2	74.6	-	58.8	vesicular, heavy cobble. Fitted and smoothed to hand. Nutting hole in center but also seems like was turned on end to grind. Siltstone? Hold roughly 20mm wide and 10mm deep	AR 457-8 A; AR: 458 a,b
BE-19-KH	JRC	1.1	1	1	hammer	1	N3 (dark gray)	42.2	40.8	-	24.3	basalt? Super hard, dense, dark stone. Very heavy battering on both ends, but more on 'b' side. Used for celt manufacture?	AR: 482 (D)
BE-19-KH	JRC	1.1	1	1	nutting stone	1	10 YR 6/2 (pale yellowish brown)	41.7	38.5		35.2	siltstone? (from AR 458-9). Dense, pitted stone. Fitted and smoothed to fingers. Battering on bottom. Very small	AR: 458 a-c
BE-19-	JRC	1.1	1	1	mano (ovoid)	1	5Y 7/2 (yellowish	98.5	61.4	42.2	37.4	rough, almost like pumice. Siltstone? Magnetite inclusions. Bottom edge flattened	AR: 455 f

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH							gray)						
BE-19-KH	JRC	1.1	1	1	blade	2	5B 5/1 (medium bluish gray)	46.7	19.1	12.8	4.2	central ridge on 'a' side	AR: 444C
BE-19-KH	JRC	1.1	1	1	blade	2	5B 5/1 (medium bluish gray)	53.9	18.4	8.5	5.1	blade has a point, though not necessarily intentional?	AR: 446 d,e
BE-19-KH	JRC	1.1	1	1	celt	2	N6 (medium light gray)	78.5	67.9	50.3	27.9	coarse igneous material. Wear at waist seems to indicate hafting? Type B celt	
BE-19-KH	JRC	1.1	1	1	celt	2	5B 5/1 (medium bluish gray)	180.8	64.7	27.1	40.4	dramatically large. Snapped at a steep diagonal. Type B celt	AR: 421
BE-19-KH	JRC	1.1	1	1	celt	3	5B 5/1 (medium bluish gray)	63	42.6	21.3	28.5	type B. butt of celt, nicely chipped and polished. Rounded. Side 'a' has a central ridge	
BE-19-KH	JRC	1.1	1	1	celt	3	5B 5/1 (medium bluish gray)	43.5	25.2	14.2	13.8	identical to #15 of this context, but much smaller	
BE-19-KH	JRC	1.1	1	1	celt	3	5B 5/1 (medium bluish gray)	49.5	36.2	22.4	23.9	broken off tip of celt. Dense, igneous rock. Type B celt	
BE-19-KH	JRC	1.1	1	1		3	10 YR 5/4 (moderate yellowish brown)	45.5	39.5	-	15.1	same stone as #4 of this context. Broken edge of a ground stone something. Interesting profile - sort of like an anvil?	AR: 458 d-f for similar profiles
BE-19-KH	JRC	1.1	1	2	rasp	1	5Y 7/2 (yellowish gray)	77.5	72.4	-	10.9	very finely sharpened corner. Fin (3 mm) edge shows wear. Is like an ice scraper for a car windshield. Light sandstone?	AR: 460 f,g
BE-19-KH	JRC	1.1	1	2	blade	1	5B 5/1 (medium bluish gray)	84	29.7	-	7.4	sides worked, looks as if was hafted. Bottom smooth and flat. Untanged, unifacial. Andesite	AR: 474 b
BE-19-KH	JRC	1.1	1	2	chisel or blade	1	5B 5/1 (medium bluish gray)	66.2	36.3	12.9	9.1	is a blade with tang and working edge on tip. Retouch along sides. Andesite	AR: 481 D3
BE-19-KH	JRC	1.1	1	2	adze or celt	1	5B 5/1 (medium bluish gray)	65.1	36.5	17.6	10.9	small. elegant edge to butt. Tang well rounded and worked	
BE-19-KH	JRC	1.1	1	2	chisel	1	5B 5/1 (medium bluish gray)	118.6	42.4	24	31.7	dense, heavy igneous material. Large chisel as described by AR 480 D	AR: 480 g,h
BE-19-KH	JRC	1.1	1	2	celt	1	5B 5/1 (medium bluish gray)	73.2	35.7	15.8	16.3	small. Cute. Well made. Type B celt	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-19-KH	JRC	1.1	2	2	flakes	4	5B 5/1 (medium bluish gray)	47	30	-	5.3	flakes of same andesite material as celts, edge shows possible signs of retouch?	
BE-19-KH	JRC	1.1	1	2	rasp	-	10 YR 5/4 (moderate yellowish brown)	85.7	44	22.4	33.5	super porous, like pumice but heavy	AR: 460 e-h
BE-19-KH	JRC	2.1	1	2	chisel	1	5B 5/1 (medium bluish gray)	75.7	28.8	16.9	24.3	bottom has hafting location, roughly created by knocking off pieces. Has 4 faces due to 2 ridges. Rounded but pointed bit. Could be a multi-purpose tool rather than a traditional chisel?	AR: 480 g has haft marks
BE-19-KH	JRC	2.1	1	2	celt	1	5B 5/1 (medium bluish gray)	128.7	53.6	19.4	28.8	bit comes to a delicate sharp edge. Symmetrical profile. b/t edge of side 'b' the wear marks extend 30 mm. Type B celt	AR: 450 i
BE-19-KH	JRC	2.1	1	2	celt	1	5B 5/1 (medium bluish gray)	69.8	35.1	11.9	19.8	beautiful tear drop shape. Finely made, small, perfectly formed. Face not smoothed	
BE-19-KH	JRC	2.1	1	2	chisel	2	5Y 4/1 (olive gray)	85.9	30.3	20.4	26.4	a' side is rounded chisel, 'b' side is rough hewn, unsmoothed	AR: 480 c (for a side appear ance)
BE-19-KH	JRC	2.1	1	2	adze	2	5 YR 4/1 (brownish gray)	67	40.6	21.3	30.9	am calling this one an adze rather than a celt b/c side 'b' is flattened and worn while 'a' is convex and very rounded	AR: 451 c
BE-19-KH	JRC	2.1	1	2	celt	3	5 YR 4/1 (brownish gray)	83.4	39.6	26.2	25.9	ugly, rough, twisty celt butt	
BE-19-KH	JRC	2.1	1	2	blade	3	5 YR 4/1 (brownish gray)	44.6	22.4	16.7	3.4	stem/tang to blade. Very fine and thin. Both sides retouched	
BE-19-KH	JRC	2.1	1	2	celt	3	5B 5/1 (medium bluish gray)	60.3	55.8	30.8	34.7	dense igneous rock (andesite?). 2 facets to each face due to central ridges. Gentle curve to butt	
BE-19-KH	JRC	2.1	1	2	celt	3	5B 7/1 (light bluish gray)	58.1	37.1	15.1	25.1	butt w/some wear/chipping on 'a' side. 'a' side is flatter and smoother than b	
BE-19-KH	JRC	2.3	1	2	celt	3	N4 (medium dark gray)	49.1	29.5	12.4	16.4	butt end of celt. Comes to sharp torpedo like point	AR: 450 i
BE-19-KH	JRC	3.1	1	1	handstone (ovoid)	1	5G 7/2 (pale green)	65.02	53.2	-	37.7	stone is more porous and craggy than that of the celts in this context, is a different material	AR:455 h,i

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-19-KH	JRC	3.1	1	1	mano	2	10 YR 5/4 (moderate yellowish brown)	76.2	50.6	45.2	43.8	perhaps is NOT broken, but end was used to grind? Bottom also flattened. Is coarse grained igneous rock like in AR 426 l,k	Mac: 27, 17; AR: 455 e
BE-19-KH	JRC	3.1	1	2	celt	1	5G 6/1 (greenish gray)	69.1	38.8	17.3	16.4	type B celt	AR: 421 b,h
BE-19-KH	JRC	3.1	1	2	scraper plane	1	5B 5/1 (medium bluish gray)	117.1	52.1	31.1	27.4		AR: 417 f
BE-19-KH	JRC	3.1	1	2	celt	1	5 PB 5/2 (grayish blue)	106	47.4	15.6	21.2	edge very fine but slightly worn/irregular. Type B celt	AR: 421 h
BE-19-KH	JRC	3.1	1	2	celt	2	5B 5/1 (medium bluish gray)	98.1	59.5	29.6	23.9	finely chiseled edge. Type B celt	AR: 421 h
BE-19-KH	JRC	3.1	1	2	celt	2	5 BP 3/2 (dusky blue)	72.5	60.4	33	22.1	very thin, finely chiseled edge. Type B celt	AR 421 h
BE-19-KH	JRC	3.1	1	2	celt	2	5 BP 3/2 (dusky blue)	57.7	33.4	16.9	18.3	type B celt	AR: 421 f-h
BE-19-KH	JRC	3.1	1	2	blade	2	5 PB 5/2 (grayish blue)	72.6	22	14.8	19.8	"bottom" end is super flat	AR: 446 b
BE-19-KH	JRC	3.1	1	2	scraper plane	2	5B 6/2 (pale blue)	112.4	57.2	28.3	29.6	almost could be a celt, but bottom ('b' side) is eroded from use	AR: 29, 417 f
BE-19-KH	JRC	3.1	3	2-Jan	blades	3	N4 (medium dark gray)	40	28	11.8	2.7		AR: 446 g,h
BE-19-KH	JRC	3.1	7	2	flakes	4	5 BP 3/2 (dusky blue)	51	23		7.1	strong bulb of percussion	
BE-19-KH	JRC	3.2	1	2	chisel or celt	1	5B 5/1 (medium bluish gray)	106.7	47.3	32.5	30.5	side 'a' flatter than side 'b'. 'b' is convex. 'a' bit shows heavy use with wear to the 20 mm mark	
BE-19-KH	JRC	3.2	1	2	celt	2	N4 (medium dark gray)	100.8	40.3	19.4	24.1	tall tapered triangle. Would be symmetrical but 'b' side broke off 48 mm from bit	
BE-19-KH	JRC	3.2	1	2	celt	3	5B 5/1 (medium bluish gray)	52.3	42.3	32.6	22.2	finely chiseled edge. Type B celt	
BE-19-	JRC	3.2	1	2	celt	3	N4 (medium dark gray)	77.1	58.9	28.4	35.2	rounded, finely worked butt of a large celt. Both sides ridged to create 4 faces. Is symmetrical. Type B celt	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH													
BE-19-KH	JRC	3.2	1	2	celt	3	5 YR 4/1 (brownish gray)	82.8	40.5	18.8	27.9	butt. Finely chiseled edges. Side 'a' has 2 facets. 'b' only one as is smoother, leading to asymmetrical profile	
BE-19-KH	JRC	3.2	1	2		3	N4 (medium dark gray)	54.6	26.5	12.8	17	tang. Shows waist for hafting. Part of a celt? Adze? Chisel?	
BE-19-KH	JRC	3.4	1	1	hammer	1	5B 6/2 (pale blue)	44.8	43.8	-	31.6	fits fingers perfectly, worn very smooth from use. Working edge very worn	AR: 457 b,f
BE-19-KH	JRC	3.4	1	1	palette	2	5B 7/1 (light bluish gray)	43.6	47.3	-	18.6	magnetite flakes. Roughly rectangular. Worn one side	AR: 423 e-g
BE-19-KH	JRC	3.4	1	1	nutting stone	2	5B 7/1 (light bluish gray)	40.9	36.3	34.9	17	light stone. Magnetite inclusions (but is not in long shards like usual, does this mean it's something else?). Perhaps used in stone tool manufacture. Not nutting per se.	AR: 458 c
BE-19-KH	JRC	3.4	1	1	?	?	5 YR 7/2 (grayish orange pink)	47.2	20.2	11.7	14.9	4 facets. Has circular depression in side 'a' which could be 'top'. Side 'c' also could be, has curved profile. Whetstone? Base for something?	
BE-19-KH	JRC	3.4	1	2	celt	1	N3 (dark gray)	115	47.4	17.6	23.6	type B celt	AR: 421 f-h
BE-19-KH	JRC	3.4	1	2	bifacial wedge	1	N3 (dark gray)	123.7	47.8	20.3	24.3	has been used on one side to hack at things like an axe, was hafted at the bottom. Is a celt re-used as a hammer?	AR 323 d,j
BE-19-KH	JRC	3.4	1	2	celt	1	N4 (medium dark gray)	128	64.9	26.9	31.4	type B celt	AR: 421 f-h
BE-19-KH	JRC	3.4	1	2	scraper plane	2	5G 7/2 (pale green)	92.2	56.4	42.1	28.6	could be a celt that is poorly formed or eroded on "bottom". Pieces roughly knocked off of end - re-used as a hammer?	AR: 417 f or 457 h
BE-19-KH	JRC	3.4	1	2	celt	2	5RP 4/2 (grayish red purple)	102.9	67.3	33	42.6	dense, heavy stone. Massive. Tip is battered heavily on one side	
BE-19-KH	JRC	3.4	1	2	scraper plane	3	5B 6/2 (pale blue)	71.8	52.2	36.1	18.7	magnetite flakes. Poor condition. Could be mid-part of an eroded celt?	
BE-19-KH	JRC	3.4	1	2	tang (celt)	3	5B 6/2 (pale blue)	41.1	36.3	21.8	26.6	tapered tang/butt of an adze or celt? Can stand up on own	
BE-19-KH	JRC	3.4	1	2	celt	3	5B 5/1 (medium bluish gray)	65.1	65.7	51.8	29.6	round bit portion. Rather worn/dull	
BE-	JRC	3.4	1	2	celt	3	5B 7/1 (light	52	45.4	50	25.4	bottom very flat and even, can stand up on own. Round bulb is not sharp.	AR:

