Early Settlers of the INSULAR CARIBBEAN

Dearchaizing the Archaic

edited by
Corinne L. Hofman
Andrzej T. Antczak

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Sidestone Press

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Published by Sidestone Press, Leiden
www.sidestone.com

Imprint: Sidestone Press Academics

Lay-out & cover design: Sidestone Press
Photograph cover: Cover design by Oliver Antczak. Cover photo is a composite of photo's by Tiago Fioreze (sea and cloud, Wikimedia Commons), Patrick Nouhailler (island, Flickr.com), and David Bottome (canoe).

ISBN 978-90-8890-780-7 (softcover)
ISBN 978-90-8890-781-4 (hardcover)
ISBN 978-90-8890-782-1 (PDF e-book)

Contents

List of Contributors

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John G. Crock is Associate Professor of Anthropology at the University of Vermont and the Director of the UVM Consulting Archaeology Program. He received his BA from the University of Vermont in 1989 and his PhD in Anthropology from the University of Pittsburgh in 2000. In addition to teaching field schools and maintaining an active research program in the Caribbean, Crock is heavily engaged in public archaeology and directs cultural resource management studies in northeastern North America. His research interests include maritime adaptations, interregional trade and exchange, the development of inequality and heritage management.

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Corinne L. Hofman is Professor of Caribbean Archaeology at the Faculty of Archaeology, Leiden University in The Netherlands. She has conducted fieldwork in many of the Caribbean islands over the past 30 years. Her research and publications are highly multi-disciplinary and major themes of interest center around mobility and exchange, colonial encounters, inter-cultural dynamics, settlement archaeology, artefact analyses, and provenance studies. Her projects are designed to contribute to the historical awareness, preservation, and valorization of indigenous heritage. Hofman has obtained numerous research grants from the Netherlands Organisation for Scientific Research (NWO), the Humanities in the European Research Area (HERA), and the European Research Council (ERC), as well as prestigious prizes. She is the PI of the NWO-Island Networks project and the ERC-Synergy project NEXUS1492. Hofman is the author of many articles, bookchapters, and edited volumes on Caribbean archaeology. Her recent books are *The Caribbean Before Columbus* (with William F. Keegan; Oxford University Press 2017) and *Material Encounters and Indigenous Transformations in the Early Colonial Americas: Archaeological Case Studies* (with Floris W. M. Keehnen; Brill 2019).

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Michael J. Lace has been actively involved in cave exploration and multidisciplinary cave studies in conjunction with public and private land trusts, government agencies, and private landowners within the U.S. and abroad since 1986. Lace currently serves as the Executive Director of the Coastal Cave Survey (CCS) – a non-profit organization dedicated to the exploration, study, and preservation of coastal cave and karst resources, specializing in island coastal cave exploration, karst landscape archaeology, and coastal speleogenesis. Recent project areas span a diverse array of coastal and inland settings, including numerous island platforms and continental settings in the Caribbean Basin, Bahamian Archipelago, Balearic Islands, and the Yucatan Peninsula. Current research efforts include a multiscalar rock art distribution analysis as a function of associated cave geomorphologies.

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Isabel C. Rivera-Collazo is an environmental archaeologist specialized on coastal and marine geoarchaeology, archaeomalacology, and climate change. She received her doctorate in Environmental Archaeology from the Institute of Archaeology at University College London, where she also completed an MSc in Paleoecology of Human Societies. Rivera-Collazo has worked in underwater and maritime/coastal projects along the Caribbean Sea, the Mediterranean Sea, and the Pacific Ocean. Her current research focuses on coastal socioecodynamics and human adaptation to coastal landscape change in relation to sea level rise and climate change. Rivera-Collazo is Assistant Professor at the University of California San Diego with a dual affiliation at the Department of Anthropology and at the Geosciences Research Division of Scripps Institution of Oceanography. She directs the Geoarchaeology and Archaeomalacology laboratory at Scripps Institute of Oceanography, is founding member of the Scripps Center of Marine Archaeology, and is affiliated researcher at SIO's Center for Climate Change Impacts and Adaptation, and at the Center for Applied Tropical Ecology and Conservation of the University of Puerto Rico, Rio Piedras.

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Handbook of Caribbean Archaeology (with William F. Keegan and Corinne L. Hofman, Oxford University Press 2013).

Roberto Rodríguez Suárez is a Senior Researcher at the Cuban Institute of Anthropology. His research interests are focused on Caribbean archaeology, Paleobotany, and Archaeometry. In particular, his interests are centered on the study of the hunter-gatherer way of life and the contribution of the plants to the diet through analysis of residuals on artifacts and in dental calculus. He directed systematic excavations in the archaeological site of Canímar Abajo from 2004 to 2014. His research using archaeometric techniques have been published in specialized journals.

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Casper Jacobsen Toftgaard is a PhD student at the National Museum of Denmark (NMD) and the University of Copenhagen, Denmark. His dissertation is a diachronic examination of Amerindian colonization of the US Virgin Islands through a reanalysis of the Magens Bay, Krum Bay, Coral Bay, Lt. Cruz Bay, Spratt Hall, and Longford sites, excavated by Gudmund and Emilie Hatt in 1922/23. This will be a continuation of Toftgaard's Master thesis work on the pre-Columbian Caribbean type sites at Coral Bay and Longford, and intermittent studies into the subject since 2010, when he started analyzing pre-Columbian Caribbean stone axes in the so-called Hatt Collection curated by the NMD.

Jorge Ulloa Hung (PhD Leiden University, 2013) is currently Postdoctoral Researcher of ERC-Synergy project NEXUS1492. He is Research Professor of Social Sciences and Humanities at the Instituto Tecnológico de Santo Domingo (INTEC) and manager of Archaeology at the Museo del Hombre Dominicano. Ulloa Hung is founder and coordinator of *El Caribe Arqueológico* and has worked on the study of cultural landscapes before and after contact with Europeans, and the processes of origin and transformation of indigenous ceramics in Cuba and Hispaniola.

Roberto Valcárcel Rojas is Postdoctoral Researcher in the ERC-Synergy project NEXUS1492 and Research Professor at the Instituto Tecnológico de Santo Domingo (INTEC). He has conducted archaeological projects in Cuba and participated in fieldwork in Dominican Republic. His main research interests are cultural interaction, ceramic analysis, indigenous social organization in the Caribbean, and archaeology of the early colonial times in the America's. Valcárcel Rojas is author of *Archaeology of Early Colonial Interaction at El Chorro de Maíta, Cuba* (University Press of Florida, 2016).

List of Figures

List of Tables

1

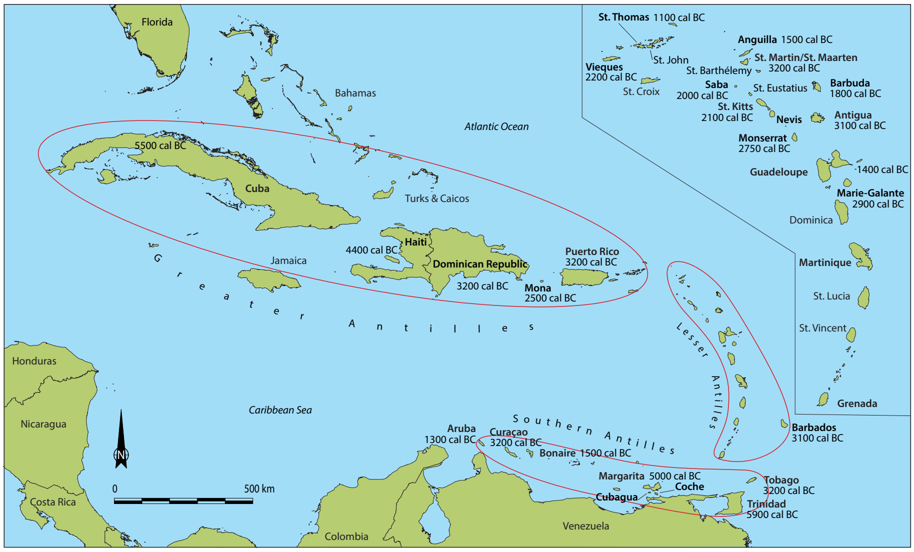
Introduction

Corinne L. Hofman and Andrzej T. Antczak

This volume is a result of the *New Insights into the Archaic of the Circum-Caribbean* session that we chaired at the 81st Annual Meeting of the Society for American Archaeology in Orlando, Florida, in April 2016. The session was organized in the context of the Island Networks project supported by the Netherlands Organisation for Scientific Research (NWO-gr. nr. 360-62-060) and the Synergy project NEXUS1492 which received funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007–2013) (gr. nr. 319209). The session assembled a large number of prominent researchers and colleagues who, over the past decennia, have been applying novel theoretical approaches and state-of-the-art methods and techniques to interpreting the deep past of the insular Caribbean Archaic Age (Figure 1.1).

We opted not to strive to include the earliest developments on every single island of the Caribbean archipelago, but instead to present a broader regional and topical focus. While designing the session, we also realized that – aided by sophisticated techniques and with the development of new theoretical trends in long-term perspectives on human ecodynamics, multidimensional approaches to biocultural evolution, and synergies between modellers and paleoecologists, among others – research on the early settlers of the insular Caribbean has become increasingly interdisciplinary and informed by the realization that humans are not passive adaptors to their environment. Rather, they creatively shape and re-shape their landscape and islandscape, while being simultaneously molded by dynamic biological, sociocultural and environmental feedback. Concomitantly with these theoretical shifts, the approaches to uncovering the origins of the Archaic Age indigenous populations, their mobility and exchange, and modes of life have also been transformed. No longer are these transitional processes perceived as having been caused by single "revolutionary" events, but as multistranded trajectories depending on combinations of economic, social, and ideological phenomena. With the notable exception of impactful natural catastrophic events such as tsunamis, hurricanes or volcanic eruptions, these processes have been liberated by researchers from their dependency on propitious environmental conditions, and from the previously inseparable co-phenomena of sedentarism, domestication, pottery making, and the

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 21-28.



1.1. Map of the insular Caribbean with the available earliest dates for settling (see Appendix). The dates are presented in three groups: Greater Antilles, Lesser Antilles and Southern Antilles including Trinidad and Tobago. Island names in bold indicate that radiocarbon dates are available for archaeological sites on these islands. The dates provide an average of the two oldest dates available for each island (Map by Menno L.P. Hoogland).

hierarchization of social organization. These approaches have also been changed by the negation of any clear-cut distinction between foragers' and farmers' modes of living and of viewing the world.

In summary, in this volume we present theoretical, methodological, and analytical approaches that are currently being used to understand the origins of the Archaic Age peoples and their dynamic and long-lasting impacts on the history of the insular Caribbean. Drawing from such novel and often astonishing archaeological findings, we also aim at dearchaizing the Caribbean Archaic Age peoples themselves. By making "their" worlds more understandable and relevant to present-day scholars, students, and the general public, we are confident that this volume also contributes to changing our erroneous and condescending perception of these indigenous peoples as mere pawns on the "chessboard" of the Archaic Age Caribbean.

The organization of this volume

Chapter 2, by Andrzej T. Antczak and Corinne L. Hofman, is a conceptual backbone to the entire volume. The authors focus on topics related to human/environment interactions, time, scale, and complexity and discuss how they have been applied to the research on the Archaic Age peoples of the insular Caribbean. Drawing from these considerations and novel archaeological findings that negate the previously taken for granted 'truths' about the Caribbean Archaic Age, they aim at dearchaizing not only the very foundations of the Caribbean Archaic Age but its peoples themselves. This chapter also outlines some avenues for future research. The remaining chapters of this volume are grouped into three thematic sections. The first part, *Environmental* *challenges and subsistence strategies*, focuses on both short-lived haphazard events and long-term changes in the Early to Mid-Holocene environment and climate that early human settlers of the Caribbean called home. Those chapters explore the possible effects that major wave events, volcanic eruptions, earthquakes, and general climatic change had on sea level, shorelines, and biotic communities and, therefore, on indigenous settlement patterns and the availability of food. Natural agents greatly affected the current visibility and thus the recoverability of archaeological sites and artifacts from this period. In Chapter 3, Isabel Rivera-Collazo offers an updated insight into some topics that have long attracted the attention of Caribbean archaeologists. Using precise barometric and other environmental data and connecting it with recent and broader archaeological data sets on the early peopling of the region, Rivera-Collazo sheds new light on the environmental conditions at different points in time since the end of the Pleistocene. Using the paleoisland of Puerto Rico as a case study, Rivera-Collazo showcases how radical these environmental changes were, as well as how biased our view on the early peopling of the islands could be if we do not keep in mind that an important portion of the earliest history of human presence on the islands might be unknown to us due to site inaccessibility (i.e., many potential early habitation sites and exploitable terrestrial areas could now be underwater). This chapter sets the stage for visualizing new research programs directed at unraveling potentially rich archaeological and terrestrial habitats that have been protected by the Caribbean Sea waters for perhaps 10,000 years. In Chapter 4, Jay Haviser presents a unique perspective on understanding the Archaic Age in the Southern Caribbean, utilizing new radiocarbon data for the Dutch Caribbean island of Bonaire to highlight the significance of extreme natural events (paleotsunamis) to the coral reefs on which the early populations were heavily dependent. He believes that the multiple identified paleotsunami events on Bonaire may also correlate with localized migrations and cultural developments. In this chapter, an emphasis is placed on the importance of understanding post-depositional natural factors that have affected the actual physical archaeological sites, and in turn the previous interpretations based on that lack of evidence. John Crock, in Chapter 5, discusses how natural and anthropogenic processes have altered the landscape, destroyed or obscured archaeological evidence of early settlement, and inhibited our ability to reconstruct the early human history of the northern Lesser Antilles. Focusing on the Whitehead's Bluff site assemblage on Anguilla, Crock demonstrates a heavy maritime orientation in the range of marine shellfish used for subsistence and toolmaking, and a balance between local and exotic terrestrial resources in the lithic materials used in the production of blades, microflakes and adornments. In Chapter 6, Peter Siegel, John Jones, Deborah Pearsall, Nicholas Dunning, Pat Farrell, Neil Duncan and Jason Curtis observe that anthropogenic disturbances to landscapes commence on the first arrival of humans to new places. Later groups of peoples make yet additional modifications and so on over time, such that today the landscape contains a cumulative record of anthropogenic history. Combining the interpretive frameworks of landscape and historical ecology, the team investigated anthropogenic trajectories across selected islands of the southern and eastern Caribbean. Microfossils from a series of environmental cores reveal the shifting and cumulative humanization of landscapes from ca. 6000 BC through early European colonial occupations in this region. In Chapter 7, Jaime Pagán-Jiménez, Reniel Rodríguez Ramos and Corinne L. Hofman for the first time combine two ethnobiological data sets in which the most important plant and faunal subsistence items of the so-called Archaic Age peoples of the Caribbean islands might be represented. With the aim of providing answers about the possible role of domestic plants as the main triggering factor that influenced decisions surrounding the earliest processes of mobilization into the Caribbean islands, the authors perform a single exploratory assessment of two of the main outputs of the optimal foraging theory: diet breadth and ideal free distribution models. Although the data sets used provide different sources of information and means for assessing varied models of foraging and phytocultural behavior, the authors focus their analysis on the possible interdependence between the foraging behavior of faunal items and phytocultural behavior related to domestic plant management. Because human behavioral models give strong, but partial answers to the research question posited by the authors, they also recommend looking with special care at other theoretical constructs, such as niche-construction theory and experiential phenomenology, for integrally understanding these kinds of research phenomena. In Chapter 8, Yadira Chinique de Armas, Roberto Rodríguez Suárez, William Buhay, and Mirjana Roksandic propose that starch and stable isotopic analyses have changed our understanding of the subsistence strategies and food consumption patterns of "Archaic" populations in Cuba. They describe how the incorporation of these techniques have challenged outdated concepts regarding the cultural importance of plants and the homogeneity of dietary practices among "Archaic" groups, indicating that these groups relied on a broad-spectrum diet comprised of cultigens and wild plants important for other Neotropic economies in the Americas. The isotopic results demonstrated that at least two different dietary traditions were present in Cuba at the same time, one consisting of C3 and C4 plants, and other likely characterized by a reliance on C3 plants. Thus, the authors join the group of colleagues who suggest that a critical revision of the classification system operating in the Antilles is necessary to recognize the greater economic and social complexity of Antillean "Archaic" groups. In summary, the chapters contained in this part of the volume use the currently available theoretical approaches, offer novel and interdisciplinarily acquired data, and present fresh interpretations of the complex interrelationships between Archaic Age settlers of the insular Caribbean and their constantly changing environment across the Holocene millennia.

The second part of this volume, *Local developments and regional entanglements*, presents a series of recent case studies that shed new light on early indigenous settlers from across the insular Caribbean. Some of the sites and materials discussed in this part were previously unknown. But the influx of new data also reinvigorates regional scenarios by enabling reexamination of already-known inter-site entanglements. The contributions in this part also provide critical recontextualizations and reevaluations of key archaeological sites in their currently perceived spatiotemporal and sociocultural frameworks. Arie Boomert, in Chapter 9, discusses how seafaring and navigating using large dugouts necessarily formed part of the cultural heritage of the earliest colonists of the Caribbean islands. It has long been debated whether the first settlers of the Caribbean archipelago entered the Lesser Antilles from Trinidad and the South American mainland and/or from the Greater Antilles. While recent research has shown that the long-ingrained ideas about the subsistence, settlement, and sociopolitical configuration of the Archaic Amerindians in the Caribbean need thorough revision, the debate over their entry into the smaller islands of the archipelago has not ended. Boomert reviews the present evidence on this subject and concludes that the first settlers of the Windward Islands originated from Trinidad and Tobago, while in the Leeward Islands and the Virgin Islands by ca. 3500 cal BC, there developed an interaction sphere in which influences from the Greater Antilles, notably Puerto Rico, and the Windward Islands, conflated. In Chapter 10, Andrzej Antczak, Luis Lemoine, Ma. Magdalena Antczak, and Valentí Rull analyze the human remains of two individuals and associated cultural materials from the site of El Tirano, dated to 2140–1960 cal BC, that were accidentally unearthed on Margarita Island, in Venezuela. The authors situate these findings within the wider regional panorama of coasts and islands of the Venezuelan Caribbean, considering this a historically contingent socionatural space. This position also allows them to transcend the archaeological models that have generally conceived this region as a mere backdrop for sequential migrations. The authors examine the capacity of the Archaic Age indigenous communities to implement socioeconomic changes and transformations that had an important impact on their daily lives. The chapter highlights the contextual and material correspondences with Archaic Age sites located in other parts of the Caribbean and provides novel support for these cultural connections. However, the authors recognize that these connections do not guarantee homogeneity in the Archaic Age of the region, but rather that they are perceived as a palimpsest of social and cultural processes that promoted variety and diversity within the same geographical and temporal frames. In Chapter 11, Harold Kelly and Corinne Hofman show that recent archaeological investigations and new radiometric information urge that the traditional classification schemes for Aruba be revised, and that the proposed criteria for distinguishing pre-Ceramic and Ceramic Period sites are not viable anymore. The classification of sites as "pre-Ceramic" was based on the combination of a lack of pottery, a high percentage of bivalves, and a limestone association. In contrast, "Ceramic Period" sites were classified as having pottery in fair amounts and lacking in bivalves/oysters in any significant quantities. In this chapter, the authors present new evidence for the first migrations to the island, offering novel insights into the lifeways of the Early Archaic Age dwellers of Aruba. Jorge Ulloa Hung and Roberto Valcárcel Rojas, in Chapter 12, consider that although the diversity, complexity, and transformation of "Archaic" communities are recurrent themes in current Caribbean archaeology, the tradition of research on this phenomenon is quite old in Cuba and Hispaniola (today Haiti and the Dominican Republic). The authors examine, discuss, and compare the use of archaeological data for these communities on both islands, and their influence in creating and perpetuating the historical divide of Archaic versus Agriculturalist. They also contextualize and analyze new archaeological information in order to illustrate how the current narrative does not agree with the traditional points of view developed in the archaeology of Cuba and Hispaniola. In Chapter 13, Roberto Valcárcel Rojas, Jorge Ulloa Hung, and Osmani Feria García present a new approach to one of the most emblematic sites for the study of the Lithic and Archaic Ages in Cuba and the Antilles: the Levisa 1 site. The critical revaluation of the context of this site, far from reinforcing the traditional criteria for the Lithic and Archaic Ages, rather dismantles them and points to the need to study the convergence, coexistence, and interaction between cultures traditionally separated by the "age system." In addition, this approach points to the more precise chronological and contextual register of multicomponent sites, and the impossibility of understanding them using preestablished chronological-cultural schemes. In Chapter 14, William Keegan broaches an unresolved issue in Caribbean archaeology, namely the question of why there is no evidence for Lithic or Archaic Age sites in Jamaica. He argues that it is possible that sites from these time periods will eventually be discovered, but given the extensive investigations by avocational and professional archaeologists, it is more likely that the island was not settled before AD 600. Although the available evidence for artifacts that could date to this time is discussed, more importantly, the situation raises questions regarding the way the problem has been framed. It is argued that classifying cultural practices according to an age system limits our understanding. Keegan suggests a new focus on mode of life (*modo de vida*) and human ecodynamics and argues that the redware period in Jamaica (often called Ostionoid) is in fact a continuation of a *protoagrícola* (Archaic Age) way of life. With regards to the question of why Jamaica was not settled earlier, the only answer at present is that maritime conditions limited access to the island. In Chapter 15, Reniel Rodríguez Ramos, Jaime Pagán-Jiménez, Yvonne Narganes Storde, and Michael Lace discuss rock art and its associated archaeological remains from the Cueva Ventana cave site in Puerto Rico. Caves constitute some of the most important, yet commonly understudied archaeological contexts in the Antilles. This is particularly the case for the caves occupied by the primeval inhabitants of the islands. In this chapter, the authors discuss the potential role(s) of caves during the early precolonial period of Puerto Rico based on data generated from excavations at Cueva Ventana, one of the earliest archaeological sites documented in the mountainous interior of the island. The information that has been generated from this cave context lends support to the pre-Arawak presence of cultivars in the insular Caribbean, including manioc and maize, as well as the ability to process wild (albeit potentially tended) resources such as zamia and *zarzaparilla*. Furthermore, the presence of pottery supports the idea that this type of material was already present during this early period. This information, together with the presence of rock art and sumptuary artifacts in this cave, show that these enclosed spaces not only served for dwelling purposes, as commonly assumed, but that they also began to constitute ceremonial scapes for early societies. This leads the authors to argue that the substratum of the spiritual worldview articulated much later in time, in which caves formed an integral element, began to take shape from the initial occupations of the island. In Chapter 16, Casper Jacobsen Toftgaard discusses the first scientifically examined Archaic Age sites in the Virgin Islands, which were excavated at Krum Bay on St. Thomas in 1923. These excavations were very successful, but the results have since faded into near oblivion, which is all the more unfortunate given that the excavation methods used were outstanding for that time. The excavation results were briefly published by the primary excavator, Gudmund Hatt (1924), and later in fuller form by Ripley Bullen (1963). However, Bullen never retrieved the excavation diaries or all the artifacts; therefore, an untapped research potential exists, and the preliminary evidence suggests that the Archaic Age past of the Virgin Islands needs revision.

In summary, the chapters in this section strengthen the realization that different views of sites and materials can broaden our understanding of the diversity and dynamism of the indigenous societies thus far considered "Archaic." They also emphasize that comparative regional approaches are essential for the critical evaluation and modification of the existing interpretations of early indigenous spaces in the insular Caribbean. Finally, the interdisciplinary research discussed in these chapters indicates how diverse socioeconomic, environmental, and symbolic factors could have contributed not only to the cohesion of the Archaic Age settlers, but also somehow fomented their presence in the next, so-called "Ceramic Age" of the precolonial history of the Antilles.

The chapters grouped in the third part, *Mobility and Exchange*, provide insights into the emerging dynamics, complexities, and mobilities in the indigenous worlds of the deep past. Such qualities cannot be expected of the "walking stomachs" imposed by nineteenth-century unilineal evolutionism onto previously assumed Archaic Age modes of life. This part presents us with a novel perspective on the amply interconnected worlds in which goods and ideas united peoples as materials flowed across large stretches of the Caribbean coasts and islands. In Chapter 17, John Cherry and Krysta Ryzewski present an Archaic Age site that has recently been discovered at Upper Blakes in northern Montserrat, with associated ^{14}C dates of 2878–2832, 2820–2657, and 2654–2633 cal BC. Unlike most Archaic sites in the Lesser Antilles, it is located well inland and at relatively high altitude. Comprised exclusively of lithics, using cherts from Long Island on Antigua, the technology focuses on the *in situ* production of blades and macroblades, with a scarcity of formal tools or retouched items. The specialized nature of the assemblage and the lack of other early sites on Montserrat mean that it may reflect one or more visits by Archaic Age peoples living on Antigua, rather than permanent settlement on Montserrat itself. In Chapter 17, Corinne Hofman, Lewis Borck, Emma Slayton, and Menno Hoogland study fisher-collector sites in the northeastern and southern Caribbean that have shown that Archaic Age communities managed extensive subsistence/resource/activity systems, involving intra-archipelagic and mainland-island voyaging. The authors indicate a set of vital resources, which would remain important for later Ceramic Age communities, that guided the formation of early procurement and, by extension, social networks. For the northern Lesser Antilles, one important node is the flint sources on Long Island (Antigua). This is illustrated by the Plum Piece camp site, located at 400 m asml in the tropical forest of Saba, whose record suggests a yearly cycle of archipelagic resource mobility, of which the flint sources on Long Island were a crucial part. They further suggest that for the southern Caribbean islands, the rich marine shell resources may have fulfilled a similar role. The *Lobatus gigas* heaps at Spanish Water, Curaçao evidence the intensive exploitation of shellfish and potentially the preparation for transport to the mainland. Using computer models of reciprocal voyaging and archaeological network exploration, Hofman and colleagues put forward novel insights into the early formation of social networks around the Caribbean Sea.

The chapters contained in this part suggest that the Archaic Age communities were organized around complex cycles of most probably seasonal mobility, based on the search for food, raw materials and certain symbolic elements. The mobility of these populations is attested by the systematic presence of exogenous biotic and abiotic raw materials in the archaeological sites (largely shells and lithic) that were displaced from island to island. These movements are the result of either an exchange between Archaic Age communities, shipments to the supply sites, or an admixture of the two hypotheses. Interestingly, computer simulations propose diverse predictive models to analyze the lifestyles of the Archaic Age settlers.

The volume concludes with an Appendix edited by Menno L.P. Hoogland presenting the calibrated chronometric data on this early period of Caribbean settling that is currently available to us. The Appendix includes more than 480 previously published and unpublished ^{14}C dates for the first settlement of the insular Caribbean. The dates listed are the result of a joint effort of all contributors to the volume. In the chapters we have followed the preferences of the authors, i.e., ^{14}C dates from archaeological sites as BC/AD – cal BC/AD or BP – cal BP.

Acknowledgements

We would like to acknowledge all the participants of the SAA session in Orlando, and in particular those who ultimately could not participate in this volume for various reasons, such as Dominique Bonnissent and colleagues (on St. Martin Archaic Age sites in the context of the northern Lesser Antilles), Alvaro Castilla-Beltrán (modelling Archaic Age mobility in the northern Lesser Antilles), Martijn van den Bel (on Archaic Age French Guyana), Mirjana Roksandic and colleagues (on an Archaic Age burial from the Caribbean coast of Nicaragua), and Ivan Roksandic (on linguistic origins). On the other hand, we have invited other scholars, such as John Cherry and Krysta Ryzewsky (on Archaic Age flint production on Monserrat and its relationship with the flint quarries on Antigua) to complement the topical focus that we wish to reflect in this volume.

We want to acknowledge Alvaro Castilla-Beltrán, Kristen de Joseph, Angus Martin and Dan Bailey for their help with the bibliography and editing the English language of the chapters, of which several were written in and by Spanish-, French-, and Dutch-speaking colleagues. We especially would like to thank Emma de Mooij for her outstanding editorial help. The final preparation stages of this work were supported by a fellowship from "The Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS)" awarded to Corinne L. Hofman in 2018. Finally, we would like to thank Marlena and Menno for supporting us during the editorial process of this volume and we would like to dedicate this book to our sons Konrad, Yann and Oliver, who have been participating in and following the work of the four of us in the Caribbean ever since they were born!

2

Dearchaizing the Caribbean Archaic

Andrzej T. Antczak and Corinne L. Hofman

Introduction

In this chapter, we focus on broad topics related to human/environment interactions, time, scale, and complexity in the insular Caribbean. However, these topics are diversely entangled with tightly interrelated concepts that include power, gender, mobility, identity, ethnogenesis, language, warfare, islandscapes, places, animals, spirits, things and affect, and emotion, among others. The material manifestation of some of these concepts and their participative roles in forging, sustaining, and changing the Archaic Age communities are variably reflected in the chapters that follow. Finally, we outline avenues for future research.