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
19-KH							bluish gray)					Not completely secure with classification as a type B celt.	421 f-h
BE-19-KH	JRC	3.4	1	2	celt	3	5B 6/2 (pale blue)	45.1	41.5	-	22.5	type B celt	AR: 421 f-h
BE-19-KH	JRC	3.4	1	2	tang (celt)	3	N4 (medium dark gray)	31.6	23.7	14.1	15.1	type B celt? Or could also be a broken tip of an adze such as AR 451 h	
BE-19-KH	JRC	3.4	1	2	scraper	2 or 3	N3 (dark gray)	53.8	40.7	25.9	16.5	very flat, scraped on "bottom" ('b' side)	AR: 418 c
BE-19-KH	JRC	3.4	1	2	celt	3	5B 7/1 (light bluish gray)	33.5	33.6	-	17.5	same light stone as #1 from this context. Butt of a celt?	
BE-19-KH	JRC	3.4	1	2	blade	3	5 YR 6/1 (light brownish gray)	53.6	24.7	15.4	8.6	dacite blade, one side seems retouched. Same material as #4	
BE-19-KH	JRC	3.4	1	2	blade	3	N4 (medium dark gray)	27.8	41.1	26.3	8.7	fragment of strangely shaped end, not sure if it is bit or butt	
BE-19-KH	JRC	3.4	1	2	blade	3	N4 (medium dark gray)	20	20	-	3.7	tiny fragment of blade, very thin and delicate, super sharp	
BE-19-KH	JRC	3.4	1	2	flake	4	5B 5/1 (medium bluish gray)	29.6	34.4	-	4.2		
BE-19-KH	JRC	3.4	1	2	core?	-	5 YR 6/1 (light brownish gray)	81.7	61.1	31.9	21	dacite piece. Lots of magnetite inclusions and white quartz. 3 sides seem chipped?	
BE-20-KH	EST	A (from tarp hole)	1	2	flake knife		5B 5/1 (medium bluish gray)	59.1	43.9	-	8.2	bit edge highly worked and worn both sides. Thin, compact material. Very fine grained	AR: 418
BE-20-KH	EST	A.2	1	1	pebble polisher	1	N3 (dark gray)	28.6	16.1	-	10.2	very smoothed. Edge worn at steep angle from work	AR: 460 c,d
BE-20-KH	EST	A.2	1	1	burin? Chisel?	3	N4 (medium dark gray)	43.2	12.5	-	10.2	long narrow piece. Very dense, hard material. Looks like natural fracture, but used as a drill bit perhaps and broken? Other use?	
BE-20-KH	EST	A.2	1	2	blade	1	N5 (medium gray)	58.5	28.3	-	14.8	curved. Very worn on one edge of bottom (to 11mm from edge) along natural ridge	AR: 474 d
BE-20-	EST	A.2	1	2	whetstone or mano	?	10 YR 7/4 (grayish	47.1	42.3	-	27.7	very porous stone. Very worn cobble? Volcanic? Slight curve to top ('a') (from sharpening?). Battered on side. Alternately could be fragment of a	AR: 483 a

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH					fragment?		orange)					worn mano (flattened bottom sides ('b'). Rectangular from use	
BE-20-KH	EST	A.3	1	1	flake knife	1	N5 (medium gray)	59.1	44.4	-	13.7	perfect arc to wear on one edge. Other edges retouched and worn as well	AR: 418 m
BE-20-KH	EST	A.3	1	1	reused metate fragment?	3	N5 (medium gray)	50.6	34.9	-	30.6	fragment of perfectly rounded corner. 3 striations may be from hafting after broken	
BE-20-KH	EST	A.3	1	2	?	?	10R 4/2 (grayish red)	79.2	40.5	-	20.5	natural fracture? Very flat, hard igneous rock. Perhaps core for long, narrow potential drill bits since fractures in straight planes?	
BE-20-KH	EST	A.3	1	2	grater chip or perforator ?	?	N5 (medium gray)	43.9	26.9	-	11.6	sharp point - could just be tang fragment or natural fracture?	AR: 445
BE-20-KH	EST	B.1	1	1	edge ground cobble	1	10 YR 5/4 (moderate yellowish brown)	75.1	54.2	31.3	40.4	porous, heavy volcanic rock. Fitted to right hand. 'b' side battered. 'c' is for thumb. 'd' for fingers. Referenced tools in AR are not identical, but is an obvious grinder/chopper	AR: 340 a-f or AR: 423 - 423
BE-20-KH	EST	B.1	1	1	hammer stone	1	10 YR 5/4 (moderate yellowish brown)	38.7	30.6	-	26.1	small, heavy pebble. Use edge slightly concave. Fits fingers comfortably and is smooth from use. (or possibly could have been hafted?)	AR: 457 b
BE-20-KH	EST	B.1	1	2	scraper plane	1	N4 (medium dark gray)	142.5	75.9	28.2	32.9	dense andesite. Bit finely chiseled. 'b' side flat so is asymmetrical. Otherwise is a lot like a celt	AR: 417 e-g
BE-20-KH	EST	B.1	1	2	adze	1	N4 (medium dark gray)	84.7	57.7	41.5	19.1	dense andesite. Plano-convex and asymmetrical in cross-section. Smooth. Bottom flatter and less symmetrical than expect for a type A celt, otherwise is similar	AR: 451 g,h
BE-20-KH	EST	B.1	1	2	rasp	1	N4 (medium dark gray)	65.5	50.5	12.6	12.5	dense, heavy. Right angle corner to butt portion. Cutting edge very worn.	AR: 460 g
BE-20-KH	EST	B.1	1	2	perforator	2	N4 (medium dark gray)	32.3	14.5	2.8	3.1	seriously sharp, fin point. Worked both sides	
BE-20-KH	EST	B.1	2	2	flake	3	5 YR 6/1 (light brownish gray)	48	45	-	4.2	light, compact stone	
BE-20-KH	EST	B.1	1	2	flake	3	5 YR 6/1 (light brownish gray)	49.7	33.2	10.6	5.5	is perforated. Almost looks like a little ice scraper, but has a hole. Almost like a bottle opener	
BE-20-	EST	B.1	1	2	celt	3	N4 (medium dark gray)	40.9	42	17.3	30.7	butt of celt, well rounded. Sharpened to very fine tip. No mid-ridge	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH													
BE-20-KH	EST	B.1	4	2		4	N2 (grayish black)	57	32	-	20.6	various flat remnants. May be nothing	
BE-20-KH	EST	B.1	1	2	flake	4	N5 (medium gray)	62.7	49.7	-	17.1	still has bit of cortex. Shows multiple percussion points	
BE-20-KH	EST	B.1	32	2	scrapers/ flakes	4	N4 (medium dark gray)	45	30	-	5.1	includes 3 partial blades	AR: 331 f-t
BE-20-KH	EST	B.2	1	1	polishing pebble	1	10 YR 7/4	16.9	11.5	-	11.4	very smoothed. Used for burnishing celt surfaces?	
BE-20-KH	EST	B.2	1	1	whetstone	1	10 YR 5/4 (moderate yellowish brown)	45.3	36.1	-	16.4	sandstone. Small chunk. Flattened bottom. Convex from use on 'a'	AR: 483 b
BE-20-KH	EST	B.2	1	1	whetstone ?	3	N5 (medium gray)	62.8	49.6	-	32.9	very heavy, dense. 2 sides and rounded corner in b/t 'a'. Super smooth, rest of the rectangular piece has chopped, unsmoothed sides	
BE-20-KH	EST	B.2	4	1	?	?	5 YR 6/1 (light brownish gray)	61.5	51.8	-	15.5	very battered edges. Smooth, dark stone	
BE-20-KH	EST	B.2	1	1	whetstone ?	2 or 3	10 YR 6/2 (pale yellowish brown)	28.6	30.3	19.2	17.9	very light, porous. Pumice like but harder - is this sandstone? Medium grained if so. 'a' side well ground. Notch like wear on a. could be a whetstone fragment?	AR: 483 b
BE-20-KH	EST	B.2	1	2	chisel bit	1	5 YR 5/1	48.6	16.7	-	9.6	very light but hard stone. Highly smoothed edges. Perhaps point end not used, but flat end as a chisel?	AR: 32 C
BE-20-KH	EST	B.2	1	2	flake scraper	1	10 YR 5/4 (moderate yellowish brown)	57.8	38.5	-	5.4	very light. Not strong feeling material	AR: 418 i
BE-20-KH	EST	B.2	1	2	core	1	N5 (medium gray)	61	53.9	-	43.2	multi-directional, irregular. Very dense heavy material. Maybe used as a chopper/hammer on blunt end ('b') as well?	AR: 414 e,f
BE-20-KH	EST	B.2	1	2	adze	2	N5 (medium gray)	70	28.6	-	19.14	oblong, parallel sides. Bit completely eaten by use. Coarse underside, fine grained igneous rock. Plano-convex profile	AR: 480 d,e
BE-20-KH	EST	B.2	1	2	blade	2	10R 5/4 (pale reddish brown)	56.4	20.6	-	-	bit is slightly serrated, dulled. 1 ridge. Lightweight material	AR: 417 b

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
BE-20-KH	EST	B.2	2	2	scraper	2	5B 5/1 (medium bluish gray)	51.9 and 35.9	35.1 and 27.6	-	7.9 and 5.3	light material (not usual dense andesite)	
BE-20-KH	EST	B.2	1	2	flake scraper	2	N5 (medium gray)	70	55.6	-	19.8	double ridge. Almost like broken but to celt but 'b' side is convex. Bulb of percussion. Wear both sides	AR 416 H
BE-20-KH	EST	B.2	1	2	celt	3	10R 4/2 (grayish red)	60.3	49.9	-	19.9	craggy, very heavy material. Super rough due to hardness of stone. Heavily worn on bit	
BE-20-KH	EST	B.2	1	2	adze?	3	10R 4/2 (grayish red)	68.5	45.9	34.8	13.1	super heavy reddish material like in #22 from this context. Craggy. obvious tang. Bit heavily worn. Both sides relatively flat, though heavily pitted from use and effort of creation w/such hard material	
BE-20-KH	EST	B.2	1	2	celt (butt?)	3	N4 (medium dark gray)	34.3	34.1	-	22	snapped tip to a celt? Symmetrical. Edges worked and craggy. Very hard and dense material	
BE-20-KH	EST	B.2	1	2	flake	4	N5 (medium gray)	71	53.8	-	15.2	no sign of retouch or use. Concave bulb of percussion on 'b' side	
BE-20-KH	EST	B.2	6	2	misc strange bits	-	10 YR 7/4 and 10 R 6/2 and N5	35	18	-	5	small pieces. 4 gray igneous, 1 sandstone (gray), one reddish other type. Small, various shapes. Could possibly be worked	
BE-20-KH	EST	B.2	1	2	blade	-	-	65.3	34.6	20	14.9	possible tang, light weight but solid material (andesite)	
BE-20-KH	EST	B.2	1	2	?	?	10 R 5/4 (pale reddish brown)	46.1	54.7	-	22.3	triangle, broken butt of scraper plane? Flat bottom ('b')	
BE-20-KH	EST	B.2	12		misc odds and ends							various odd sandstone and pumice pieces	
BE-20-KH	EST	B.3	1	1	edge ground cobble	1	N6 (medium light gray)	63.6	43.6	-	26.8	long edge. Very visibly worn in straight line 7.5 mm wide. Porous stone. Would have to hold at 45 degree angle to create the wear pattern. Entire bottom well worn	AR: 30-31
BE-20-KH	EST	B.3	1	1	milling stone	3	N7	63.9	45.5	-	40.4	heavy dense stone. Flat smoothed side 'a'. Rounded corner. Side 'b' has remnant of leg/support?	AR: 423 i
BE-20-KH	EST	B.3	1	1	milling base	3	10R 5/4 (pale reddish brown)	34.9	40.6	-	13.5	ground, slightly concave top ('a') and flat bottom ('b'). Porous light, pinkish orange material w/same small white and large red inclusions you see in ceramic temper. Is this a tephra? Or type of rock? Very hard when scrape with fingernail	
BE-20-KH	EST	B.3	2	2	used flakes	1	N5 (medium gray)	44.8 and 41.4	33.5 and 33.8	-	6.7 and 6.8	flakes with retouching and use wear (first one has 6mm wide use wear, second is 6.7mm)	AR: 445 ss (for e.g. of

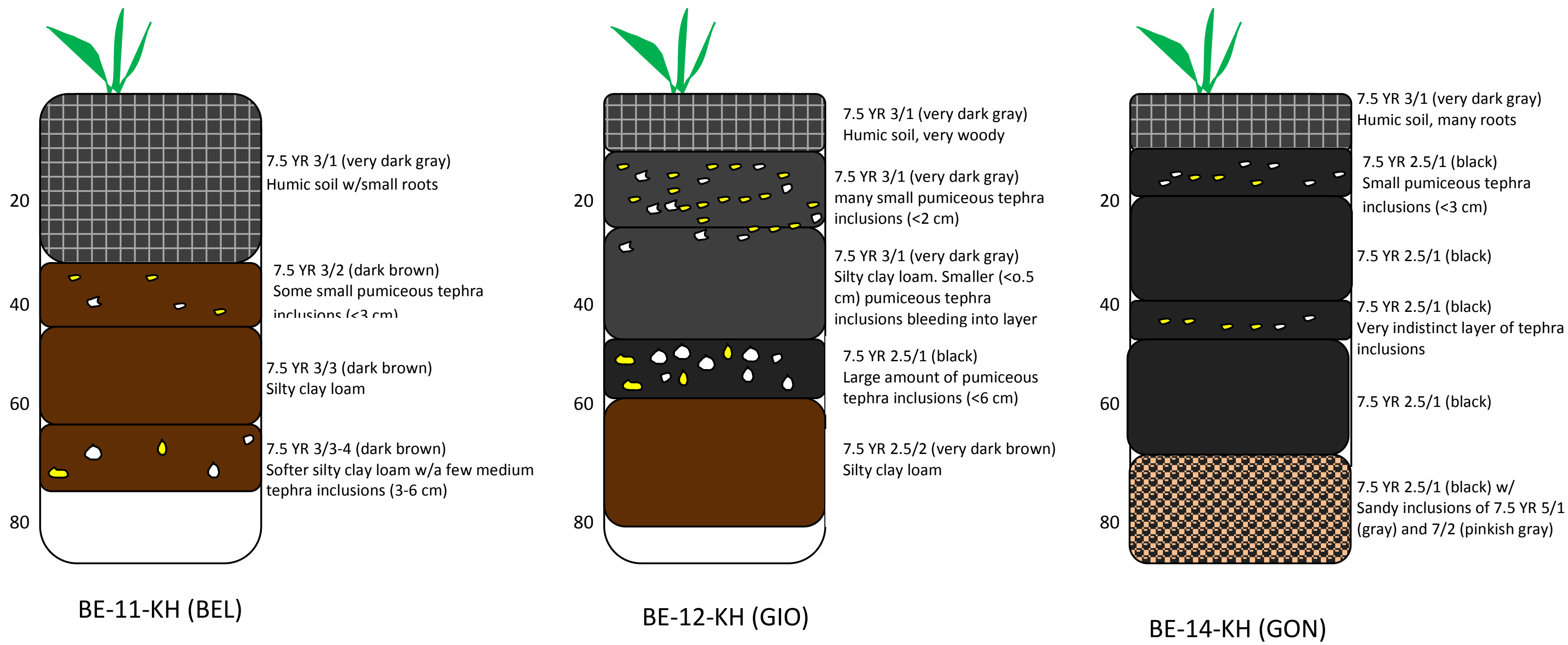
site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
													worn edge)
BE-20-KH	EST	B.3	1	2	blade	3	5 YR 4/1 (brownish gray)	26	28.4	-	7.8	snapped tang, or alternately could be completely worn down scraper/adze?	
BE-20-KH	EST	B.3	1	2	blade	3	N5 (medium gray)	23.5	33.5	-	6.3	rounded chipped edges of what may have been a tang/end of blade or a round scraper? Light, dense stone	
BE-20-KH	EST	B.3	2	2	flakes	4	N5 (medium gray)	-	-	-	-	unused	
BE-20-KH	EST	B.4	1	1	pebble polisher	1	10R 4/2 (grayish red)	31.1	15.3	-	10.8	worn smooth all over. One working edge rough as if was used for grating. Very heavy, dense stone	AR: 460 b
BE-20-KH	EST	B.4	1	2	adze? Scraper plane?	1	N4 (medium dark gray)	109.5	50.1	-	24.2	super heavy, dense igneous rock. Bit edge very worn on 'b' side. Not the usual andesite. Notch taken out of butt end. Natural chipping?	
BE-20-KH	EST	surface (bag 1 of 4)	1	2	rasp	1	5 YR 4/1 (brownish gray)	117.6	73.7	13.3	18.3	very heavy, dark stone. Fits left hand perfectly due to chips put in 'b' side. Bit edge is worked. Is like an ice scraper	AR 460 f
BE-20-KH	EST	surface (bag 1 of 4)	1	2	perforator	1	5 YR 4/1 (brownish gray)	89.2	36.9	6.5	9.9	worked on both sides of dull tip. Very flat, heavy	AR: 445 hh-ii
BE-20-KH	EST	surface (bag 1 of 4)	1	2	core (bipolar)	1	5 YR 6/1 (light brownish gray)	92.6	68.4	33.8	19.3	andesite	
BE-20-KH	EST	surface (bag 1 of 4)	1	2	flake scraper plane	1	5 YR 4/1 (brownish gray)	59.5	40.1	28.7	19.7	comfortably fits the right hand	
BE-20-KH	EST	surface (bag 1 of 4)	1	2	flake scraper plane	1	N3 (dark gray)	69.1	53.3	-	21.2	very heavy, dense stone	AR: 417 j
BE-20-KH	EST	surface (bag 1 of 4)	1	2	perforator	1	N3 (dark gray)	123.3	42.9	6.6	16.3	very flat, dense stone. Perforation edge worked both sides	AD445: hh-ii
BE-20-KH	EST	surface (bag 1 of 4)	1	2	blade	1	5 PB 3/2 (dusky blue)	184.4	45.1	18.6	25.5	long blade turned in to an "ice scraper". Bottom very flat. Could have been hafted or fits hand comfortably as well. Bit end obviously is worked (is the wider end). Also mixed w/10 YR 6/6 (dark yellowish orange)	
BE-20-KH	EST	surface (bag 1 of 4)	1	2	anvil	1	10 YR 6/6 (dark yellowish brown)	126.9	102.3	-	50.3	super dense clump of lava (?). Super porous. Large (32 mm) circles on top. Bottom is flat. Potential hafting. Heavily battered "bit". Mixed colors: 10 YR 5/4 (moderate yellowish brown) and 5 YR 4/4 (moderate brown). Could be an anvil used as a chopper, like AR 456/7. alternately, anvil? heavy hafted scraper?	AR 456/7
BE-	EST	surface	1	2	flake	2	N4 (medium	90.8	51.6	-	27.3	worked along two edges. Side 'b' is flattened. Broken at butt. Super heavy,	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
20-KH		(bag 1 of 4)			scraper plane		dark gray)					dense stone	
BE-20-KH	EST	surface (bag 1 of 4)	1	2	perforator	2	5P 2/2 (very dusky purple)	108.1	44.6	4.1	26.3	large heavy perforator point worked both sides. Was likely hafted	AR 445: hh-ii
BE-20-KH	EST	surface (bag 1 of 4)	1	2	perforator	2	N3 (dark gray)	144.7	22.3	13.5	32.4	fits right hand comfortably. Bit is damaged. Very heavy, dense material	AR: 445 hh-ii
BE-20-KH	EST	surface (bag 1 of 4)	1	2	perforator	2	N3 (dark gray)	65	36.5	14.2	20.2	may be broken perforator, or nothing at all. Mixed w/10 YR 6/6 (dark yellowish orange)	
BE-20-KH	EST	surface (bag 1 of 4)	1	2	perforator	2	10 YR 6/6 (dark yellowish brown)	81.3	24.3	11.1	22.1	may show signs of hafting. May be nothing at all. Side 'b' is flat	
BE-20-KH	EST	surface (bag 1 of 4)	1	2	?	3	5P 2/2 (very dusky purple)	71.3	40.1	13.6	20.7	scraper tang? Thick blade? Debitage?	
BE-20-KH	EST	surface (bag 1 of 4)	1	2	whetstone? Perforator? Planer?	1	5P 2/2 (very dusky purple)	130.8	67.7	13.6	20.4	strange profile, very flat. Super heavy, dense material. Perhaps used like one of those things that rocks back and forth for chopping things (mezza luna?), or could be a perforator?	
BE-20-KH	EST	surface (bag 1 of 4)	1	2	?	1	5R 4/6 (moderate red)	68	39.1	-	14.9	like #9, strange profile seems intentional. Super flat. Some sort of small anvil support?	
BE-20-KH	EST	surface (bag 1 of 4)	1		?	2	5 PB 3/2 (dusky blue)	134.9	68.5	20.2	26.5	super dense, porous stone. Lava? Super flat. No clue of use/function if any. Bottom very flat and sides comfortably fit hand. Mixed w/10 YR 6/6 (dark yellowish orange)	
BE-20-KH	EST	surface (bag 2 of 4)	1	2	scraper plane	1	5B 5/1 (medium bluish gray)	115.6	65.3	26.1	25.9	bit edge worn and battered on 'b' side to 23 mm mark from use. Likely was hafted	AR: 417 f
BE-20-KH	EST	surface (bag 2 of 4)	1	2	flake knife	1	N4 (medium dark gray)	70.3	51.9	17.5	13.5	dense stone, heavy. Made from celt flakes	AR: 418 k-m
BE-20-KH	EST	surface (bag 2 of 4)	1	2	flake knife	1	N4 (medium dark gray)	67.2	64.6	42.3	12.5	flattened bit edge. Almost like an adze/rasp	AR: 418 k-m
BE-20-KH	EST	surface (bag 2 of 4)	1	2	adze?	2	10 YR 5/4 (moderate yellowish brown)	148.5	66.7	55.25	-	super heavy stone. Very flat bottom. Relatively flat top as well. Sides seem worked (could be natural). Notch at end visible from side 'a'	
BE-20-KH	EST	surface (bag 2 of 4)	1	2	large wedge/scraper	2	10 YR 4/2 (dark yellowish brown)	98.1	73.5	30.5	14	large. 2 ridges give 3 facets on one side. Bit edge worn/broken. Some yellow cortex still on side 'd'	AR: 323 for large wedge