Recent archaeological research has created significant fissures in the traditionally accepted, monolithic definitions of the Caribbean Archaic Age. Thus, more than ever, the question "was the *Archaic* a specific age, a definable stage of sociocultural trajectory, or a socioeconomic mode of life?" requires a more studied reply. In fact, cracks in the conceptualization of *Archaic* or *primitive* peoples in precolonial South America can be found in the anthropological writings of many decades ago. Claude Lévi-Strauss, for example, noted in the '60s that under the increasing scrutiny of anthropologists, the *archaism* of Amazonian societies appeared less certain than before (Lévi-Strauss 1963, 105). During our session, we realized that different opinions – not disagreements – also exist regarding the conceptualization of what is and what is not *Archaic*. But undermining all these opinions requires challenging certain unchallenged critical preconceptions that lie at the very foundation of the *Archaic* concept itself (cf. Nash 2003, 200).

Lévi-Strauss's call for the disengagement of anthropology from "philosophical residue surrounding the term *primitive*" (Lévi-Strauss 1963, 117) is being taken up by scholars who work within the stream of the ontological turn in the social sciences. In this approach, according to Martin Holbraad and Morten Pedersen (2017, 152), "the only thing that may be deemed 'primitive' in anthropological parlance is the impoverished framework upon which anthropological analyses sometimes rest."

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 29-42.

Here, we call for the archaeological reassessment of the adequacy of the term and concept *Archaic* to denominate the early indigenous settlers of the insular Caribbean. This aim can be achieved through critical recalibration of the epistemological and ontological levels at which the archaeological analyses of the Archaic Age past take place: the level of Western scholarly projects and that of the non-Western grounding of the world's understandings (Course 2010, 248). Continuing with the inadequacy of the current terminology hampers our understanding of the Archaic Age peoples at each of the abovementioned levels and contributes to the preservation and even further pollution of their current biased perception; these concerns were expressed by the participants of the SAA session.

Conceptual conundrums

The concerns begin with the very pertinence of the term *Archaic*, widely used in Caribbean archaeology to denote one of the earliest stages in the indigenous settling and inhabitation of this macroregion. Irving Rouse and José M. Cruxent (1963, 22; Cruxent and Rouse 1958) used material culture signatures of early indigenous technologies and subsistence strategies to define four subsequent "epochs" of the Caribbean's cultural history: Paleo-Indian (15,000–5000 BC), Meso-Indian (5000–1000 BC), Neo-Indian (1000 BC–AD 1500 [further subdivided into three periods]), and Indo-Hispanic (AD 1500 to the present). Later, Rouse (1972, 136–138) redefined the epochs, based on mostly technological terms, into four consecutive "ages": the Lithic (4000–2000 BC), Archaic (2000–500 BC), Ceramic (500 BC–AD 1500), and finally Historic Age, which brings us to the present. Other scholars have considered the Archaic as a developmental stage in which subsistence was largely centered on the exploitation of marine environments. This was conceived as a stage of subsistence largely dependent on mollusk-gathering (Davis 1982), which precedes a further stage of terrestrially-oriented subsistence (Willey 1976). Meanwhile, Rouse and Allaire (1978) defined the Archaic as an "age" technologically marked by the absence of pottery and the use of ground stones and shells (Goodwin 1978; Veloz Maggiolo 1972; Veloz Maggiolo and Vega 1982).

Despite these divergences and the ensuing debate, the starting point of the Archaic Age or period in the entire Americas is still largely considered to coincide with the beginning of the Holocene (Browman *et al.* 2005, 313). In this volume, we favor a tripartite chronostratigraphic subdivision of the Holocene into the Early (11,700–8200 BP), Middle (8200–4200 BP) and Late (after 4200 BP) intervals, as this organization coheres well with the chronological conceptions used by the contributors. The boundaries between these temporal series have been marked by nearly globally documented climatic shifts, and interrelationships between these events and historical processes around the world have been largely correlated (Braje and Erlandson 2013; Siegel *et al.* 2005; Walker *et al.* 2012, 654–655). It is still debated whether the term *Anthropocene*, coined to designate the epoch in which Earth's "natural" systems became dominated by humans, should replace *Holocene* for its entire time span (Braje *et al.* 2014; Erlandson and Braje 2014; Rivera-Collazo 2015). The heat of the recent debate about the conceptualization of the Anthropocene (Erlandson and Braje 2014; Malhi 2017; Morton 2014; Whitmore 2018; Williams *et al.* 2015) can particularly be felt in the controversy over the very dating of the beginning of this epoch: some put it at the Pleistocene/Holocene boundary (ca. 11,700 BP), others at the Mid-Holocene rise of agriculture (ca. 7000 BP), others at the onset of the industrial revolution, ca. AD 1800 (Steffen *et al.* 2011; Young *et al.* 2006), and still others at the onset of the Atomic Age, i.e., the mid-twentieth-century (Ellis *et al.* 2013, 1).

Transitioning from the archaeological terminology and adapting the notion of *dearchaization* (Michaluk 2014) to our purposes, we briefly revise the usefulness of the term and concept *Archaic* as it has been applied thus far in Caribbean archaeology. We do this amid increasingly precise and sophisticated cutting-edge technologies as well as shifting research paradigms that enable the investigation of human beings in deep-time perspective. We also acknowledge the role of the swiftly changing economic, sociopolitical, ideational, and environmental realities of the modern world, which is to say the world surrounding the scholars active in academia. In this context, the meaning of the term *Archaic* has been in constant flux, broadening, or narrowing due to the exponential increase in the use of metaphors and analogies as well as the constant birth of new, interrelated terms and concepts.

The widespread use of the term *Archaic* in the modern Western world has often been related to the notions of *primitivism* in art and cultural colonialism (e.g., Hiller 1993, 11; Price 1989; Rhodes 2008). But the scenarios that have emerged from recent interdisciplinary archaeological research into the deep human past became strikingly counterintuitive to the above notions and incentivized us to undertake the task of *dearchaization* of the Caribbean Archaic Age. Among the building blocks of such scenarios are the variables related to human/environment interactions, time, scale, and complexity that we discuss in the sections below. Critically defining these variables and operationalizing them interdisciplinarily in specific case studies may help us not only to better understand this deep past but, at the same time, to dearchaize the conceptual grounding of the Caribbean Archaic Age as a chronological period. Any change in chronological conceptualization, moreover, translates to substantial shifts in the overly qualitative perceptions of these early indigenous peoples and their historical roles. Were the early indigenous peoples simply wiped from the historical-geographical record by later, more advanced migrants? Or did they contribute, and if so how, to subsequent sociocultural dynamics in the Caribbean? Throughout this volume, the attempts at replying to these questions will provide a better scholarly understanding of the early settlers of the Caribbean. Moreover, we are confident that it will also contribute to changing the essentializing and pejorative perception of these early indigenous peoples as "walking stomachs and talking heads" or "sitting ducks" (Gamble and Roebroeks 1999, 10; Rouse 1992, 70; see also Antczak *et al.* 2018; Hofman *et al.* 2006; Rodríguez Ramos *et al.* 2013).

Humans and the environment: Two sides of the same coin?

For more than a century, the impacts of paleoenvironmental and paleoclimatic factors on the developmental trajectories of human societies have been the focus of archaeologists, environmental scientists, and historical geographers (Dincauze 2000; Fisher *et al.* 2012; Joyce and Goman 2012; Reitz and Shackley 2012; Terrell 2006). Evolutionary-driven environmental determinism focused the attention of the twentieth-century scholars on the rise of agriculture and its revolutionary role in the trajectories of human societies (Barker 2009; Roosevelt 2016; Terrell *et al.* 2003). Demonstrable environmental impacts on the trajectories of past indigenous cultures in the precolonial Americas have also been compellingly proven (e.g., Meggers 1996; Peterson and Haug 2005; Sandweiss *et al.* 2009). However, skeptical voices consider that the establishment of contemporaneity between climate change and culture change "is not enough" claim of a causal correlation between them, but only a starting point for further investigation into such a hypothetical causality (Contreras 2017; Hulme 2011).

In recent decades, deterministic approaches were abandoned in favor of bidirectional interactions rather than unidirectional causality (but see Hulme 2011 for a recent variant of climate determinism). They aimed at the conceptualization of changes in socionatural or socioecological systems including historical ecology, cultural niche construction, landscape management, and human ecodynamics (Antczak and Cipriani 2008; Balée 2013a/b; Crumley *et al.* 2017; Hofman and Hoogland 2018; Holm *et al.* 2001; Kennett and Beach 2013; Kirch 2007; Laland *et al.* 2016; McGlade 1995; Rick *et al.* 2013; Rostain 2016; Schaan 2016; Siegel 2018; Smith 2015b; Zeder 2016). Recent developments also add approaches from political ecology, ethnobiology, sustainability, and several more specific perspectives that aim at pulling apart the divide between nature and culture by exploring the differences between Western and non-Western ontologies (Descola 2013; Ingold 2000a, 2017; Kohn 2013; Menon and Karthik 2017; Viveiros de Castro 1998; Wolverton *et al.* 2014). In these approaches, albeit to varying degrees, the factors conducive to change come from natural and social domains in largely recursive and mutually constitutive interaction. Therefore, the aim would be to establish sound chronological sequences for both archaeological and paleoenvironmental data, then move on to deeply grounded causal and inter-causal explanations, thereby bridging the theoretical divide between the social and the ecological (Joyce and Goman 2012).

The theoretical preoccupation of current archaeological discourse not only focuses on the recursive interplay between the 'realms' of the sociocultural and the natural (if not on entirely dismantling the nature/culture divide), but also considers the sociocultural consequences of gradual, punctuated, and catastrophic environmental change. The release of powerful natural forces such as tsunamis, hurricanes, volcanic eruptions, and earthquakes, not to mention asteroid impacts, seems to remove choice from human survival (e.g., Cooper 2013; Cooper and Peros 2010; Hofman and Hoogland 2015; Malaizé *et al.* 2011; van Nooren *et al.* 2017; see chapters by Rivera-Collazo, Cherry and Ryzewski, and Haviser this volume). But the indigenous peoples of the Caribbean Archaic Age were attentive to and monitored these happenings in order to respond to them accordingly; whatever the sociocultural shifts were, they were tightly interrelated with changes that occurred in associated ecosystems (Mayewski *et al.* 2004, 244–245). The response to catastrophic events could involve significant changes and promote societal sustainability or collapse (Butzer 2012; Fitzpatrick *et al.* 2008). Such post-cataclysmic transformations and reorganizations of the socioecological or socionatural landscape(s) were a product of conscious choices and unintended actions and operated at different scales of space, time, and social organization (Cooper 2012; Redman 2005) across the entire macroregion. The transgenerational management practices could mitigate the effects of catastrophic events (Terrell 2006; see also Hill 2011;

Sassaman 2016), effectively dealing not only with subsistence-related stresses, but also with indigenous experiences of material absence or loss in the material post-cataclysm worlds (Bille *et al.* 2010, 3; Samson *et al.* 2011). In long-term diachronic perspective, such sudden catastrophes should be examined *alongside* the long-standing effects of the unintended anthropogenic environmental changes that indigenous societies put in motion as a result of the strategic interplay of sustainability and resiliency (Tainter 2006). All the abovementioned topics are important opportunities for further interdisciplinary studies on the Archaic Age societies. But the socioecological resilience that can be perceived in the deep archaeological past cannot be taken for granted in the rapidly changing present-day Caribbean, where the modern understanding of natural phenomena goes hand in hand with active management and deterrence (Adger *et al.* 2005; Stancioff 2018).

Time

Time is one of archaeology's heuristic tools *par excellence*, used in defining the historical flow of past cultures and, indeed, separating them from the present (Thomas 1996). Therefore, the notion of time plays a critical role in the archaeological determination of what could be and what cannot be *Archaic*. Scholars working in the Circum-Caribbean beyond the insular archipelagos use different terms, concepts and corresponding time ranges than the already mentioned Roussian categorizations (e.g., see Rosenswig 2015, 116–117; cf. Joyce 2004, Figures 1.4–5, 15 for the Archaic Age in Mesoamerica). Despite these differences, however, all Archaic Age peoples were traditionally defined by what they were missing in comparison to those who came later (see Fowles 2010): they were missing not only pottery, but also material signatures related to agriculture and sedentism. This initially clear-cut distinctiveness of these peoples with respect to their predecessors (the Lithic Age peoples) and successors (Ceramic Age peoples) has been increasingly questioned in recent years.

Under critical scrutiny, foraging, long considered the opposite of farming (or agriculture *sensu stricto*), emerges as not always being as different as has been commonly thought. "Farming" in the Caribbean is a loose term encompassing a diverse range of human behaviors and relationships with other-than-human species (Reid 2018). In this sense, advances in archaeobotanical research have had a profound impact on the recent way of looking at Caribbean Archaic Age peoples' subsistence (Pagán-Jiménez *et al.* 2015). At some Archaic Age sites, the initial recovery of macrobotanical remains from fruit trees (e.g., avocado and several Sapotaceae species such as yellow *zapote* and *sapodilla*) and seed plants (e.g., Mexican-poppy and iguana hackberry), remains known to be exogenous to the Caribbean islands, led Newsom (1993) to argue that intentional cultivation of these and similar plants may have begun during Archaic Age times. Her findings partially supported previous notions posited by Davis (1988), who suggested that at least some cultivated plants historically used in the insular Caribbean could have been carried to the islands before the Early Ceramic Age. Despite these realizations, until recently, the predominant narrative regarding Archaic Age subsistence strategies maintained the ideas originally proposed by Rouse (1956, 1960, 1992), namely that Archaic Age peoples were basically hunter-fishers and gatherers who simply adapted their continental subsistence strategies and skills to their new insular environments. By the same time, other narratives used concepts such as the appropriator (*apropiador*) or the gatherer mode of life (*modo de vida recolector*) (e.g., Guarch Delmonte 1990; Veloz Maggiolo and Vega 1982; see also Sanoja and Vargas 1974, 1995) to describe a similar subsistence-oriented perspective on Archaic Age peoples.