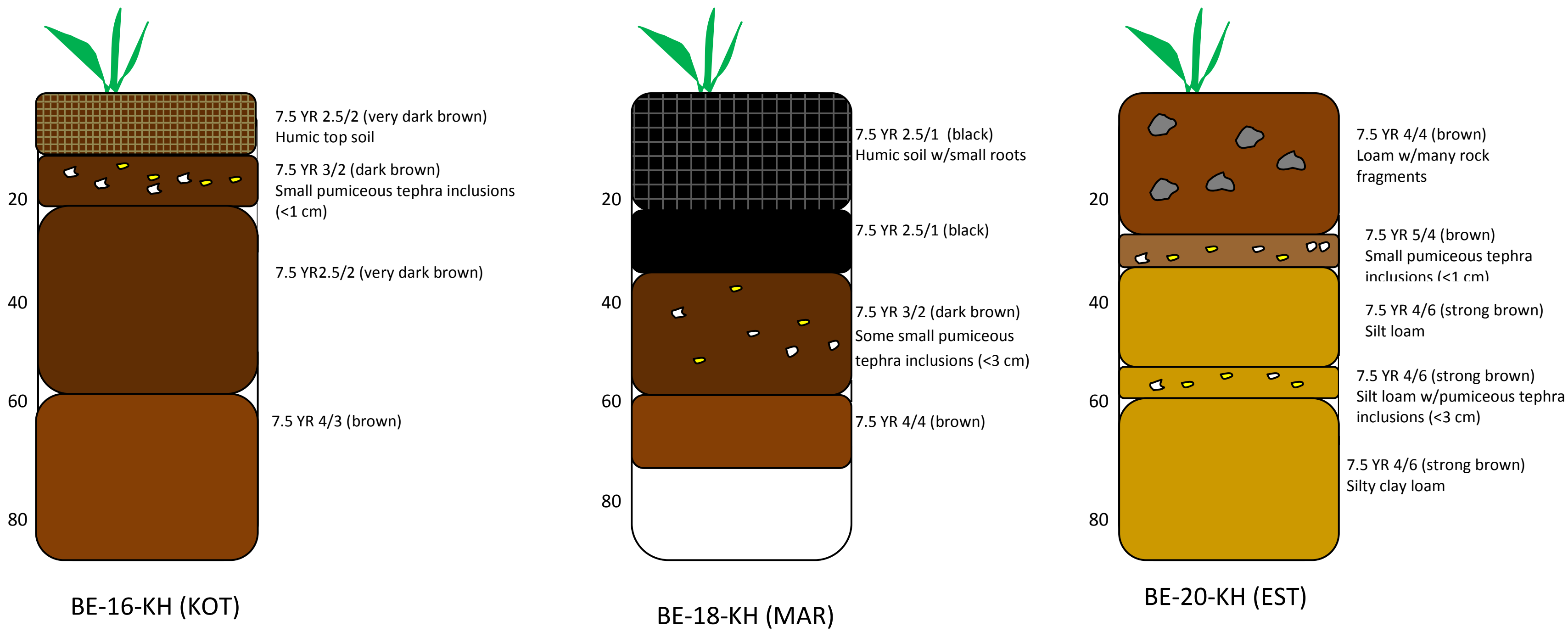
site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar ** exampl es
BE-20-KH	EST	surface (bag 2 of 4)	1	2	scraper plane?	2	5B 5/1 (medium bluish gray)	174.4	41.1	24.4	34.4	twisting dorsal ridge on 'a' side. 'b' side highly flattened. Super heavy. Bit edge chiseled to fine point	
BE-20-KH	EST	surface (bag 2 of 4)	1	2	adze	3	5B 5/1 (medium bluish gray)	64.4	67.7	-	25.2	retouched around entire edge on both sides. Side 'b' flatter, more worn, so is not symmetrical. Could be bit end of a type B celt	AR: 421 h or AR 451 g, h
BE-20-KH	EST	surface (bag 2 of 4)	1	2	notched stone	3	N4 (medium dark gray)	50.5	116.8	76.9	34.9	2 notches at end, one that goes through both sides and one that only is visible on 'a' side. Dense stone	
BE-20-KH	EST	surface (bag 2 of 4)	9	2	-	4	N4 (medium dark gray)	-	-	-	-	various unidentified debris or naturally fractured pieces	
BE-20-KH	EST	surface (bag 3 of 4)	1	2	hammer	1	5Y 8/1 (yellowish gray)	77.6	62.3	-	64.3	very battered cobble. Porous stone, heavily edge battered	
BE-20-KH	EST	surface (bag 3 of 4)	1	2	anvil? Drill?	1	5B 5/1 (medium bluish gray)	61.5	37.6	4.8	15	perfectly formed steep triangle/1/2 pyramid w/flat edge on 'b' side. Very sharp point, flat base	
BE-20-KH	EST	surface (bag 3 of 4)	1	2	"ice scraper"	1	N4 (medium dark gray)	88.3	89.9	37.6	29.8	right angle at butt, very flat sides, bit end has 2 V notches (2mm deep). Side 'b' unfinished, shows percussion of creation	
BE-20-KH	EST	surface (bag 3 of 4)	1	2	"ice scraper"	1	N5 (medium gray)	75	45.2	8.2	14.5	flat sides leading to tapered butt. No distinct V notches like larger one (#3), but is worn in places like was being used same way	
BE-20-KH	EST	surface (bag 3 of 4)	1	2	scraper plane	1	N3 (dark gray)	123.6	61.5	26.5	40.6	dense dark andesite. Obvious wear on larger end. Underside ('b') extends 24mm from edge. Appears was hafted ~25mm from narrow end	AR: 417 f
BE-20-KH	EST	surface (bag 3 of 4)	1	2	flake scraper plane	1	N4 (medium dark gray)	92.7	97.7	-	23.6	wavy ridge on side 'a'. Sides retouched. Round, flat bulb	AR 418 m
BE-20-KH	EST	surface (bag 3 of 4)	1	2	flake scraper plane	1	N4 (medium dark gray)	68.7	68.5	-	16.6	sides nearly serrated, not totally positive is retouch. Round flat bulb	AR: 418 k-m
BE-20-KH	EST	surface (bag 3 of 4)	24	2	misc flakes/blades	4	N4 (medium dark gray)	-	-	-	-	-	
BE-20-KH	EST	surface (bag 4 of 4)	1	2	core (bifacial)?	1	N3 (dark gray)	111.3	97.8	-	35.2	flakes taken off of both sides. Could possibly have been a massive tool itself except super heavy. Side 'b' has part of cortex still	
BE-20-	EST	surface (bag 4	1	2	blade	1	N4 (medium dark gray)	88.7	40.9	-	11.1	retouch both sides, but dull. Long flat bottom. Bit end dulled from use. Ridge to lower right of side 'a' potential hafting site?	