In 2005, all of these previous interpretations were firmly questioned by Pagán-Jiménez and colleagues (Pagán-Jiménez *et al.* 2005; see also Pagán-Jiménez 2009, 2013) after performing an archaeobotanical analysis of lithic grinding tools from two Archaic Age sites in Puerto Rico: Puerto Ferro and Maruca. Direct microbotanical data (starch residues) extracted from two groups of tools revealed, for the first time in the insular Caribbean, the use of some of the most important domestic plants known in the Neotropics, such as maize, manioc, sweet potato, bean, and *achira* (*Canna* spp.), in addition to high-yield wild plants like *marunguey* (*Zamia* spp.), palm, and yam. This new data was used (Pagán-Jiménez *et al.* 2005) to critically open the debate on the assumed simple and preagricultural sociocultural structure of the so-called Archaic Age populations in the Caribbean islands. Similar realizations made in other parts of the Americas set the stage for discussing aspects of early indigenous interactions with plants and animals as well as their mobility. In eastern North America, for example, the hunting of small game animals and plant gathering has also been discarded as factors separating Lithic (Paleo-Indian) and Archaic subsistence practices (Stoltman 1992). By the same token, the evidence of plant cultivation or the presence of pottery has not been taken to mark the end of an Archaic Age and the beginning of the following stage. Willey and Phillips (1958, 108), nearly 60 years ago, had already found evidence of plant cultivation to cohere with the then-existing conceptualization of Archaic Age peoples' subsistence pattern. Thus, several decades ago in eastern North America, archaeological evidence of plant cultivation was widely accepted as a feature of the Late Archaic stage. It has also been recognized that pottery was consonant with Archaic Age innovation. In Mesoamerica, the Archaic period is considered to end with the first evidence of pottery use during the Early Formative Period. However, in the Maya area specifically, pottery appeared at the end of the second millennium BC, that is, nearly 1000 years later than in other adjacent regions (Rosenswig 2015, 122). Coupled with similar evidence of differing regional-temporal appearances of horticulture, this data suggests that the populations of the Archaic and Formative periods coexisted and interacted in various ways during the second millennium BC (Rosenswig 2015). Interaction between foragers and horticulturalists has been documented throughout the entire Circum-Caribbean, both in the form of ongoing sequences of events varying by locality or region, and as a segment of a larger-scale phenomenon. Either way, such interaction should not be straightjacketed *a priori* into any given block of time (Joyce 2004, 18).

In the insular Caribbean, local pottery production on the part of Archaic Age peoples has been demonstrated in recent research side by side with the use of imported pottery that was made by "others" (e.g., Kozłowski 1974; Rímoli and Nadal 1983; Rodríguez Ramos *et al.* 2008a; Ulloa Hung and Valcárcel Rojas 2002, 2013; see also several chapters in this volume). Moving even further back in time, the purported lack of ground-stone technology among Lithic Age predecessors of the Archaic Age peoples has also come into question (Keegan 2006; Rodríguez Ramos *et al.* 2008a). Some researchers have suggested that the pre-Arawak Pottery Horizon was developed in the

Antilles prior to the arrival of the Arawakan-speaking Huecoid and Saladoid pottery makers. Therefore, a more appropriate term for Lithic or Archaic Age insular groups, or both, might be "pre-Arawak" (Keegan 2006; Keegan and Rodríguez Ramos 2007; Rodríguez Ramos *et al.* 2008a). This conceptualization, previously signaled in diverse ways by Latin American archaeologists (e.g., Chanlatte Baik 2000; Dacal Moure and Rivero de la Calle 1986; Pantel 1996; Ulloa Hung and Valcárcel Rojas 2002; Veloz Maggiolo and Ortega 1996), emphasizes the dynamic nature and technological sophistication of indigenous societies before the inception of the Ceramic Age, which, according to the periodization of Rouse (1972), had happened by 500 BC.

When discussing time, however, we should also ask ourselves how much confidence may be placed in the absolute dating of Caribbean Archaic Age sites/materials – especially those dates determined during the first decades of the ^{14}C boom. Since the discovery of the radiometric dating method based on the isotope carbon-14 in the late 1940s (Curtis *et al.* 1981), thousands of archaeological samples from the Caribbean macroregion have been processed in various laboratories across the world. The dates obtained have constituted the backbone of the cultural-chronological charts (Rouse 1955). Recently, however, the fast-evolving sophistication of the techniques of radiocarbon corrections and calibrations has occasioned serious concern about the accuracy or even the very validity of early and uncalibrated dates. If the uncalibrated radiocarbon dates are wrong, then the synchronization of sociocultural events and the environmental episodes in which these dates were used is also wrong. In addition, Caribbean absolute chronology is heavily dependent on samples coming from the remains of marine animals and from the bones of humans whose diet could have included a significant intake of marine food. Such samples require critical application of local reservoir corrections as well as comparison and contrast with the results of alternative chronometric techniques (Fitzpatrick *et al.* 2015, 8; Pettit 2005, 317; Pollard 2009, 159; Thomas 2015).

Finally, we emphasize the recent recast of scholarly attention on the topics of continuity and interaction. In the Old World, for example, research on coexistence, assimilation and interbreeding between Neandertals and early modern humans in western Eurasia, as well as investigations on diverse forms of interaction instead of the previously suggested clear-cut displacement of the European Late Mesolithic hunter-gatherers by the first farmers incoming from the Near East, has been increasingly supported by relevant genetic data and novel approaches to old problems (e.g., Villa and Roebroeks 2014). But in the insular Caribbean, is our move in direction of continuity and interaction decisive, or is it still at the stage of wishful thinking? Despite the claims of some scholars who believe that much of the archaeology in the Circum-Caribbean continues within the cultural-historical framework (Webster 2009, 20), we consider that the move in the abovementioned direction is unstoppable. Several chapters in this volume clearly indicate that many Archaic Age populations of the Caribbean leaped out of the time frames traditionally assigned to them by cultural-historical archaeology and continued to thrive until AD 600–800 or even later (e.g., see particularly the chapters in this volume by Kelly and Hofman, Rodríguez Ramos *et al.*, Ulloa Hung and Valcárcel Rojas, and Valcárcel Rojas and Ulloa Hung). Perhaps, if we want to maintain the notion of the Archaic Age as a useful epistemic tool in Caribbean archaeology, then the term should be defined in a more fruitful way than by positing a chronologically bounded period. Can we consider the Caribbean Archaic Age an assemblage of specific socioenvironmental parameters, a type of subsistence economy, a sociocultural pattern loaded with ideational meanings or as a locally contingent admixture of all these characteristics? We do not have a ready-at-hand reply to these questions, but we already know that several lifeways-defining conditions and activities related to sedentism, agriculture, pottery-making, and non-egalitarianism have lost their persuasiveness as characteristics restricted exclusively to the "following" Ceramic Age peoples. Moreover, we also know that Archaic Age peoples were not simply replaced by more advanced pottery makers and sedentary agriculturalists. Instead, they functioned as vital but still barely understood agents of interaction who channeled the foundational shifts of the post-Archaic Age (Hofman *et al.* 2011, 2014b, 2018b, this volume; Rivera-Collazo 2011a/b/c; Rodríguez Ramos *et al.* 2008a).

Scale

In the insular Caribbean, distinct Archaic Age peoples could employ subsistence strategies variably dependent on hunting, fishing, gathering, horticulture, and pottery production, and could be characterized by diverse residential mobility. Similarly, across the Circum-Caribbean, we probably confront an array of resource use strategies that changed over time (Rosenswig 2015). Although such variability is more reasonably to be expected than homogeneity (Zeitlin and Zeitlin 2000, 46), concrete examples that could support one side or the other depend on the scale of analysis that is used in approaching the ancient peoples and their worlds. This heuristic tool allows the deactivation of micro-foci placed on local scenarios in favor of opening a wide lens on the scale of macroregional *longue durée*, in which we miss the fine-grained resolution of everyday lives of Archaic Age communities. To change the focus of analysis from local and eventful realities to macroregional and *longue durée* conceptualizations is to change from nuanced and admittedly messy pictures of events, peoples, and things to a single, much neater broad-brush picture of a large time and place. Such a perspective often exhibits convincing overall patterns of operating forces, factors, variables, and parameters, and may be achieved by the application of people-free system theory and other functionalist approaches (Harris 2014).

On the macroscale of deep-time history, the *ultimate causes* of the changes observed along sociocultural trajectories have often been attributed to coincidental climate change (Rosenswig 2015, 120; see also Hodell *et al.* 1991). For example, there is an increasing indication that many transitions from one cultural period to the next occurred at times of major ecological and environmental change (Barker 2009, 472; Kennett *et al.* 2012; Rosenswig 2015, 145). Nonetheless, synchronizing sociocultural and environmental events within a sound chronological frame of interrelation and causation persists as one of the main challenges archaeologists face (Munoz *et al.* 2010). Understanding these interrelations not only requires sound dating of both long- and short-term processes, it also requires special attention to the intersections – the antecedents, causes, and results – of microscale events and long-term large-scale phenomena (Robb and Pauketat 2013, 3). We may know *when* something happened, but that does not mean we understand the nature and dynamics of the relationship between *before* and *after* the something, and any "archaeology which cannot apprehend [that]…

is a mere work of fantasy" (Pollard 2009, 164). Clearly, such research demands that the close conceptual correspondence between natural and cultural variables be compared.

The search for *proximate causes* brings the *longue durée* perspective down to the microscale of specific historical cases or the *social time* (Braudel 1980, 3). On a microscale, we may start to (re)populate the deep Caribbean past with early indigenous communities composed of peoples and things (see Harris 2014, 92). It is on this scale that we may also realize that the Archaic Age communities could have coexisted on certain Caribbean islands, perhaps much more closely related to each other than we have been able to imagine. To understand the strategies that might have been applied by a specific sociocultural formation to cope with perceived ongoing climate change, the microscale focus is placed on the interrelations between peoples and the material circumstances of their encounters with their surroundings. This move away from generalizing and reductionist trends toward multiple pathways or trajectories or locally variable socionatural configurations accords with a general "postmodernist turn" in anthropology and archaeology (Harrison-Buck 2014). The possibility of an interpretative shift goes even further. An especially attractive approach to the early Caribbean settlers may construe humans as parts of relationalities rather than objects (as in traditional large-scale approaches) or subjects (traditional agential approaches) (Robb and Pauketat 2013, 28). In general, the microscale offers the chance for Archaic Age Caribbean archaeology to transform the dots on distribution charts depicting so-called "natural processes" into locales inhabited by communities of peoples with an embodied understanding of the surroundings they inhabited (Ingold 2000a; Lock 2009, 178–179).

Complexity

New archaeological discoveries, cutting-edge technologies, critical revaluation of existing datasets (including museum collections) and, crucially, the adoption of novel theoretical frameworks have not only prompted exploration into hitherto unexamined interactions between Archaic and Ceramic Age peoples; these factors have also stimulated a critical evaluation of the social complexity characterizing early Caribbean settlers (Boomert 2000; Curet 2003; Curet *et al.* 2004; Keegan and Hofman 2017; Siegel 1989; Wilson 2007). Traditionally, complexity has been employed as a concept intimately related to the sociopolitical *hierarchical* stages perceived in the evolution of a social system. It was derived from the doctrine of progress rooted in nineteenth-century unilineal evolutionism (Sanderson 1990). In the 1970s and '80s, however, approaches to social complexity became increasingly more flexible and sensitive to specific historical and sociocultural contingencies while still being functionally associated with inequality. Recent research into social complexity aims to disclose attributes of human systems that might have resulted from interactions among human beings, other-than-human beings, things, and surrounding environments. Some researchers argue that focusing on how power is managed within society might be a better approach to social complexity than understanding how hierarchy emerges, especially because hierarchy is often purposefully discouraged (Angelbeck and Grier 2012; Borck 2016; Borck and Simpson 2017; Borck and Sanger 2017; Crumley 1995, 2003; Flexner 2014; Fowles 2010; Graeber and Sahlins 2017; Scott 2017; Wengrow and Graeber

2015). This approach may be particularly well-suited to the study of early Caribbean settlers, peoples often portrayed as egalitarian societies. Moreover, this approach may also assist in understanding simplicity in the modern world beyond helping to dearchaize the Caribbean Archaic.

Two decades ago it was argued that the presence of a stable food supply was a fundamental condition for the development of sociopolitical complexity (Feinman 1995; Hayden 1995). Accordingly, unpredictable subsistence-related resources were held likely to prevent the formation of hierarchical sociopolitical structures (Morgan 2009). The Lesser Antilles have been portrayed as unable to provide resources sufficient for sustaining substantial populations of human foragers (e.g., Keegan and Diamond 1987). Together, the above statements echo the decades-long debate arising from Betty Meggers's notion, on the one hand, of the Amazonian rainforest as an environmentally impoverished receiver of higher cultural influences from the Andes, versus Donald Lathrap's theory, on the other hand, that Amazonia is instead the donor of socio-cultural complexity, "the center and not the backwater of innovation, migration and cultural development" (Roe 1976, 73). The examples drawn from the northwestern coast's "complex chiefdoms" and Poverty Point groups illustrate an alternative argument, namely that sociopolitical complexity (i.e., hierarchy and division/specialization of labor) also occurs within resource variable areas as a means to organize against this variability (Borck 2016).

Returning to the Caribbean, the deterministic statements may be considered reiterations of the early colonial Spanish denomination of many of the small Antilles as "useless" (*islas inútiles*), islands sparsely populated by cannibal barbarians (Antczak and Antczak 2015; Hofman *et al.* 2018a). With the passing of time, all these statements have proved to be insufficiently supported by empirical data. It has been argued that the ecotonal areas in which diverse ecological zones intersect, and which are widespread across the Caribbean including the Lesser Antilles, could have provided resource stability to a considerable population (e.g., Pantel 1996). It has been recognized that the small islands are in fact important biodiversity centers, and as such, can offer – and could have offered – not only seasonally obtainable but also permanently available resources (Antczak and Antczak 2006; Hofman *et al.* 2006; Hofman and Hoogland 2018; Keegan *et al.* 2008; Miloslavich and Klein 2005; Rick *et al.* 2013). Scholarly debate has slowly moved beyond discussion of the purportedly determinant role of environment in societal trajectories, although much of the research is still fundamentally focused on environment. Tainter (2006) eloquently argued that social complexity, together with sustainability, emerges from successful problem-solving when a society faces difficulties – not from environmental constraints or affordances. If social complexity is the inclusion of hierarchical rulership roles and division of labor/specialization, Crumley (1995, 2003) and other scholars have regularly argued that complex or state-like societies are not sustainable, and only decentralized/heterarchical ones or those that can flip between centralized and decentralized (i.e., most recently Wengrow and Graeber 2015) have long-term sustainability. Therefore, any direct link between the small Lesser Antilles (with, in many cases, their often-reduced diversity of available resources) and the complexity of social organization should be critically revised with the use of adequate data and sound chronologies.

As mentioned above, Caribbean archaeologists now recognize that ceramics production and horticulture took place within previously "purely" Archaic Age contexts, and that some early indigenous societies were possibly sedentary. If the archaeological signatures of such subsistence-related realities have surpassed archaeologists' expectations, then it is also possible that Archaic Age societies were socially and politically much more complex than traditionally expected (e.g., Emerson and McElrath 2009, 25); or, alternatively, that their simplicity has been inadequately understood. Organizational, sociological, and anthropological literature (especially Boehm 2001; Clastres 1987; Scott 2017; Graeber 2011) make it clear that horizontal organizations can be much more complex than vertically organized "complex" societies. Therefore, perhaps we should avoid using the *simplicity* terminology, except when discussing how states rework complex behaviors into less complex ones (*sensu* Yoffee's [2005] legibility/simplicity work).

Archaic Age societies were traditionally portrayed as simple, nomadic, and egalitarian, whereupon they were inserted as such into neatly defined cultural-evolutionary frames. However, little attention has been paid to the question of how such systems featuring balanced power were attained and maintained over time within different Archaic Age communities (Borck and Sanger 2017). Contrary to the traditional perspective that still largely permeates the perception of Archaic Age islanders, these early peoples, as earlier noted, likely were not annihilated by or acculturated to more technologically advanced and socially complex newcomers. Instead, encounters and interactions with the so-called Ceramic Age immigrants could have evolved based on diverse forms and dynamics of transculturation (Ortiz 1995) or intercultural interaction. New approaches to socionatural dynamics in the Caribbean (Rivera-Collazo 2011a/b/c; Antczak 2018), along with further theorization and operationalization of concepts relating to neolithization processes (Hofman *et al.* 2018b), may help us discover strikingly new ways to support the non-linear reading of indigenous history. Non-linearity of social processes (Murray-Román 2015, 24) and hierarchy forms the basis of John McGlade's theory of ecodynamics (Garnsey and McGlade 2006; McGlade 1995, 2005, 2014). This theory should be taken up more daringly by Caribbean researchers. We should be able to explore the sets of interactions – not simple but complex – that ruled the creation of human-modified landscapes in the precolonial Caribbean. We can do this in three ways: by operationalizing the concepts of socionatural systems as social constructs; by tracing the coevolution of historically determined structures and contingent processes; and by addressing the multi-scalar temporalities mentioned above. Applying such paradigms can avoid the essentializing of, and blind oscillating between, the poles of equality/inequality or egalitarianism/hierarchy in the precolonial Caribbean. Power as a force can indeed be used to create equal cooperation or enforce labor. But we may perceive a continuum within a dialogic process that incorporates interactions between humans, the environment, animals, plants, and the spirit world. These and other approaches should more audaciously emphasize fluidity, historicity, and contextuality to cope with the multidimensional variability of Archaic Age societies already established in the archaeological record. Using novel heuristic tools and merging independent lines of evidence resulting from interdisciplinary synergies, researchers will become more sensitive to the archaeological signatures of differences between non-linear and unpredictable trajectories, between complex and complicated systems, and even between organized and disorganized complexity. Without delving deeper into this matter, we conclude that complexity can no longer be posited as an intrinsic ontological property of any specific past society. Complexity resides in the perspectives adopted by researchers.

Last, while stressing the interactions between Archaic Age and post-Archaic Age peoples, we should pay more attention to disentanglements, disruptions, and interruptions of connectivity, as well as to the temporalities, dynamics, and intensities of those separations (Antczak 2017; Semerari 2016). Intersocietal interactions could have been abruptly halted by non-anthropogenic catastrophic events, but we also have to focus our attention on those disruptions that are not always accidental or caused by environmental factors. Signals detectable in the archaeological record may also tell us about purposeful acts of social reorganization and internally triggered sociocultural changes that could easily have occurred within a single generation (Neff 2000, 427). On this scale of horizontal (i.e., between unrelated contemporaries) and heterarchical interactions, the causes of change might have been many but nevertheless amenable to identification through "thick" reconstruction of the past. Such an effort would involve interdisciplinary research incorporating archaeology, anthropology, geology, ecology, climatology, oceanography, and other related disciplines. The Archaic Age, approached in such a manner, can be rendered more palpable and three-dimensional. New insights may also be gained using sophisticated statistical packages, modeling and simulation, and applying them to ever increasing data bases (Kristiansen 2014). Although all our heuristic modeling, no matter how ingenious or extensive, cannot achieve a perfect portrayal of past reality (Beekman and Baden 2016), we believe that the Archaic Age, approached in such a manner, can be rendered as a socionatural unit more three-dimensional, vibrant and livable than it is perceived today.

Concluding remarks: Dearchaizing the past – dearchaizing the present

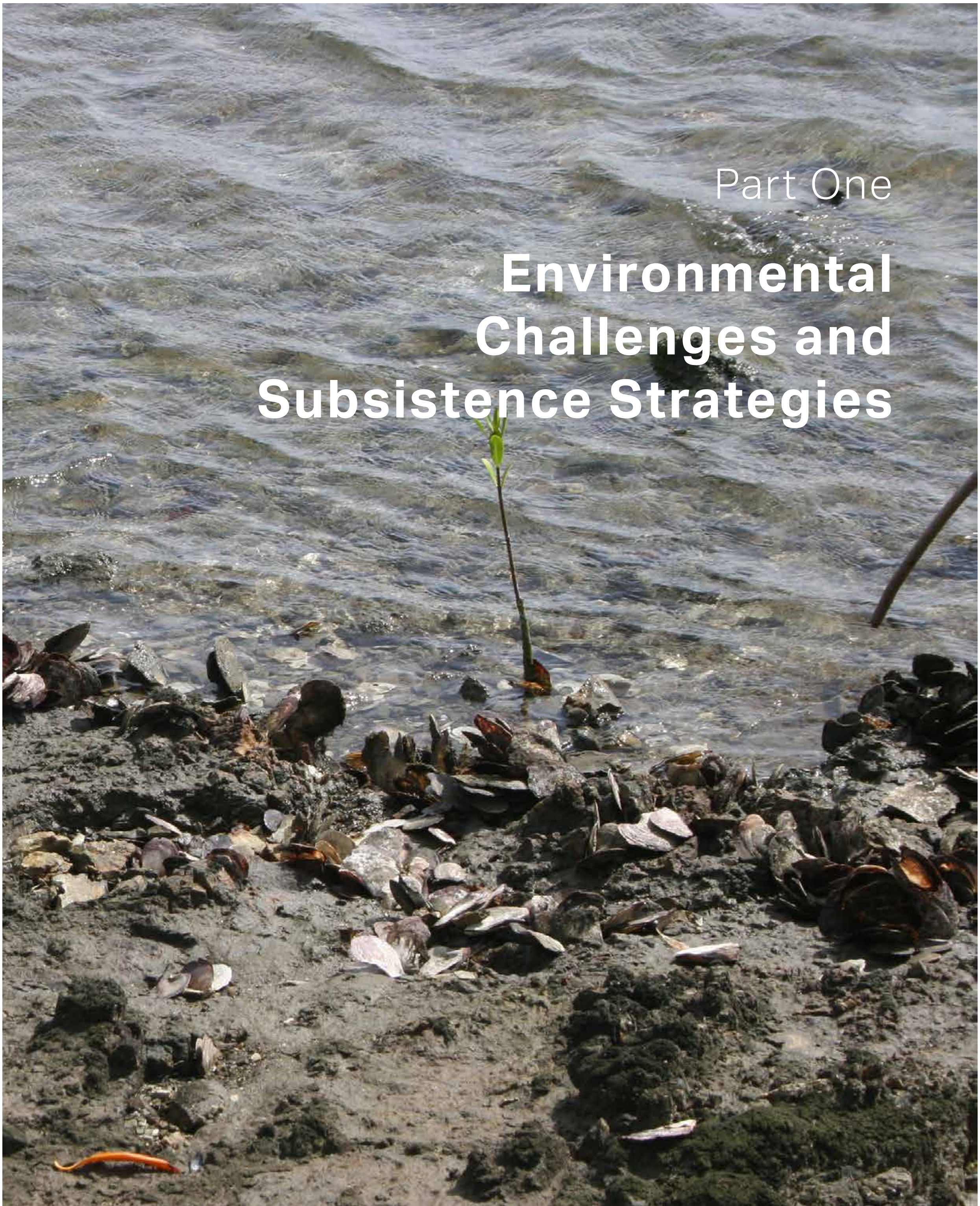
Upon discussing the antecedents and current understanding of the term and concept "Archaic" in the context of Caribbean archaeology in the previous sections, and introducing the content of this book's chapters, it became clear that, although the contributors employ this term, none applies it in the traditional sense: i.e., early indigenous peoples without pottery, agriculture, or sedentism, who lived and actuated within a rigidly determined time frame. Thus far, we agree that the first settling of the insular Caribbean macroregion began during the dramatic sea rise characterizing the beginnings of the Holocene at 11,500 BP and continued to the Mid-Holocene from about 7000 to 5000 BP. But it may be astonishing to some readers that purported Archaic Age populations were still present in the insular Caribbean at a much later date – some one thousand years later than the well-documented movements of Early Ceramic/Saladoid populations out of northeastern South America in the mid-first millennium BC. We recognize that even if recent research discussed in this volume continues to identify the presence of the descendants of early indigenous settlers in the further course of the Holocene, thus clearly slipping out of the time frame traditionally allocated to them, it also opens up a search for more robust replies to a series of pivotal questions. Were the early settlers genetically and/or phenotypically similar to or different from their predecessors and later successors (e.g., Schroeder *et al.* 2018; Mendisco *et al.* 2015; Mickleburgh and Pagán-Jiménez 2012; Pagán-Jiménez *et al.* 2015)? Were the Archaic versus non-Archaic populations comprised of distinct "peoples" with a distinct way of life (*modo de vida*)? How did the Archaic Age populations interact with the incoming "other" known as the "Early Ceramic" or "Early Saladoid" peoples? What was the overarching contribution of the Archaic Age peoples to the subsequent course of Caribbean history? Both the new results discussed in this volume and the gaps identified in our knowledge invigorate the debate. They naturally produce new research questions and hypothetical scenarios, which in turn instantly launch a search for new theoretical and methodological tools to address them. For example, among the questions that require future interdisciplinary research is the topic of the visibility of Archaic sites, as William Keegan addresses with respect to Jamaica in this volume. This problematic is also relevant for the Windward Islands, as it relates to the sociodynamic of the landscape of the islands, including changes in paleoshorelines and the extension of mangrove swamps, as well as the impacts of natural hazards.

In reviewing this volume, we can also ask: what baseline of knowledge remains on which to build the future of studies encompassing Archaic Age peoples of the insular Caribbean? Can the Caribbean Archaic Age play a leading role in the next stage of research on the Circum-Caribbean scale and beyond? The construction of this baseline is among the major challenges that Caribbean researchers face and requires sustained interdisciplinary effort. Sociocultural factors in the reconstruction of the Archaic Age paleolandscapes should be carefully evaluated and chronologically synchronized by interdisciplinary teams in case-by-case studies (see Redman 2005, 76). But approaching these worlds of the deep past also requires attention to the fact that the social realities of the early settlers of the insular Caribbean were most probably characterized by the simultaneous existence of diverse timescapes and multiple worlds (*sensu* Goodman 1978; also consider the role of time in the cosmologies and everyday life of present-day indigenous societies [e.g., Halbmayer 2004; Overing 1985; Viveiros de Castro 1998]).

Diverse perspectives and narratives of the Caribbean Archaic Age existed and will continue to exist. However, future research should also move forward in constructing bridges of understanding between the diverse theoretical frameworks and conceptualizations characterizing the various scholarly traditions and ways of thought in today's Caribbean. Conceptualizations such as *protoagrícola*, *agroalfarero*, *modo de vida*, Archaic, Mesoindian, pre-Ceramic, and pre-Arawakan, to mention just a few, are often entrenched in specific countries and associated with specific languages, histories of Caribbean scholarship, and sociopolitical stances. Even within the borders of a given nation-state, one finds strong adherence to the discrete bodies of work of specific researchers and their alumni. There are not only important semantic issues to be sorted out, but also conceptual ones. In a sense, this fragmentation is positive in its heterogeneity, but at the same time it severely hampers the productive exchange of ideas and a critical negotiation of shared perspectives on the Caribbean Archaic Age. Emerging from this predicament is an additional task for researchers in order to bridge the divides regardless of affiliation.

While recognizing the importance of science-oriented archaeology of early settlers of the insular Caribbean to current and future research, our dearchaization call is also related to the humanistic, culture-historical (*sensu* Kristiansen 2014, 15), and even philosophically-conceived processes of dearchaizing. We are confident that all these efforts will succeed in further erasing the essentialisms that hinder intimate connection between contemporary communities and their ancestral pasts, dramatically impacted by centuries of colonialism. Old mega-narratives about the Archaic are variably grounded in the Western "idea of progress," which has its roots in the unilineal evolutionism of the nineteenth century, in the eighteenth-century Enlightenment, and in even earlier social thought about the foundations of subjective and objective forms of understanding and knowledge (e.g., Glacken 1967; Hogden 1971; Targovnick 1990). This unilineal reading of societal developments impedes the creation of alternative scenarios and historicities, including indigenous constructions of history based on different, ontologically non-Western perspectives. Having said this, we know that dearchaizing the Archaic is still far from permeating mainstream thinking and praxis in contemporary academia, and beyond this, the public should also be involved in our dearchaizing efforts. If we are to spread this alternative way of thinking about the indigenous peoples of the deep past beyond the walls of academia we – the researchers – should endorse vigorous public outreach.

Oysters in the intertidal zone at Spanish Water, Curaçao (Photograph by Corinne L. Hofman/Menno L.P. Hoogland).


Part One
Environmental Challenges and Subsistence Strategies

3

Gone with the waves: Sea-level rise, ancient territories and the socioenvironmental context of Mid-Holocene maritime mobility in the pan-Caribbean region

Isabel C. Rivera-Collazo

The Archaic Age refers to the initial trans-Caribbean migrations and the settlements that followed them. This movement of people and their things into the archipelago effectively transformed the ecodynamics of the islands and the sociodynamics of the region (Rodríguez Ramos *et al.* 2013; Rivera-Collazo *et al.* 2017). However, this earliest period of human habitation in the Caribbean is largely under-researched. Reassessments of the archaeology of the Archaic Age have questioned the traditional, outdated perception of these societies as simple hunter-gatherers living in small, nomadic bands, given that this characterization is incongruous with the archaeological record (Hofman *et al.* 2014a; Ulloa Hung and Valcárcel Rojas 2013; Pagán-Jiménez *et al.* 2015; Rivera-Collazo *et al.* 2015; Oliver 2009; Rodríguez Ramos 2010; Chanlatte Baik 2007; Rivera-Collazo 2011b; Pantel 1996). This has left us with a fully open period, lasting over several thousand years, in which people lived and worked, and of which we know very little.