site #	SITE	CONTEXT	Quantity	1=GROUND 2=CHIPPED 3='OTHER'	type of artifact	Description *	Munsell rock color	length (mm); avg if more than one artifact	width (mm)	narrow end width if applicable (mm)	thickness (mm)	Notes	Reference for similar **
KH		of 4)											
BE-20-KH	EST	surface (bag 4 of 4)	1	2	flake knife or saw	1	5 YR 4/1 (brownish gray)	114.9	65.3	20.5	23.6	resharpened large flake. 'b' side large bulb of percussion. Interesting teardrop shape w/one flat side. Could be used in back and forth motion?	
BE-20-KH	EST	surface (bag 4 of 4)	1	2	blade knife	1	N3 (dark gray)	102.2	36.8	-	18.5	long. straight right angled back (like called a rasp in other contexts). Use on both sides of single cutting edge.	
BE-20-KH	EST	surface (bag 4 of 4)	1	2	flake scraper	1	N5 (medium gray)	75.8	102.8	39	11.4	like #12 of this context, wear in perfect arc. Looks like has a tang. Very flat bottom. All wear polish is to top ('a' side)	
BE-20-KH	EST	surface (bag 4 of 4)	1	2	flake scraper plane or unifacial core	2	N5 (medium gray)	83	72.7	52.6	13.6	butt broken off completely flat. Round flat bulb. Sides retouched. Big bulb of percussion	AR: 417 h; AR: 414 a,b
BE-20-KH	EST	surface (bag 4 of 4)	1	2	flake scraper plane?	2	N4 (medium dark gray)	50.8	63.2	33.2	20.2	butt broken off completely flat. Round flat bulb. Sides retouched. Big bulb of percussion	AR: 417 j
BE-20-KH	EST	surface (bag 4 of 4)	1	2	adze	2	5 PB 5/2 (grayish blue)	61.7	39.3	-	6.9	very thin, fine. Different material than others in context - lighter, slightly porous. Made on tip of adze. Very flat, fine bit to edge	AR: 480 d
BE-20-KH	EST	surface (bag 4 of 4)	1	2	flake knife	2	N4 (medium dark gray)	73.8	47.5	-	14.6	small, lots of retouch/wear. Oyster shaped. Bottom unworked. 1 main ridge and one minor on 'a' side. Use wear both sides. Is from celt flake?	AR: 416/419
BE-20-KH	EST	surface (bag 4 of 4)	1	2	blade	2	N4 (medium dark gray)	114.6	57.5	30.8	18.4	curving blade. Central ridge on 'a' side. Ridge worn where perhaps was hafted at bulb of percussion (concave on 'b' side). Wear on inner curve, both sides at bit tip	AR: 417 a
BE-20-KH	EST	surface (bag 4 of 4)	1	2	flake knife	2	N4 (medium dark gray)	100	73.7	-	14.4	use wear both sides. Interesting wear on 'b' side - accentuates a convex bulb of percussion or fully created by use? Wear from use on 'b' side also to left tip of bit. On 'a' side see heavy arcing use wear to 15 mm mark	AR: 416/419
BE-20-KH	EST	surface (bag 4 of 4)	1	2	blade	2	N4 (medium dark gray)	97.8	54.1	14.8	13.9	triangular, almost like a point. Flat unworked 'b' side, 1 main ridge. Not much re-work or use wear. Notched V in right side of 'a'	
BE-20-KH	EST	surface (bag 4 of 4)	1	2	blade tang	3	N4 (medium dark gray)	67.2	50.8	17.4	13.4	double ridged so has 3 facets to 'a' side. 'b' side is flat	AR: 447 q, 446 h
BE-20-KH	EST	surface (bag 4 of 4)	1	2	flake scraper	3	N5 (medium gray)	69.2	48.6	-	15.5	b' side heavily worn, slightly concave. Snapped edge. Used like a plane? Use wear extends 16mm from bit	AR: 416 G
BE-20-KH	EST	surface (bag 4 of 4)	1	2	blade knife			111.9	36	21.6	13.5	double ridge. Angle to unretouched base almost provides a handle. Bit end worn.	

Appendix J: Stratigraphic locations of tephra in the Boquete survey sites*



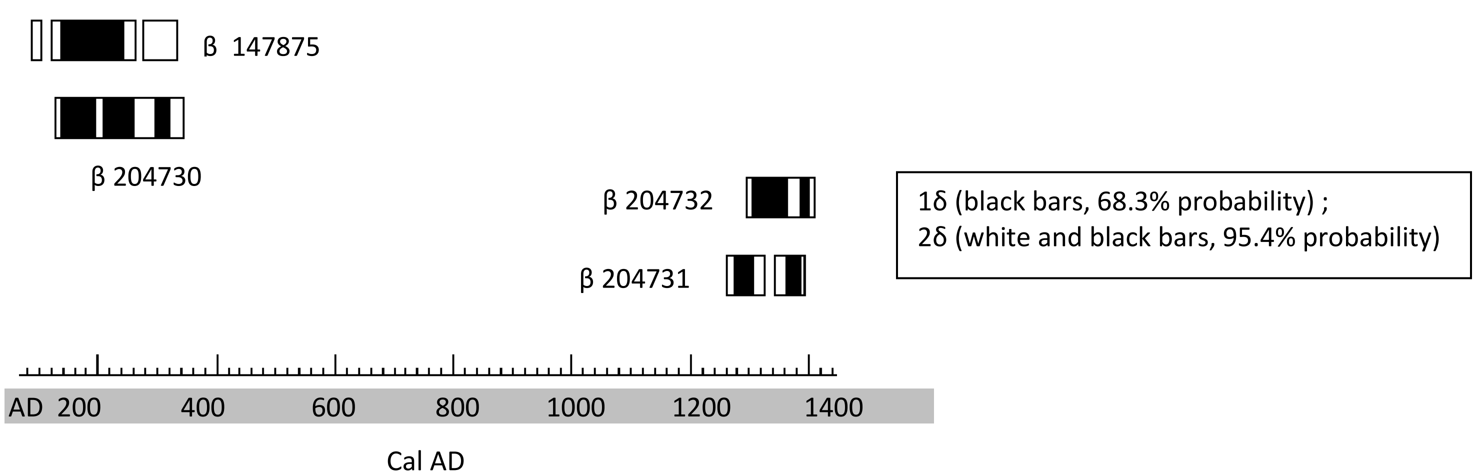
** Stratigraphy for BE-13-KH (LPN) and BE-15-KH (GLY) are not included as the fieldwork consisted primarily of surface surveys. Stratigraphy data for BE-17-KH (PLM) and BE-19-KH (JRC) were not recorded as the sites were surveyed very early in the fieldwork before my tephra recording protocol was fully developed. While I examined stratigraphy at a large number of additional locations within the study area, I am only including stratigraphic drawings from excavated site contexts.*


7.5 YR 2.5/2 (very dark brown)
Humic top soil
7.5 YR 3/2 (dark brown)
Small pumiceous tephra inclusions
(<1 cm)
7.5 YR2.5/2 (very dark brown)
7.5 YR 4/3 (brown)
20
40
60
80
BE-16-KH (KOT)
7.5 YR 2.5/1 (black)
Humic soil w/small roots
7.5 YR 2.5/1 (black)
7.5 YR 3/2 (dark brown)
Some small pumiceous
tephra inclusions (<3 cm)
7.5 YR 4/4 (brown)
20
40
60
80
BE-18-KH (MAR)
7.5 YR 4/4 (brown)
Loam w/many rock
fragments
7.5 YR 5/4 (brown)
Small pumiceous tephra
inclusions (<1 cm)
7.5 YR 4/6 (strong brown)
Silt loam
7.5 YR 4/6 (strong brown)
Silt loam w/pumiceous tephra
inclusions (<3 cm)
7.5 YR 4/6 (strong brown)
Silty clay loam
20
40
60
80
BE-20-KH (EST)

Appendix K: AMS dates from excavated units

Lab Sample #*	Site**	Material pretreatment	Radiocarbon age	$^{13}C/^{12}C$	2 δ calibration (95.4% probability)***	
					Cal AD age range	Relative area under probability distribution
β 204730	BE-20-KH (EST)	(charred material): acid/alkali/acid	1790 +/- 40 BP	-26.2 o/oo	Cal AD 130-350	1.00
β 204731	BE-16-KH (KOT)	(charred material): acid/alkali/acid	680 +/- 40 BP	-22.5 o/oo	Cal AD 1270-1330	0.592
					Cal AD 1350-1400	0.408
β 204732	BE-16-KH (KOT)	(charred material): acid/alkali/acid	600 +/- 40 BP	-24.4 o/oo	Cal AD 1300-1410	1.00
β 147875	BE-19-KH (JRC)	(carbonized food remains): acid/alkali/acid	1810 +/- 40 BP	-23.7 o/oo	Cal AD 90-110	0.024
					Cal AD 120-270	0.845
					Cal AD 280-330	0.131

Visual representation of the calibrated age ranges of the samples



* all AMS samples were dated by Beta Analytic
**see Appendix L for further contextual information for each sample
*** I calculated the calibrations using CALIB 5.0.2 and the IntCal04.14C dataset (Reimer et al. 2004) and assumed a -25 $^{13}C/^{12}C$.

Appendix L: Carbon samples from excavated units

**rank* = a number from 1-4 that I assigned to designate my level of confidence in the quantity and integrity of the sample for radiocarbon dating; 1 is the highest confidence and 4 is the lowest. I lacked sufficient data to provide a number for unranked samples. SHADED samples were AMS tested and the results arereported in this thesis.