This chapter examines the Archaic Age in the context of its temporal and geographical setting. While explanations of environmental settings are common in Caribbean Archaeology, these descriptions are often static accounts of modern conditions. It is well known that climate has changed significantly though time (Hodell *et al.* 1991; Higuera-Gundy *et al.* 1999; Peros *et al.* 2015; Lane *et al.* 2009), and that these changes also triggered broader changes in the environment and geomorphology (Cooper and Peros 2010; Dearing *et al.* 2015; Rivera-Collazo *et al.* 2015; Rivera-Collazo 2011b).

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 47-56.

It is also known that sea level in the Caribbean has changed following climate change (Milne *et al.* 2005; Milne and Peros 2013; Peros *et al.* 2007, 2015).

The present study evaluates how environmental change could have affected what we have seen so far of the people that lived in the Caribbean during the Archaic Age. The maps presented in this chapter use the NOAA GIS data on bathymetry (https://www.ngdc.noaa.gov/mgg/bathymetry/relief.html), the corrected curve for the Caribbean produced by Milne and Peros (2013) and the local relative sea level (RSL) measures produced by Khan *et al.* (2017), which are more accurate at smaller scales. No modeling for tectonism, sedimentation, or wind and currents under previous climatic conditions was conducted, but these aspects must be taken into account in future research, particularly when downscaling to local case studies.

The Caribbean landscapes in chronological context

Northern South America and parts of Central America have been cited as the main sources of migration to the archipelago (Fitzpatrick 2013b; Hofman *et al.* 2011; Wilson *et al.* 1998; Rouse 1992; Rodríguez Ramos 2010). The earliest record of human habitation on the continental portion of the Caribbean basin dates to 16,000–14,000 BP in Colombia and Venezuela, and 13,000–10,000 BP elsewhere (Ardila Calderon and Politis 1989; Cruxent 1979; Gnecco and Aceituno 2004; Oliver and Alexander 2003; Ranere and López 2007; Aceituno *et al.* 2013; Aceituno and Loaiza 2015; Dickau *et al.* 2015; Cooke *et al.* 2013; Collins *et al.* 2015; Chatters *et al.* 2014). This chronology sets the peopling of the Caribbean basin firmly within the Late Pleistocene and the Pleistocene/Holocene transition.

The end of the Pleistocene, after the Last Glacial Maximum, is a period of significant climatic instability as part of the global warming process that marked the beginning of the Holocene. One of the most significant effects of the Pleistocene/Holocene transition was sea-level rise due to meltwater return to oceans. During the maximum extent of the glaciation between 26,000 to 19,000 BP, so much water was retained in glacial caps that global sea level decreased by ca. 120 m (Clark and Tarasov 2014; Fleming *et al.* 1998; Lambeck and Chappell 2001; Lambeck *et al.* 2002; Lambeck *et al.* 2014; Milne *et al.* 2005; Milne and Peros 2013; Lambeck and Chappell 2001; Lambeck *et al.* 2002; Lambeck *et al.* 2014). As the polar caps retreated, sea level rose rapidly and in distinct pulses, reaching -25 m below modern levels by 10,000 BP, -1.3 m around 5000 BP and stabilizing around 2000 BP (Fleming *et al.* 1998; Lambeck *et al.* 2014; Milne and Peros 2013).

Between 16,000 BP and 10,000 BP, when there is already strong archaeological evidence of human habitation in the mainland Caribbean region, the sea level rose at a rate of 10 m every 100 years (Lambeck *et al.* 2014; Khan *et al.* 2017; Milne and Peros 2013). That is 1 cm per year. To put these numbers into perspective, sea level has risen only 0.5 m in the last 1000 years, most of it occurring during the last 100–150 years (Lambeck *et al.* 2014). We currently have no modern equivalent to compare to the magnitude of sea level change and land loss at the end of the Pleistocene. As with the case of Doggerland and other submerged landscapes, lower sea levels exposed as dry land hundreds of kilometres of lowlands (Figure 3.1) that would have housed diverse ecosystems with rivers, estuaries, swamps, and forests, most probably with associated

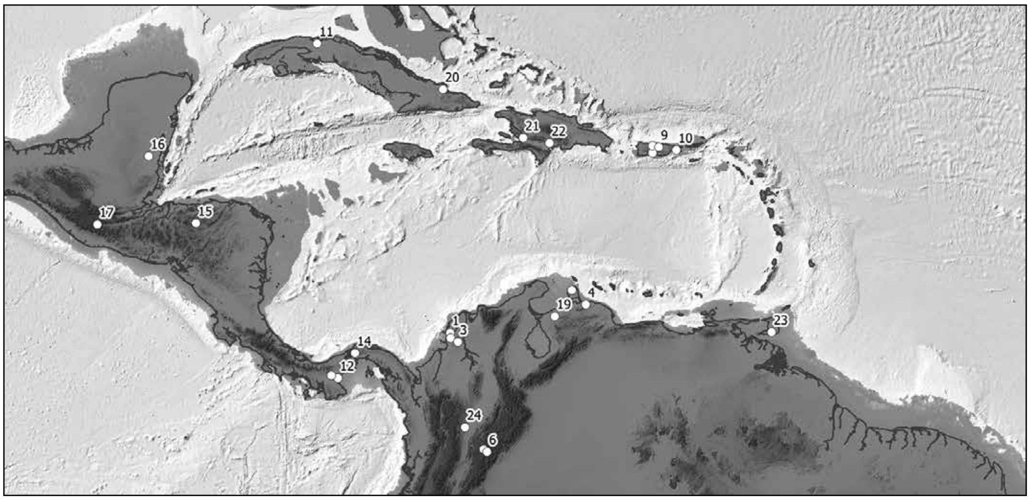


Figure 3.1. Map of the Caribbean Region showing the lowlands of the Late Pleistocene. The dark lines mark the location of the shoreline in the present. Sea level is shown at -61 m, which corresponds to the ESL around 13,000 BP (Lambeck et al. 2014). The numbered points mark a selection of early sites dating between 16,000 and 3000 BP. See also the Appendix, this volume, for the ^{14}C dates from the insular Caribbean sites. 1. Monsú (ca. 8000 cal BP); 2. Puerto Hormiga (ca. 6000 cal BP), located between 1 and 3; 3. San Jacinto I (ca. 6000 cal BP); 4. Taima Taima (14,400 cal BP); 5. El Abra (12,400 cal BP); 6. Tibitó (11,800 cal BP); 7. Maruca (4700 cal BP); 8. Angostura (4400 cal BP); 9. Paso del Indio (4600 cal BP); 10. Puerto Ferro (4300 cal BP); 11. Canímar Abajo (7400 cal BP); 12. La Mula and Cueva Vampiros (8600 cal BP); 13. Aguadulce Shelter (ca. 10,500 cal BP); 14. Alajuela Lake (Paleoindian surface finds); 15. La Esperanza (13,000–10,000 cal BP); 16. Belize sites (10,000 cal BP); 17. Los Tapiales (13,000–10,000 cal BP); 18. El Cayude (13,000–10,000 cal BP); 19. Río Pedregal (13,000–10,000 cal BP); 20. Levisa (ca. 4400 cal BP); 21. Vignier III (ca. 6400 cal BP); 22. Barrera-Mordán (ca. 5300 cal BP); 23. Banwari Trace (ca. 8000 cal BP); 24. Pubenza (16,400 cal BP); 25. Hoyo Negro (13,000–12,000 cal BP).

human settlements (Bailey 2004; Bailey and Flemming 2008; Coles 2000; Gaffney *et al.* 2007; Faught 2004; Faught and Gusick 2011; Gusick and Faught 2011).

The distribution of Late Pleistocene sites in northern South America and Panama suggests that entry to South America occurred along the coasts, and penetration inland followed large river basins, such as the Magdalena or the Cauca in Colombia (Aceituno *et al.* 2013; Anderson and Gillam 2000; Cooke *et al.* 2013; Erlandson and Braje 2011; Goebel *et al.* 2008). Sites with very early radiocarbon dates, such as Pubenza (ca. 16,500cal BP), Taima-Taima (ca. 14,400 cal BP), El Abra (ca. 12,400 cal BP) and Tibitó (ca. 11,800 cal BP) are kill sites or specialized sites associated with hunting and butchering (Aceituno *et al.* 2013; Ardila Calderón and Politis 1989; Cruxent 1979; Gnecco and Aceituno 2004; Oliver and Alexander 2003; Ranere and López 2007). Patterns of settlement and discarded projectile points suggest that people during this period used to live near aquatic environments, favoring ecotonal areas (Lavallée 2005; Rostain 2013; Santos Vecino *et al.* 2014), carrying out exploratory incursions inland and modifying the rainforests (Aceituno *et al.* 2013; Rostain 2013).

Between 11,000 and 6000 BP, the number and density of sites expand considerably (see caption of Figure 3.1). Intensification is particularly evident between 10,000 and 6000 BP, when there is a marked increase in site numbers and types along the coasts and inland (Aceituno *et al.* 2013; Aceituno and Loaiza 2015). By this time, the archaeological record suggests varied contemporary hunter-gatherer adaptive strategies tailored to markedly different environments, including savannahs, highlands, tropical forests, seasonally-flooded coastal plains, and offshore islands (Ardila Calderon and Politis 1989; Barton *et al.* 2012; Borrero 2015; Cruxent and Rouse 1958; Dickau *et al.* 2015; Gnecco 1999; Gnecco and Aceituno 2004; Neff *et al.* 2006; Oliver and Alexander 2003). While some sites, such as San Jacinto I (Oyuela-Caycedo and Bonzani 2005), present seasonal occupation for the targeted exploitation of resources, others, such as Las Vegas in Ecuador (Raymond 2008), Puerto Hormiga (Oyuela-Caycedo 1996; Reichel-Dolmatoff 1965), or Monsú in Colombia (Reichel-Dolmatoff 1985), evidence permanent settlement with year-round exploitation of resources with overlapping availability. As early as 9000 BP, human habitation in northern South America was accompanied by arboriculture and the management of specific economic plant assemblages. In some locations, allochthonous species were introduced through landscape management (Arroyo-Kalin 2010; Bray 1984; Bonzani 1998; Dickau *et al.* 2015; Gnecco and Aceituno 2004; Kennett *et al.* 2010; Piperno 2011; Santos Vecino *et al.* 2014). Managed plant assemblages include palms, tubers (*Dioscorea, Xanthosoma, Ipomoea, Manihot*), Curcubitaceae, and other cultivars or domesticates such as *Zea mays* (Piperno 2011).

The archaeological record on the lowlands before 11,000 BP is sparse. However, the magnitude of sea level rise was such that the areas we see as coasts today were far inland at the time of early migrations (Figure 3.1). If people were arriving in the Americas along coastal corridors and made sporadic, specialized incursions for hunting and butchering, as suggested by Taima-Taima, El Abra, and Tibitó, then the archaeo-

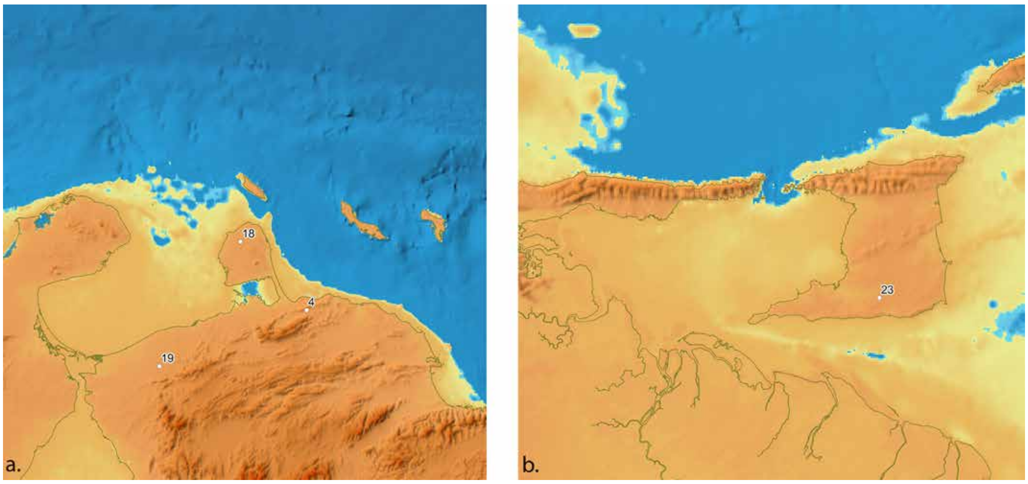


Figure 3.2. Map showing today's Gulf of Venezuela (a) and Gulf of Paria (b) with the sea level of 13,000 BP (-61 m bmsl). This proposed landscape would be contemporaneous to the sites shown in 3.2a: (4) Taima Taima, (18) El Cayude and (19) Río Pedregal. Given the presence of early sites on the western coast of Venezuela, similar sites could be expected in the eastern section (3.2b). Site 23 identifies Banwari Trace, dating to ca. 8000 cal BP (see Figure 3.3).

logical record before 11,000 BP reflects these incursions and not the entirety of social processes, as the ancient coastlines are under water today (Figure 3.2). The picture of early settlement we have seen so far is incomplete, but it is important nonetheless because those rapid changes on the available land and the distribution of resources contextualized the exploration and eventual migration to the archipelago.

Paleolandscapes, maritime culture, and the peopling of the Caribbean archipelago

Successful island exploration and colonization is not a process that occurs in isolation (Broodbank 2006; Curet 2005; Dawson 2013; Hazelwood and Steele 2003; Rockman 2003; Steele and Rockman 2003; Wilson 2007). Navigation of large bodies of water, such as the Caribbean Sea, implies a long-term accumulation of traditional maritime knowledge and experience (Broodbank 2000, 2006; Cherry 1985; Rockman 2003; Steele and Rockman 2003), developed and nurtured in maritime culture, which is linked to living close to shores and near navigational routes (Boomert and Bright 2007; Westerdahl 1992). It also implies detailed knowledge of coastal landforms and

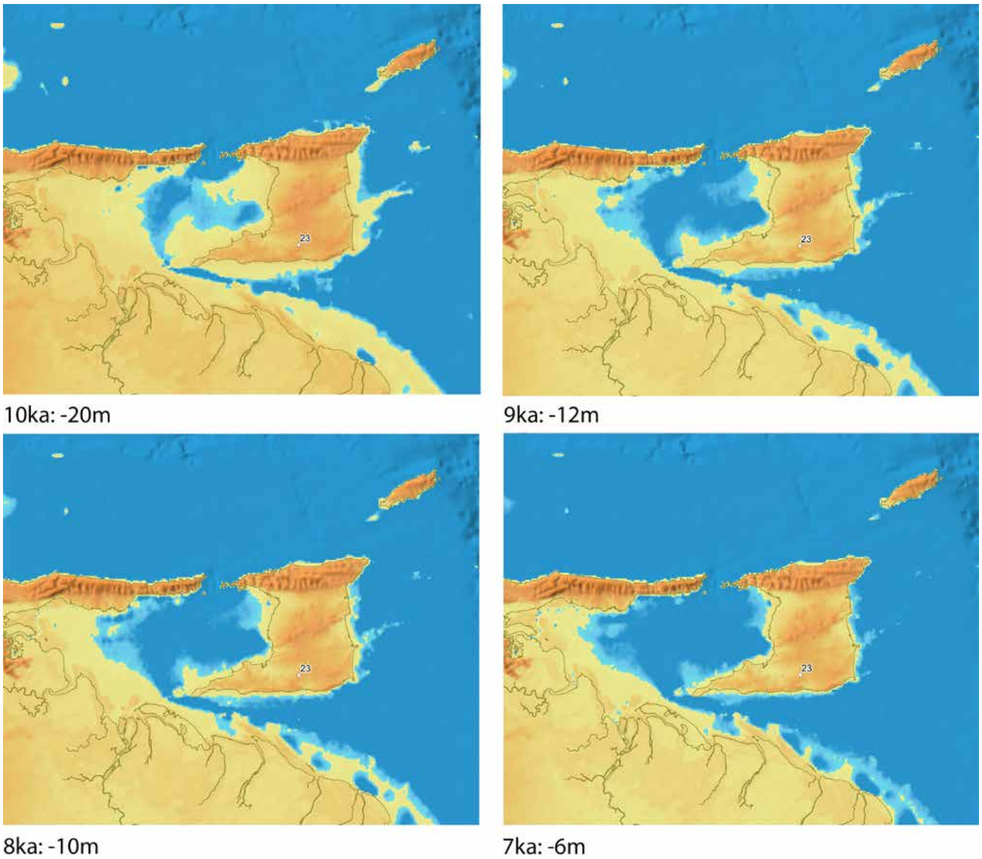


Figure 3.3. Gulf of Paria, Trinidad and Tobago showing the changes in landscape as sea level rose during the Early Holocene. Site 23 marks Banwari Trace (ca. cal 8000 BP).

resources as well as coastal and open water currents and winds. Successful island colonization entails a stage of exploration, where trips to and fro were common, followed by initial settlements with a seed population (Dawson 2013; Hazelwood and Steele 2003; Rainbird 2007; Rockman 2003; Steele and Rockman 2003). Only after the exploration and initial settlement is successful can the permanent population expand and settlements be established at strategic locations in an effort to control or facilitate access to and distribution of resources (Cherry 1985; Curet 2005; Dawson 2013; Rockman 2003; Steele and Rockman 2003).

The earliest Archaic Age record of the Archipelago dates between ca. 8000 and 4000 BP (Figure 3.1). Based on published research, the earliest dates are found on Cuba and Hispaniola, and slightly later in Puerto Rico (Martínez-López *et al.* 2007; Rivera-Collazo 2015; Rodríguez Ramos *et al.* 2013; Ulloa Hung and Valcárcel Rojas 2013; Veloz Maggiolo 1980; Wilson 2007). Earlier dates are known for Banwari Trace and St. John in Trinidad (Boomert 2000; Fitzpatrick 2015; Harris 1973, 1976; Pagán-Jiménez *et al.* 2015).

Even though today Trinidad is currently the southeasternmost island of the Archipelago, it has been doubted whether these early sites constitute the beginning of the migration towards the archipelago, given that the island would still have been attached to the mainland (Fitzpatrick 2015). A detailed analysis of the drivers regulating Holocene sea levels calculate RSL for Trinidad at -12 m ± 1.1 at 9000–8000 BP, and at -5.8 m ± 0.9 at 8000–7000 BP. The average rate of sea-level change is calculated at 10.6 m ± 0.4 between 12,000–8000 BP, slowing to 2.0 ± 0.3 between 8000–4000 BP (Khan *et al.* 2017, 30–32). Under these conditions, in spite the assumption of it still being attached the mainland (Fitzpatrick 2015, 307), Trinidad seems to have already separated from Venezuela by 9000 BP. Rising sea levels rapidly separated the island from the mainland, flooding the Gulf of Paria from the north and the south and breaching the divide at some point between 10,000 and 9000 BP (Figure 3.3; see Figure 3.2a for comparison with the 13,000 BP landscape). Considering the morphology of the area, it is apparent that flooding must have caused strong currents in between the southwestern tip of Trinidad and the northern portion of the Orinoco Delta (Warne *et al.* 2002), which could have deepened the channel of Boca de Serpientes. Therefore, while the modern bathymetry and general morphology are not an accurate reflection of past landscapes, a visualization of the area can help contextualize the occupation history of the island.

Assuming a sea level of -12m at 9000 BP, -10m at 8000 BP and -6 at 7000 BP, and under modern bathymetry, the channel separating Trinidad from the mainland would have been 2.5, 3 and 7.5 km wide respectively (Figure 3.3). While the channel of 9000–8000 BP can be considered a short, easy crossing within the context of the rivers of northern South America, a 7.5 km channel with strong currents (similar to the space separating Anguilla and Saint Martin) is more complicated. A more accurate reconstruction of the evolution of the Gulf of Paria and the Orinoco Delta is necessary for understanding the social context of the early settlements in Trinidad.

Coastal paleogeomorphology is not only relevant to understanding the timing and social effort of migrations, but also the visibility of the early archaeological record. Taking Puerto Rico as an example, the earliest evidence of occupation dates to ca. 5000–4000 BP (Rivera-Collazo 2015). At the Terminal Pleistocene, with a sea level

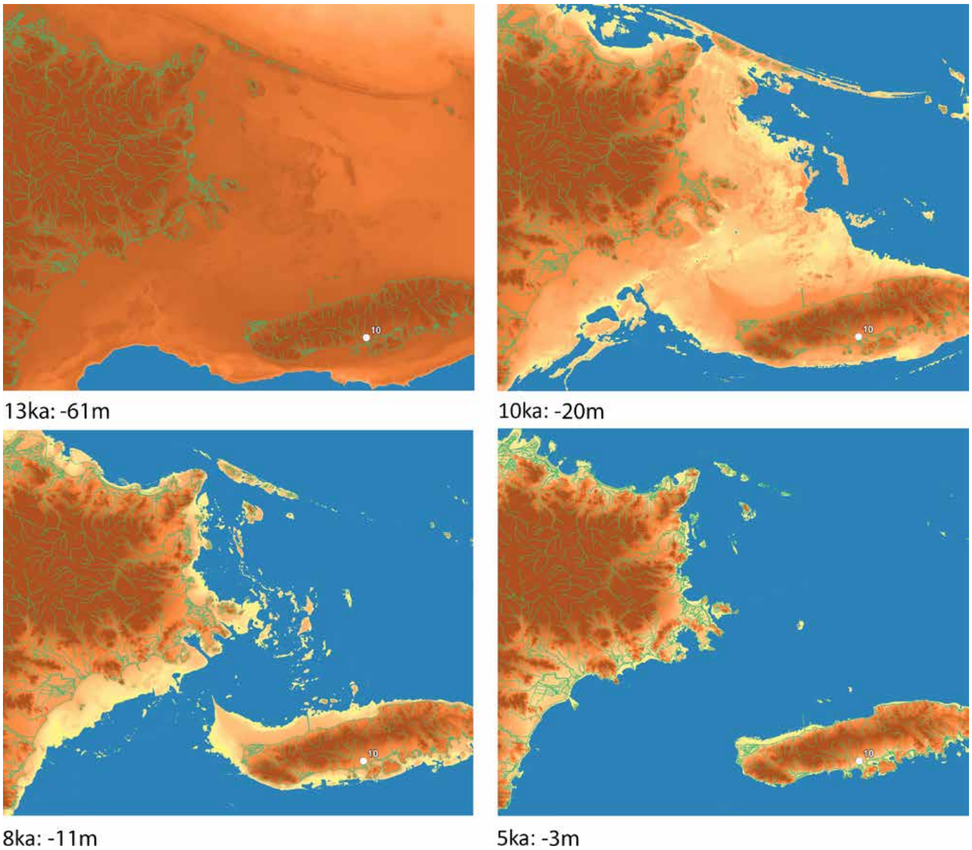


Figure 3.4. The east coast of Puerto Rico showing the changes in landscape as sea level rose between the Late Pleistocene and the Mid-Holocene. Site 10 marks Puerto Ferro (4300 cal BP).

of around -100 m at 15,000 BP, the paleoisland would have stretched from Puerto Rico to Anegada, merging Culebra, Vieques, and the Virgin Islands as a single landmass. By the Early Holocene (10,000 BP), this paleoisland was already breaking up, but Puerto Rico still maintained land bridges to Culebra and Vieques (Figure 3.4). These bridges were not lost until some point between 8000 and 5000 BP. These coastal landforms show very high potential for the investigation of submerged landscapes.

The east coast of the island, near the Archaic Age site of Puerto Ferro in Vieques, provides a clear example of how much landscape is missing from the archaeological record. Figure 3.4 presents a sequence of maps showing the shape of the selected area at 13,000 BP (-61 m), 10,000 BP (-20 m), 8000 BP (-11 m) and 5000 BP (-3 m) (Khan *et al.* 2017; Lambeck *et al.* 2014). By 10,000 BP, the area presents a wide landscape that merged the main island with Vieques and beyond. The bathymetry suggests the presence of rivers, bays and cays that would have been very attractive to people in the past. The transition to 5000 BP made a dramatic impact on these landscapes. Most of the coastal plains, cays and islands were gone by 5000 BP, leaving a coastal configuration very similar to that of the present, although some coastal areas still extended tens of meters from the modern shoreline. Most of the early sites on Puerto Rico, such as Maruca, Angostura, Paso del Indio, and Puerto Ferro, have similar radiocarbon dates, between 4700 and 4300 cal BP (Rivera-Collazo 2011a; Rivera-Collazo *et al.* 2015). All of them – Maruca and Angostura in particular – present stable occupation. Further systematic research is needed, but so far settlement patterns suggest a preference for strategic locations: for example, Maruca and Angostura at the coastal plain, near communication lanes with inland settlements, controlling access to forest resources, as could also have been the case of Paso del Indio and other sites such as Cueva Ventana. This indicates a late stage in the colonization process of the island. As was shown for the case of the mainland, sea-level rise could have drowned the earlier evidence of human presence on the Caribbean archipelago. The earliest reported dates on Puerto Rico correspond to a time when the shorelines were very close to modern levels.

Given the magnitude of lost land surfaces, it is highly probable that Caribbean archaeology is missing a large part of the history of the earliest colonization of the islands. This proposal is supported by proxy evidence of possible human impact earlier than any radiocarbon date on land, suggesting human presence on the Lesser Antilles as far back as 5900 cal BP in Barbuda (Siegel *et al.* 2015) and ca. 5300 cal BP or earlier in Puerto Rico (Burney *et al.* 1994; Caffrey and Horn 2014).

Taking into consideration the archaeological evidence of adaptation strategies and traditional ecological knowledge, subsistence strategies on the archipelago are very similar to those of the mainland lowlands. Archaeological research so far suggests a focus on the exploitation of neotropical plants such as palms, tubers, dicots, monocots, and legumes (Newsom 2008; Newsom and Wing 2004), clearly including the main neotropical cultivars and domesticates common on the mainland since the Late Pleistocene and Early Holocene. Many of these plants were introduced to the islands with the initial migrations (Pagán-Jiménez 2002, 2009, 2011; Pagán-Jiménez *et al.* 2015; Rodríguez Ramos *et al.* 2013). Mobilization of biotic resources was not limited to plants, but also included the translocation of non-native animals, as is the case of the *jutía* (*Isolobodon portoricensis*) to Puerto Rico around 4000 BP (Rivera-Collazo 2011b). This continuation of subsistence practices targeting specific resources and applying particular land-management practices evidences the maintenance of culturally significant traditions defining the identity of peoples in the area. The new colonists of the islands brought with them not only nautical and subsistence knowledge, but also traditional knowledge, accumulated over thousands of years, on how to adapt to changes in habitat.

Conclusion: The role of long-distance networks

The Leiden school of Caribbean archaeology has made very significant contributions regarding the importance of long-distance networks for pre-Columbian Caribbean societies (Hofman and Bright 2010; Hofman and van Duijvenbode 2011; Hofman *et al*. 2006; Hofman *et al*. 2007; Hofman *et al*. 2010; Hofman *et al.* 2011a; Hofman *et al.* 2014b; Laffoon *et al.* 2014; Rodríguez Ramos 2011). As Hofman and colleagues have suggested (Hofman *et al.* 2007, 2008, 2010, 2011a, 2014a/b), these exchanges seem to have been very intense and constant, supporting social bonds between the mainland and the islands and among the islands themselves. The only way these long-distance networks could have been maintained is through the presence of navigation, which implies deep traditional knowledge and maritime culture (see also Hofman *et al.,* this volume).

The analysis brought forth in this chapter suggests that those networks seem to be chronologically very deep (Rivera-Collazo *et al.* 2017), as deep as the earliest migratory processes contextualizing human dispersion through the Caribbean. The archaeological record for the Archaic Age supports social continuity and strong bonds between islands and the continent, which could only be maintained by sustained access to maritime networks. As these networks disintegrated at the end of the fifteenth century, with the transfiguration of human geography after the European conquest of the region, the native societies lost their traditional resilience-enhancing buffers, intensifying the speed and magnitude of the human catastrophe that occurred after 1492.

Another implication of maritime culture is living in physical and visual proximity to maritime routes: i.e., living on the coasts. This analysis has demonstrated that the coasts that we perceive and experience today are very different from those experienced by the early migrants of the Caribbean. Our archaeological perspective of the Mid-Holocene and earlier is geographically biased. We are seeing the periphery of important social processes that set the environmental and human stage on which everything else has developed. The ancient Archaic Age landscape drowned very quickly, which is good news for the preservation of ancient sites. The submerged landscapes of the Caribbean are yet to be explored. It is time we start rediscovering the Archaic Age, acknowledging its environmental context and its changing conditions through time.

Acknowledgements

The research for this chapter stemmed from an invitation to present as keynote speaker at the 2015 Rio Acoustics IEEE/OES Acoustics in Underwater Geosciences Symposium in Rio de Janeiro, Brazil. Many thanks to Ole Grøn and Jean Pierre Hermand for their support.

4

Archaeological evidence and the potential effects of paleotsunami events during the Archaic Age in the Southern Caribbean

Jay B. Haviser

Introduction

The tectonic context of the Southern Caribbean indicates an early lateral formation/movement of the Caribbean Plate, which created major fault lines at the Caribbean-South American interface. In the eastern Caribbean, this is manifest as an outer and inner-arc uplift of the plate boundary and subsequent volcanic activity in that area, As well as an uplift of the Venezuelan Andes, which separates the eastern and western Venezuelan coastline, and the northwestern coastal area from the interior Orinoco River basin (Beets 1977; Jackson 2009; James *et al.* 2009).