Site #	Site field name	context	rank *	depth (cm)	notes/description
BE-12-KH	GIO	A.2	1.5	30	good size sample. Close to surface. Is associated with ceramics
BE-12-KH	GIO	A.2	1.5	30	good size sample. Close to surface. Is associated with ceramics
BE-12-KH	GIO	B		38	carbon sample in film case w/associated sherd in bag. Sherd: reddish paste and slip. 15mm thick.
BE-12-KH	GIO	B.2		10-20	carbon sample in film case w/associated sherd in bag. Sherd: 14mm thick. Brownish red paste, no slip, smoothed
BE-12-KH	GIO	B.4		30-40	carbon sample in film case with associated sherd in bag. Sherd: 17mm thick, plain, reddish paste
BE-12-KH	GIO	B.5		40-50	sherd burnt on inside. Very small amount of carbon crusted inside. Sherd has red-orange exterior slip
BE-12-KH	GIO	C.2		10-20	good size sample. But close to surface
BE-12-KH	GIO	D.2		10-20	carbon sample in film case w/associated sherd in bag. Sherd: 9mm thick, reddish-orange slip and paste
BE-12-KH	GIO	H.1	4	0-10	is burnt sherd, but don't see usable carbon. Sherd is a 12 mm thick simple base (such as for a bowl) w/buff exterior slip
BE-12-KH	GIO	H.1		0-10	carbon sample in film case with associated sherd in bag. Sherd: 5mm thick, orange paste and ext/int slip
BE-12-KH	GIO	H.1		0-10	large sample, but too close to surface
BE-12-KH	GIO	H.2		10-20	carbon sample in film case w/associated sherd in bag. Sherd: red-orange slipped handle attachment, polish striations
BE-14-KH	GON	H	1.5	65	good sample size, associated with glass sherd
BE-14-KH	GON	H.1	4	14	small sample, too close to surface
BE-14-KH	GON	H.1	4	12	too shallow a context, taken by an assistant
BE-14-KH	GON	H.2	2.5	23	very large sample. Not from a deep context, though, and have better for fire pit if can even use
BE-14-KH	GON	H.2	4	20	large sample, but too close to surface
BE-14-KH	GON	H.4	2.5	65	large sample size, from deep inside pit, but have deeper.
BE-14-KH	GON	H.4	3.5	33	good sized chunk, taken by assistant
BE-14-KH	GON	H/J/K	1		by beer bottle in fire pit, deeply embedded
BE-14-KH	GON	I.2	3.5	10-20	small sample, too close to surface, taken by assistant
BE-14-KH	GON	J.3	4	30	very big chunk, looks modern. Taken by Abel
BE-14-KH	GON	J/balk II	1.5	65	large sample size, associated with floor of feature
BE-14-KH	GON	K.2	3.5	40	large sample, but not a clear context, taken by an assistant
BE-14-KH	GON	N.4	3.5	45	tiny sample size, has ceramics in same strata, though not clearly associated
BE-14-KH	GON	O.1	3.5	23	good sample size. But close to surface and taken by an assistant so can't be sure of context
BE-16-KH	KOT	A.1	4	10	too close to surface, taken by assistant
BE-16-KH	KOT	B.3	2		moderately low sample size. Associated with ceramics
BE-16-KH	KOT	B.3	3	30	low sample size
BE-16-KH	KOT	D.3	4		large sample size but taken by a field assistant, not sure of context, seems like a root
BE-16-KH	KOT	D.4	3	40	likely just from a tree root fire
BE-16-KH	KOT	E.4	3		small sample size
BE-16-KH	KOT	E.7	3	62	small sample size
BE-16-KH	KOT	F(ext). 6	1		have photo of carbon in situ. Carbon is from inside big top sherd of pot [β 204731]
Site #	Site field	context	rank *	depth (cm)	notes/description

	name				
BE-16-KH	KOT	F(ext).4	1	40	moderately small sample size but enough for AMS, associated with dacite slab and ceramics
BE-16-KH	KOT	F(ext).5	2	50	associated with ceramics
BE-16-KH	KOT	F(ext).5	3	45	tiny sample size, is from just above dacite slab
BE-16-KH	KOT	F(ext).5		40	have photos in situ (2 patches)
BE-16-KH	KOT	F(ext).5		50	large chunk
BE-16-KH	KOT	F(ext).6	1		from inside pot
BE-16-KH	KOT	F(ext).6		60	good sized chunk
BE-16-KH	KOT	F(ext).6	1.5	55	small sample size, carbon crusted inside ceramic
BE-16-KH	KOT	F(ext).6	2		carbon rich soil sample from inside of pot 4. is mixed, no large carbon chunks
BE-16-KH	KOT	F(ext).6	1	55	from inside inner pot, says "best sample" on bag, but is small sample size [β 204732]
BE-16-KH	KOT	F(ext).6	2		very low sample size. associated with pot
BE-16-KH	KOT	F(ext).6	2	47	small sample size, carbon from inside lip of pot, have photo in situ
BE-16-KH	KOT	F(ext).6	3	50	very small sample, is from inside inner pot
BE-16-KH	KOT	F(ext).7	1	80	good sample size. Is associated with ceramics
BE-16-KH	KOT	F(ext).7	2		good sample size
BE-16-KH	KOT	F.3	2.5		very small sample, carbon crusted inside ceramic. Was not washed
BE-16-KH	KOT	F.5	2		very good sample size, says "good sample" on bag
BE-16-KH	KOT	F.7	1	70	carbon surrounding foot of pot in burial cache
BE-16-KH	KOT	I.3		30	good sample size
BE-16-KH	KOT	J	2		not a large sample size. directly under north edge of dacite slab
BE-17-KH	PLM	1.D	3	40	small sample
BE-18-KH	MAR	5	4	36	good sample size, but not sure of context. Is a test pit? Taken by assistant
BE-18-KH	MAR	B.1	4	10	too close to surface
BE-18-KH	MAR	B.2	4	20	too close to surface
BE-19-KH	JRC	1.1	4	0-10	can't really see the carbon now? Sherd: unsmoothed, unslipped, 9.5mm thick, red-orange paste
BE-19-KH	JRC	1.2		10-20	carbon crusted to inside of sherd. Sherd: 7.6mm thick, beige temper, red-orange slip ext
BE-19-KH	JRC	2.3		20-30	sherd w/small amount of crusted carbon. Sherd: 7.3mm thick, unslipped, orange paste w/lots of white (tephra?) inclusions
BE-19-KH	JRC	3.2		10-20	sherd w/small amount of crusted carbon. Sherd: 6.3mm thick, red-orange ext slip [β 147875]
BE-19-KH	JRC	3.4		30-40	very small sample
BE-20-KH	EST	A.1	2.5	28	good size sample
BE-20-KH	EST	A.5	2.5	55	good sample size
BE-20-KH	EST	A.5	3	50	small sample. Taken by assistant so can't verify context
BE-20-KH	EST	A.6	1.5	60	moderate size sample. Includes very small (6.5mm) mold of seed/casing
BE-20-KH	EST	A.6	2.5	65	small sample
BE-20-KH	EST	B.2	1.5	26	not deep in stratigraphy and is a small sample, but associated with lots of stone tool fragments, ceramics. [β 204730]
BE-20-KH	EST	B.2	2.5	24	somewhat small sample. Close to surface.
BE-20-KH	EST	B.2		43	from feature (was the feature a root????? Possibly makes this a 4 and unusable)
BE-20-KH	EST	B.4	3	43	small sample size

Appendix M: Grave goods from the KOT-F unit at BE-16-KH (KOT)

1

Description: Bisquit tripod bowl with mammiform legs. Legs are double slit on the sides. Each leg contains three pellets. *Condition:* good, though a crack extends 4.5 cm from the rim and there is an 18 mm chip in the rim. *Rim diameter:* 20 cm. *Rim thickness:* 5.0 mm. *Leg height:* 8.0 cm. *Height:* 12.5 cm

2

Description: Bisquit tripod bowl with mammiform legs. Legs are slit once in the middle. One large pellet remains in one leg. *Condition:* one tripod leg is missing, and a similar leg was found near vessels 9-10. *Rim diameter:* 18 cm. *Rim thickness:* 5.9 mm. *Leg Height:* 6.4 cm. *Height:* 10 cm

3

Description: Bisquit tripod bowl with stylized zoomorphic legs. Narrow double slits on the sides of the legs approximate eyes. Pellets are contained inside the legs. *Condition:* very good, though there is a 7 mm chip on the rim. *Rim diameter:* 14 cm. *Rim thickness:* 5.3 mm. *Leg Height:* 5.8 cm. *Height:* 9.5 cm

4

Description: tripod bowl with stylized zoomorphic legs. Narrow double slits on the sides of the legs approximate eyes. Pellets are contained inside the legs. *Condition:* very good, though a small crack extends 3.2 cm from the rim. *Rim diameter:* 23 cm. *Rim thickness:* 6.14 mm. *Leg Height:* 7.7 cm.
Height: 11 cm

5

Description: Bisquit jar with zoomorphic handles. Neck is marked with circles indented while clay was still wet. *Condition:* good, though one of the zoomorphic handles is missing its head and the rim is chipped over a 6.6 cm section. *Rim diameter:* 10 cm. *Rim thickness:* 4.67 mm. *Height:* 18 cm

6

Description: small, closed bowl/cup. Highly smoothed inside and out. *Condition:* good, though rim is chipped in two places. Outside surface is blackened and may have been set in a fire, or perhaps the markings are from firing. *Rim diameter:* 7 cm. *Rim thickness:* 4.8 mm
Height: 5.5 cm

7

Description: Shallow cup or lid, roughly made. Bottom is fire blackened. *Condition:* good, though rim is slightly chipped in two places. *Rim diameter:* 9 cm. *Rim thickness:* 3.9 mm. *Height:* 2 cm

8

Description: anthropomorphic *adorno* handle created with clay pellets and strips. The figure seems to rest their elbows on their knees/breasts with their head in their hands. *Condition:* the handle is in good condition, although the rim represents slightly over half of the original diameter. Numerous sherds for the vessel were also retrieved and could be reconstructed. *Rim diameter:* 16 cm. *Rim thickness:* 6.23 mm. *Height:* 6.3 cm (the *adorno*)

9, 10

Two vessels from the construction wall side of KOT-F were heavily damaged by construction of the house foundation. The smaller vessel, which was heavily crusted with carbon, rested inside the larger vessel. A large number of pieces of the vessels were retrieved, however, and could have reconstruction possibility. Rim sherds were 18 cm and 32 cm diameters. Carbon from the inner vessel was AMS dated (β-204731) and provided a calibrated date of 680 +/- 40 BP

Appendix N: Organic casts found in excavated contexts

Site #	Site field name	Context	quantity	Diam. (mm)	comments
BE-20-KH	EST	A.5	1	24.2	57 cm depth
BE-20-KH	EST	A.5	1	24.2	57 cm depth
BE-20-KH	EST	A.6	1	22	65 cm depth.
BE-20-KH	EST	A.6	1	8.2	tiny little mold
BE-20-KH	EST	A.6	1	8.4	tiny mold, 1/2 complete
BE-20-KH	EST	B.4	1	24.2	50 cm depth. NE quad
BE-20-KH	EST	B.4	1	0	45 cm depth
BE-12-KH	GIO	B.6	1	-	65 cm depth
BE-12-KH	GIO	C.5	1	0	
BE-12-KH	GIO	C.6	1	16.8	62 cm depth
BE-12-KH	GIO	D.7	1	26.5	65 cm depth
BE-16-KH	KOT	?	1	23.7	76 cm depth. From where fragment of pot was found
BE-16-KH	KOT	A(ext).7	1	20.5	70 cm depth. Whole circle, tiny whole on top (photo)
BE-16-KH	KOT	A.3	1	-	fragment. Crushed
BE-16-KH	KOT	A.3	1	24.3	3/4 circle
BE-16-KH	KOT	A.4	1	31.2	46 cm depth
BE-16-KH	KOT	A.4	1	-	
BE-16-KH	KOT	A.5	1	33.1	
BE-16-KH	KOT	A.5	3	25	63 cm depth
BE-16-KH	KOT	A/I ext balk	1	26.2	26 cm depth
BE-16-KH	KOT	B.4	1	28.4	46 cm depth. 3/4 complete
BE-16-KH	KOT	B.7	1	-	crushed
BE-16-KH	KOT	C.5	1	29.5	
BE-16-KH	KOT	C.6	1	21.9	61 cm depth
BE-16-KH	KOT	D(ext).5	1	-	50 cm depth
BE-16-KH	KOT	D(ext).6	1	27.2	90 cm depth. Inside burial pit
BE-16-KH	KOT	D(ext).6	1	25.3	70 cm depth
BE-16-KH	KOT	D.4	1	-	
BE-16-KH	KOT	D.4	1	-	46 cm depth
BE-16-KH	KOT	E.4	1	16.5	crushed
BE-16-KH	KOT	E.4	1	14.8	Fragment
BE-16-KH	KOT	E.5	1	-	Fragment
BE-16-KH	KOT	E.5	1	15.7	fragment
BE-16-KH	KOT	E.6	1	28.7	1/2 complete
BE-16-KH	KOT	E.6	1	22.4	crushed in recovery, but was nearly whole
BE-16-KH	KOT	E.6	1	26.3	1/2 complete
BE-16-KH	KOT	E.7	2	30.2	
BE-16-KH	KOT	F(ext).5	1	21.5	50 cm depth
BE-16-KH	KOT	F(ext).6	1	20.9	is from area of broken pot (2 cm east of rim)
BE-16-KH	KOT	F(ext).6	1	21	was in midst of ceramic fragments. 60 cm
BE-16-KH	KOT	F(ext2).4	1	23.5	3/4/ complete
BE-16-KH	KOT	F(ext2).7	3	-	70 cm depth
BE-16-KH	KOT	F.4	1	16.7	fragment
BE-16-KH	KOT	F.5	1	23.2	53 cm. Fragment
BE-16-KH	KOT	F.5	1	20.7	50 cm depth. 1/2 complete
BE-16-KH	KOT	F.6	1	22.9	just a fragment
BE-16-KH	KOT	H.4	1	23.3	43 cm depth
BE-16-KH	KOT	H.4	1	29.3	40 cm depth. Whole
BE-16-KH	KOT	H.5	1	28.2	58 cm depth. 1/2 complete
BE-16-KH	KOT	H.6	1	26.6	60 cm depth
BE-16-KH	KOT	H.6	1	28.7	70 cm depth. Whole circle, tiny hole on top
BE-16-KH	KOT	H.7	1	-	70 cm depth
BE-16-KH	KOT	I.5	1	32.9	1/2 complete
BE-16-KH	KOT	I.5	1	0	44 cm depth
BE-16-KH	KOT	J	1	22.1	fill under dacite slabs
BE-16-KH	KOT	J	1	27.9	from fill under dacite slabs
BE-16-KH	KOT	J.4	1	-	65 cm depth. From NE corner
BE-16-KH	KOT	J.6	1	-	72 cm depth. SE quad
BE-16-KH	KOT	J.6	1	19.1	crushed
BE-16-KH	KOT	J.6	1	26.9	

Appendix O: Locations and descriptions of the Boquete petroglyph boulders

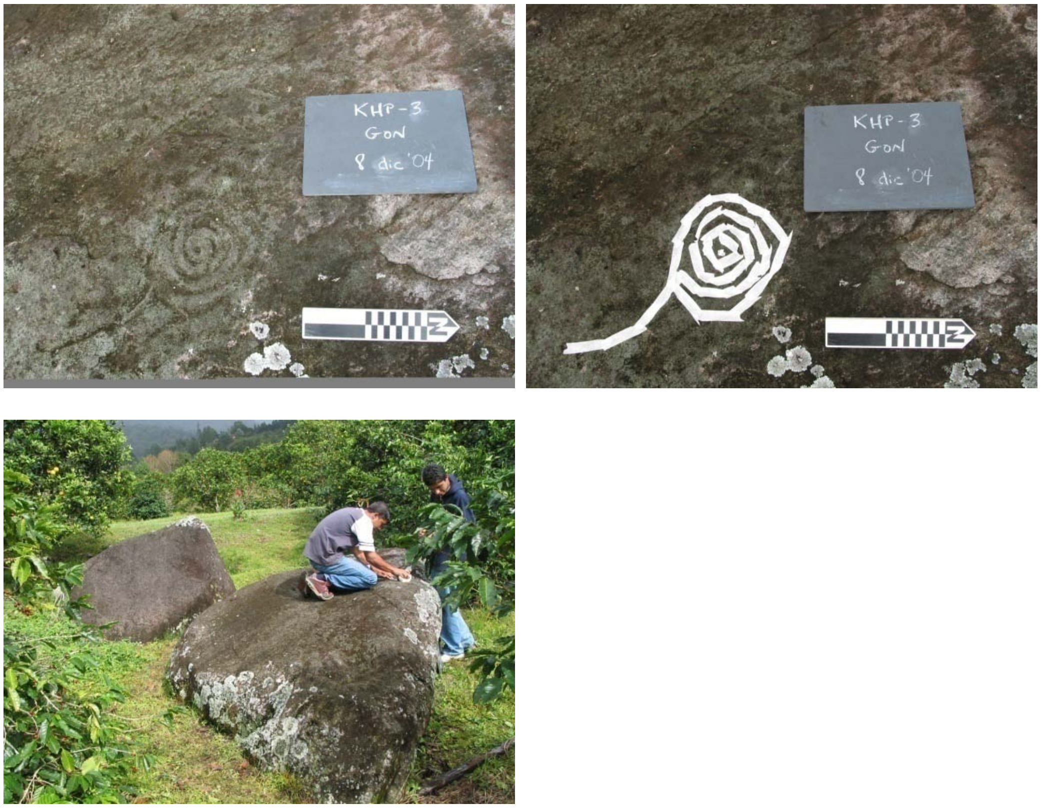
KHP-#	North	West	Munsell color	Mohs hardness	Powers roundness	Length of rock (m)	Width of rock (m)	Height of rock (m)	% of rock covered *	Comments
1	8.78978	-82.43518	N8 (very light gray)	4.5	rounded, low sphericity	0.75	0.6	0.15	2	Distinctive peak of Piedra Lino is to the NW. distinctive triangular peak is almost directly N. Barú is roughly 300°
2	8.7898	-82.43512	N7 (light gray)	4.5	angular, low sphericity	1.1	0.7	0.3	1	Same as KHP-1
3	8.78923	-82.43527	N7 (light gray)	4.5	angular, low sphericity	2.3	3.7	0.8	3	Designs are only on the NE portion of the rock
4	8.7888	-82.43403	5R 6/2 (pale reddish brown) to 10R 4/6 moderate reddish brown	1.5	rounded, high sphericity	1.5	1.2	0.3	3	
5	8.78857	-82.43417	N6 (med light gray)	1.5	rounded, low sphericity	1.5	0.7/1.3	0.65	1	Rock was 'split' like the 'passage rock' at Caldera; the split seems to predate the petroglyphs
6	8.78859	-82.43423	N8 (very light gray)	1.5	sub-angular, high sphericity	1.1	1	0.5		
7	8.78875	-82.43455	N7 (light gray)	2.5	sub-angular, low sphericity	1.8	1	0.5	1	
8	8.78852	-82.43412	N8 (very light gray)	1.5	angular, low sphericity	1	0.65	0.25	1	
9	8.78846	-82.43406	N8 (very light gray)	2.5	well rounded, low sphericity	1.7	1.2	0.4	1	Distinctive egg shaped rock; found beer bottle embedded in clay pit abutting this rock
10	8.78849	-82.43384	5R 6/2 (pale reddish brown) to 10R 4/6 moderate reddish brown	3.5	sub-angular, low sphericity	1	0.35/0.6	0.15	2	
11	8.78848	-82.43398	N8 (very light gray)	2.5	sub-angular, low sphericity	1.55	0.85	0.25	2	
12	8.78848	-82.43398	5YR 7/2 (grayish orange pink)	3.5	sub-rounded, low sphericity	1.8	0.7	0.2	1	
13	8.78848	-82.43398	N8 (very light gray)	2.5	sub-rounded, high sphericity	1.35	1.15	0.4	1	A natural channel in the rock was incorporated into the design of the petroglyphs
14	8.78821	-82.43383	5YR 6/1 (light brownish gray)	3.5	angular, low sphericity	1.05	0.5	0.15	1	Has a 'water hole', or pit filled almost constantly with rain water, as part of the design
15	8.78955	-82.43443	5YR 7/2 (grayish orange	3.5	angular, low	0.95	0.6	0.4	1	

KHP-#	North	West	Munsell color	Mohs hardness	Powers roundness	Length of rock (m)	Width of rock (m)	Height of rock (m)	% of rock covered *	Comments
			pink)		sphericity					
16	8.78822	-82.43381	5YR 7/2 (grayish orange pink)	2.5	sub-rounded, high sphericity	1.4	1.15	0.35	3	
17	8.78751	-82.43195	5YR 7/2 (grayish orange pink)	2.5	nearly square, like a cube (or could say sub-rounded, high sphericity)	0.65	0.6	0.45	1	
18	8.78795	-82.43523	5YR 7/2 (grayish orange pink)	2.5	sub-rounded, high sphericity	2.2	1.4	0.3	1	Note that the height measurement is only the current height above the surface
19	8.78802	-82.43504	5YR 7/2 (grayish orange pink)	2.5	rounded, low sphericity	1.1	0.55	0.65	1	Note that the height measurement is only the current height above the surface
20	8.78793	-82.43493	5YR 7/2 (grayish orange pink)	-	sub-rounded, high sphericity	0.7	0.7	0.4	1	is in midst of clump of large cane and difficult to access
21	8.78827	-82.4351	5GY 6/1 (greenish gray)	2.5	rounded, high sphericity	1.3	1.1	0.7	1	all rocks in this line (20,21,22) seem to line an old stream. In midst of lots of dacite slabs
22	8.78811	-82.43528	5YR 7/2 (grayish orange pink)	3.5	sub-rounded, low sphericity	1.75	1	0.45	1	
23	8.79501	-82.44708	N7 (light gray)	3.5	sub-rounded, high sphericity	2.2	2.1	0.75	1	direct line of sight through a V-shaped valley to the center of Barú. Can draw a straight line from Barú, through petroglyphs, to sunrise over mountain peaks. Rock is currently used for washing dishes as is in a backyard.
24	8.8006	-82.45174	5YR 7/2 (grayish orange pink)	2.5	1x1 m triangle on face w/designs	1.25	1	1	1	Rock is several meters away from the biggest *ojo de agua* in Boquete, which is used as the municipal water source. Is also adjacent to the basalt column outcropping.
25	8.7879	-82.43073				0.63	0.48	0.25		Location is approximate
26	8.78834	-82.43024				0.46	0.43	0.37		Location is approximate
27	8.64907	-82.34167				2.7	2.3	1.7		Appears to have an *ojo de agua* at the east corner
Caldera *Piedra Pintada*	8.65613	-82.36754	N3 (dark gray) and 5Y 2/1 (olive black); 'passageway rock' is 5YR 6/4 (light brown)	-						direct line of sight to Barú over the pert boulder from "passageway" rock. Sun sets directly over peaks to the west.

Appendix P: Petroglyph boulder photographs (with and without tape)
[Scale bar is marked in 10 cm increments]

PETROGLYPH # KHP- 1

PETROGLYPH # KHP- 2



PETROGLYPH # KHP- 3

PETROGLYPH # KHP- 4

PETROGLYPH # KHP- 5

PETROGLYPH # KHP- 6

PETROGLYPH # KHP- 7

PETROGLYPH # KHP- 8

PETROGLYPH # KHP- 9

PETROGLYPH # KHP- 10

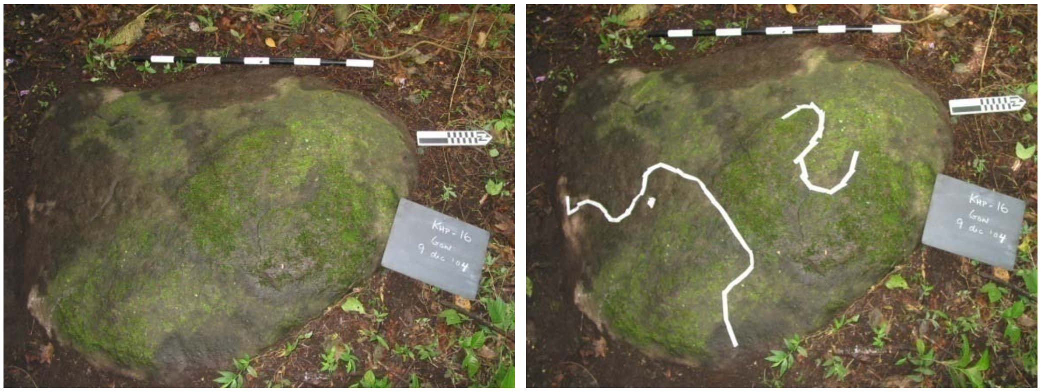
PETROGLYPH # KHP- 11

PETROGLYPH # KHP- 12

PETROGLYPH # KHP- 13

PETROGLYPH # KHP- 14

PETROGLYPH # KHP- 15



PETROGLYPH # KHP- 16

PETROGLYPH # KHP- 17

PETROGLYPH # KHP- 18

PETROGLYPH # KHP- 19

PETROGLYPH # KHP- 20

PETROGLYPH # KHP- 21

PETROGLYPH # KHP- 22

PETROGLYPH # KHP- 23

PETROGLYPH # KHP- 24

PETROGLYPH # KHP- 25

PETROGLYPH # KHP- 26

Appendix Q: Some interpretations of the *Piedra Pintada* designs

Künne (2008a: 244) suggests that the figural designs of the Caldera *Piedra Pintada* depict masks of tapirs and deer. Masks were used in ceremonies for the dead in other parts of Central America (Künne 2008a: 244, Lehmann 1907-9: 715), and the portrayal of masks could suggest the incorporation of the petroglyph boulder into ritual. The depiction of placid animals like tapirs and deer, however, seems to counteract the findings of Mayo and Mayo (2007), who note that in the Coclé Sur Basin area petroglyphs less frequently depict the non-aggressive animals that were part of the indigenous diet.

The preferencing of aggressive animals that Mayo and Mayo (ibid.) note in rock art depictions mirrors earlier findings of iconographic choices in ceramics (Linares 1976) and associations between particular animals and ferocity and strength (Cooke 1993, 2003, Cooke and Ranere 1992a). Both deer and tapirs, however, are potentially 'inedible' even if they are not overtly aggressive animals.[232] The Malekú of the Río Frío area of Costa Rica, for example, believed the souls of the dead lived in the deer livers hence deer were taboo to eat (Künne 2008a: 244, Lehmann 1907-9). The tapir played a central role in the creation myths of the Bribrí (Gonzalez Chaves and Gonzales Vasquez 1989: 135-7).[233] The white tapir, in particular, was seen as both invulnerable and inedible for the Bribrí (Künne 2008a: 244). Tapirs were seen as a powerful sexual symbol associated with large penises who were seducers of women and trickster-like figures in some Amerindian symbology (Benson 1997: 44, Quilter 2004: 181, Roe 1982: 192). The Achuar people, alternately, see tapirs as maternal symbols due to their gestation period of more than a year (Descola 1993: 79, Quilter 2004: 181). Tapirs are sometimes cast as the master of other animals or of crops or as a spirit helper that can transform into a human (Quilter 2004, Wilbert and Simoneau 1992: 1239).

[232] Tapirs tend to be shy and non-confrontational, though if threatened will defend themselves against humans. Their thick skin, size, and ability to run tend to protect them from jaguars, crocodiles, and other large predators.

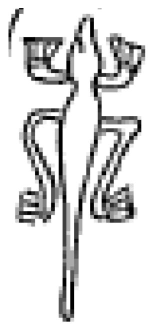
[233] If the tapir was also invoked in the Barú region myths, the ritually killed tapir pot from the BE-16-KH (KOT) site in conjunction with representations of tapirs in rock art show that the iconography was fungible. As Cooke and Sánchez (2003: 21) suggest, a close iconographic relationship is suggested between motifs found on pottery, shell, stone, and metal objects from the earliest isthmian contexts through Spanish conquest.

Thomas Joyce (1916a: 100) cites accounts by Girolamo Belzoni (1857 [1565]) in his descriptions of how people in sixteenth-century Panamá 'worshipped idols of clay, wood, stone and gold, in the form of birds, jaguars, deer and other animals. These were kept hidden in caves and buried in the earth…" Belzoni's abilities as an accurate observer, at least in the eyes of the Catholic Church, were highly suspect though this statement highlights a role of the landscape and natural world in the religious beliefs of contact-period peoples that were also cited by more credible sources such as Peter Martyr d'Angheira (1555), who additionally cited elements of sun worship. This religious association between the landscape and natural world is then linked to tapirs in the accounts of William Gabb (1875), who cited that '…supernatural beings are supposed to live inside the rocks on certain mountain peaks, and to be the owners of the tapirs' (per Joyce 1916: 101-2).

Künne (2008a) also interprets several of the Caldera *Piedra Pintada* designs as lizard motifs. Mayo and Mayo (2007: 155) suggest a connection between streams and a cult of lizards (*saurios)* from their study of the Coclé Sur rock art, noting that caymans were sacred at least by AD 700 and that streams became sacred by association.[234] If the Caldera designs do portray lizards, perhaps a similar sacredness could be attributed to the images. Other interpretations for the lizard-like designs could exist. The design interpreted as a depiction of a lizard is somewhat similar to one from a Chibcha 'stone calendar' described by Garrick Mallery (1893: 615-6, Figure 980). No scale is provided for this object, which is possibly a petroglyph covered cobble from the drawings.[235] Mallery (ibid.) interprets the carved design (below) as a possible tadpole, rather than as a lizard.

[234] Lizards were sacred in many other cultures; an interesting description of 'divinicide' involving lizards in twentieth century missionary experience is provided by Straight (2008: 845).

[235] No provenience is provided for this artifact other than that it was from the United States of Colombia (of which Panamá was a party from 1863-1886; why Mallery still used the name is unclear) and attributed to H.R. Lemly of the US Army. It is not clear whether the stone was portable and collected by Lemly or if it was non-portable and only described by him.



THE CARVED STONE DESIGN INTERPRETED AS A 'TADPOLE' BY MALLERY (1893)

Mallery (ibid.) makes the tadpole interpretation gauging from the importance of the frog (*Ata*), which was the base of the Chibcha symbolic system he describes. Other symbols on the same 'calendar' include *Bossa* (a rectangular figure with divisions indicating cultivated fields), *Mica* (a bicephalous figure with distended eyes, signifying seed selection and planting), *Muihica* (similar to *Mica*, but with nearly closed eyes indicating the dark, rainy season when the seeds sprout), *Hisca* (similar to *Mica* and *Muihica*, but with a lack of division between the heads, indicating the union of the sun and the moon as spouses), *Ta* (very similar to *Bossa*, representing the harvest month), *Cuhupcua* (an earless human head which symbolized the useless or 'deaf' months of the Chibcha year) *Aca*, (a frog like *Ata*, but larger, which was the harbinger of the rainy season), *Ulchihica* (two joined rhomboids that maybe show a seed, fruit, or ear and referred to invitations and feasts), and *Guesa* (as mentioned in the prior chapter, a human figure in a humble attitude with hands folded and a ring around the head, indicating a person sacrificed every twenty Chibcha years to the god of the harvest). In sum, the images are all interpreted as linked to the cycles of harvest and rain.

Should any of these possibly interpretations be accurate for the Caldera *Piedra Pintada*, I would point out the 'natural' uniqueness of the Caldera boulder and location - rather than the 'cultural' marking of the rock - are the source of sacredness. The distinctive aspects of the space were the originary font of its power or resonance. The designs appropriated, accentuated, highlighted, or channeled that power. It is highly unlikely, however, that we will ever truly 'know' the purpose or meanings the designs held for past peoples, though it can be safe to assume that those associations changed and morphed significantly over time.

I must now, Sir [and Madam], beg your pardon, if I have trespassed too much upon your time, I meant to be short, clear, and explicit, and if by aiming at the two latter, I have fail'd in the former, I hope I shall be excused and that you will please to take the Will for the Deed.

William Hamilton (1998 [1776]), from a letter written to Joseph Banks, president of the Royal Society, London, describing the recent eruption of Vesuvius.