Considering elevated sea levels circa 12,000 to 14,000 years ago, an isolated, stable dry climate for the last 5000 years, and its positioning south of the main hurricane belt (although hurricanes do infrequently occur), the Southern Caribbean provided distinctive environmental contexts for the Archaic Age populations in this region (Hofman and van Duijvenbode 2011; Haviser 1987).

Scheffers (2002) and Scheffers *et al.* (2009) have identified four significant paleotsunami events in the Southern Caribbean that directly affected Aruba, Curaçao and Bonaire at approximately 4200, 3500, 1500, and 500 BP. It is of some interest to note these dates also roughly correspond either to shifts in technological development or culture-contact events for the prehistoric populations where these natural phenomena occurred, and/or alteration of the archaeological evidence of those populations on the islands. Furthermore, all of these paleotsunami events are clearly evident on the island of Bonaire, with 4 million tons of coral debris occurring in ridges and ramparts over

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 57-64.

several kilometers long, and with transported boulders of up to 260 tons. In the study, it was further demonstrated that hurricanes and tsunamis, when they do occur, have distinctive effects on the coastal reef systems around the islands, serving as variable flow/depth impacts capable of transporting full or only partial particle-size deposits, as extensively identified in Scheffers *et al.* 2009. This data correlates to the identification of a temporal gap in the presence of *Acropora palmata* on various Caribbean islands ca. 4500–300 BP. The written historical record of natural events such as hurricanes and earthquakes since the 1630s, has also recently been well documented for Bonaire by Douvry (2012).

The earliest known Archaic Age inhabitants crossed over from the South American mainland onto the island of Curaçao at about 4500 BP (Hoogland and Hofman 2015). Until now, it had been assumed that after about one thousand years of living on Curaçao, some of these people migrated onto Bonaire at about 3600 years BP. These first inhabitants were adapted to exploiting the mangrove stands and associated natural food resources of coastal and bay environments, including the marine reefs. The Archaic Age was traditionally characterized by small bands of seminomadic people, having a lack of developed agriculture and pottery production, whose artifacts bear close similarities with those of the northern South American mainland, particularly those from El Heneal, Venezuela and on other southern Caribbean islands to the east, such as the Manicuare cultures from Cubagua and Margarita, Venezuela (Antczak *et al.* 2018; Rouse and Cruxent 1963). There are numerous Archaic Age sites known from Curaçao, most of which are at higher elevations on the south coast, yet the oldest site is at a inland terraced rock-shelter on the north coast, at Rooi Rincon (Haviser 2001; Hoogland and Hofman 2015). On Bonaire, there are fewer Archaic Age sites; these were identified in 1987 and are located mostly at the west and south coast inland bays, yet the only Early Archaic site sits on a high ground knoll in the east coast bay of Lagun (Haviser 1991). A 2010 study by BONAI and Leiden University (Haviser *et al.* 2011) was conducted at the large, northwestern inland bays of Slagbaai and Gotomeer, which produced considerable new data, including additional early radiocarbon dates regarding the Archaic Age presence on Bonaire, to be discussed below.

The 2010 BONAI-Leiden University survey areas resulted in the discovery of numerous archaeological sites at Slagbaai and Gotomeer, some but not all of which had been identified in the 1987 survey; the majority of sites were identified as Archaic Age (Haviser 2015). Out of 20 sites recorded, 17 were Archaic Age sites, while three had ceramics yet with more diagnostic Archaic stone/shell assemblages. The occurrence of ceramics in otherwise Archaic Age assemblages has also been attested in both Curaçao and Aruba (Hoogland and Hofman 2015; Kelly and Hofman this volume). One of the characteristic Archaic Age shell traits is the presence of very large *Melongena melongena* shells, three times the size of the same species noted in the subsequent Ceramic Age. Another diagnostic Archaic Age artifact from Curaçao and Bonaire is a modified *Lobatus gigas* gouge with what is identified as "nipple tip" use wear at the point (Haviser 1987, 1991). The conical tip wear has the diameter of the large fiber spacing in agave leaves, and has been suggested to be a shredding tool used to remove the agave fibers for textile and other uses. The agave plant has long been overlooked for its potential significant value, particularly to Archaic Age populations, for both food (proteins) and tool/fiber production.

The new dates obtained for Bonaire in the 2010 fieldwork, which range from around 3600 to 2400 BP (see Hofman *et al.*, this volume), fit within the overall dates obtained for Archaic Age sites on the ABC islands. This clearly places the Slagbaai-Gotomeer, in the northwest corner of Bonaire, as the focal loci for the Archaic Age populations throughout the Archaic Age, similarly to what has been found in recent research at the Spaanse Water inland bay site on Curaçao (Hoogland and Hofman 2015).

Regional ties

Initially suggested by Veloz Maggiolo in 1973 and supported by various authors over the years (Haviser 2001; Zucchi 1973), it is proposed here also that the earliest Archaic Age groups on the southern Caribbean coast, from the El Heneal and El Jobo complexes, likely made a trans-Caribbean movement to the Greater Antilles via the ABC islands. Wind and water-current studies support this theory (Callaghan 2003), which posits potentially intentional and/or involuntary movement. The later Archaic Age groups of the Cubagua and Manicuariod complexes were moving westward along the Venezuelan coast from Margarita towards the ABC islands. There were also potential eastward Archaic Age movements from the Colombian coast, as well as northward movements from the interior plains west of the Venezuelan Andes. Two important points need to be made here: first, the earliest human presence in the entire Southern Caribbean area, called the "Lithic Age" dating to circa 14,000 BP, was immediately adjacent to the ABC islands; secondly, as reported by Oliver (1989), except for one site at Tubo Negro, there are no recorded Archaic Age sites along the entire flat, open northwest Venezuelan coastline.

By about 1500 BP, when a third major tsunami event occurred, the Archaic Age peoples were well established on Bonaire and Curaçao, when these hunter-gatherer-fishing Archaic communities were encountered by new Amerindian cultures from the south, who ushered in the "Ceramic Age". Ceramic Age communities manufactured ceramics and made extensive use of agriculture. Thus far, based on the early Ceramic Age artifacts, it has been suggested that the remaining Archaic Age peoples on Bonaire and Curaçao were eventually integrated into the Ceramic Age lifeways by about 1500 BP.

This period of Archaic Age-Ceramic Age population contact and transition is very significant for our understanding of more than just the encounter of cultures, but rather to gain a perspective into the actual cognitive variations between these two groups, regarding their perspectives of the environment (Haviser 1987). It is with research of the cognitive basis for cultural behavior, as in the neurosciences, which are increasing our abilities for more detailed interpretative models (Park and Huang 2010). To begin, we must shed the pretense of comparing two technological level variations, Archaic and Ceramic, as 'cultures', such that these are but manifestations of the material expressions of cultures, not cultures themselves. At the root of human cognition is the formation of cognitive maps: a means through which an individual interprets the universe around them (Nisbett *et al.* 2001). Research is ongoing to pursue the potentials of reconstructing human cognitive maps, utilizing the concept that the fundamental base of culture is the individual in time and space. Individuals are seen as the core building blocks, which when compiled with common affinities to others, form social groups, recently referred to as the *Cognitive Cloud Model* (Haviser 2018). The relevancy for presenting this discussion is that the Archaic Age folk and the Ceramic Age folk clearly had very different cognitive map formations regarding, among other aspects, their individual relationships to the environment. As noted previously, Archaic Age peoples' cognitive maps included an approach to the environment in a hunter-gatherer mode, more dependent on natural resource availabilities and natural phenomena, while the Ceramic Age peoples' cognitive maps included the environment being more available to manipulation, as with agriculture. If we accept the significant psychological impact of experiencing a major tsunami event, then those Archaic Age individuals, who were present for the large impact at the contact period and within their identified resource exploitation spheres, would have had integrated a profound disorientation with the natural world of which they were dependent into their cognitive maps. Meanwhile, individuals of the Ceramic Age, having experienced tsunami impacts less directly on their exploitation spheres, would have been able to perceive the events as a continuum of natural phenomena within their cognitive maps, possible to be dealt with as social groups. I would argue that these differing Archaic Age-Ceramic Age cognitive formation responses to the contact period tsunami event, may have created a basis for more rapid disintegration of the Archaic Age social groups due to their disorientation in understanding such major natural events, which also coincided with the arrival of the further disorienting Ceramic Age groups. Some of the Archaic Age folk may also have had the cognitive response of fleeing towards the west/northwest, away from the tsunami arrival directions. The Ceramic Age social groups, using their cognitive formations, may have seen the tsunami event as a natural continuity for their attempts at natural world manipulation, which also included a position of dominance over any surviving Archaic Age populations.

To present a more thorough understanding of the impacts of paleotsunamis in the Southern Caribbean, and to specifically verify aspects of the cognitive variation between the Archaic Age and Ceramic Age populations, it is important to provide additional background regarding responses to tsunami impacts during the Ceramic Age, as being distinctive from the Archaic Age cognitive responses. The artifact evidence indicates that the ancient ancestral origins of the Ceramic Age peoples of Bonaire and Curaçao lie in the middle Orinoco and western Llanos of Venezuela (Roosevelt 1980). These manioc-cultivating, ceramic-producing peoples, established large populations at the confluence of the Orinoco and Apure rivers; sometime between 2000 and 1500 BP, part of this population migrated up the Apure and Portuguesa/Cojedes rivers and down the Tocuyo, Aroa, and Yaracuy river basins, reaching the Caribbean Sea at about 1600 to 1500 BP (Zucchi 1973). From the Caribbean coast at the Tocuyo, Aroa, and Yaracuy river outlets, these people spread westward onto the islands of Bonaire and Curaçao by about 1500 BP. It is evident that, due to the westward coastal trajectory of these Ceramic Age movements, Bonaire was first colonized, before Curaçao, as is supported by the current radiocarbon dates.

At about 1300 BP, there was a major movement of Amerindians spreading across northwestern Venezuela, covering the area now known as the State of Falcon. At the time of European contact, these people were called the coastal Caquetio, while in precontact time, they had a diagnostic ceramic decoration style, complex sociopolitical organization, and large populations (Oliver 1989). By about 1200 BP, they had domi-

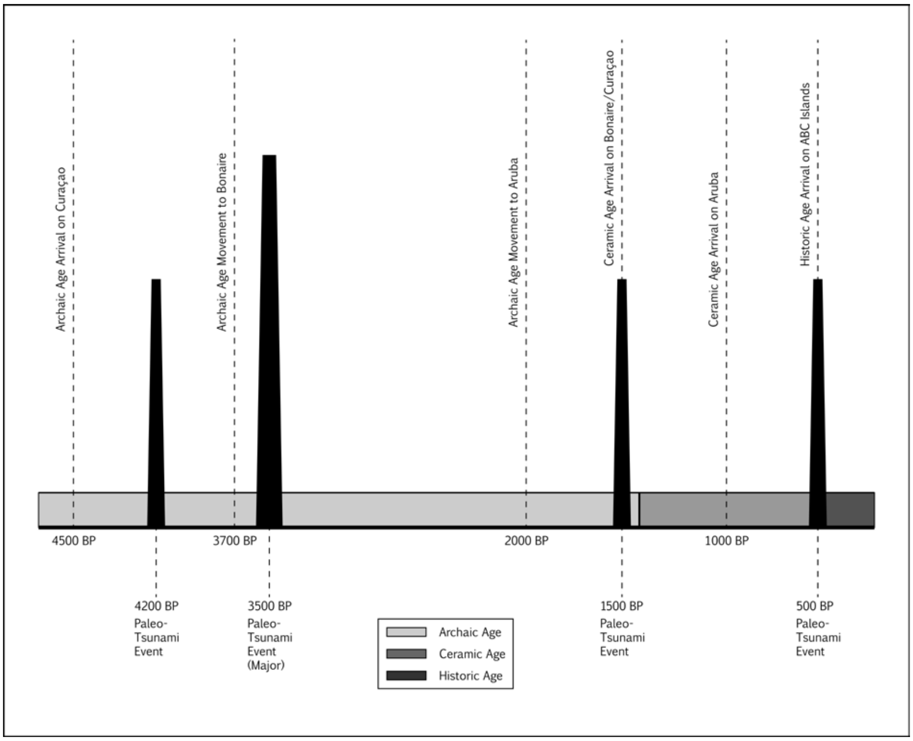


Figure 2.1: Conceptual timeline for the general correlation of paleo-tsunami events with prehistoric human population movements on the ABC Islands (Original by J. Haviser; adapted by A. Castilla-Beltrán and E.M. de Mooij).

nated the Venezuelan coast adjacent to Bonaire and Curaçao, and were thus strategically located to establish trading networks and regular cultural contacts with the Ceramic Age peoples of these islands. From the archaeological evidence, it seems that by about 1000 BP, these coastal Caquetio were the primary cultural influence on the ABC islands. However, the unique Early Ceramic Age influences on Bonaire and Curaçao were not completely eliminated, as noted by later historical Spanish documents which refer to these two islands as being inhabited by the "Indios Curacaos" as a separate clan within the Caquetio (Haviser 1991).

The Ceramic Age peoples probably never exceeded a population of about 1000 people on Bonaire or 2000 people on Curaçao; these populations lived in sedentary communities, with pole-construction huts located in the vicinity of their various manioc, maize, and possibly agave agricultural fields. It is important to note here that very few Ceramic Age sites, except for rock-art sites on cave ceilings, are found at the north or northeastern coastline of Bonaire.

With the contact of Spanish slave hunters and explorers at about 500 BP, the Caquetio of the islands became more cautious of Europeans, and their villages retreated to more isolated interior settlements (Haviser 1991). However, the general lifeways of those Amerindians who survived slave capture and disease were relatively undisturbed by the sixteenth century Spanish political domination. It was the Amerindians' responsibility to provide livestock and agricultural products to the Spanish, but otherwise they were allowed to maintain their own lifeways. Into the seventeenth century, there were forced deportations of Amerindians to the Venezuelan mainland by the Dutch occupation of Curaçao and Bonaire, and many Amerindians left the islands during the seventeenth and eighteenth centuries; yet with a reproducing population remaining on Bonaire, producing food for the Europeans. The nineteenth century brought considerable changes to the Amerindian lifeways, as the majority of the surviving population on Bonaire isolated themselves into the barrios of Rincon and Nord Salina. By the beginning of the twentieth century, it is doubtful whether any pure-blooded indigenous Amerindians were left on Bonaire, and certainly none on Curaçao (Haviser 1991). Nonetheless, there remains a strong cultural identification with Amerindian heritage on Bonaire up to the present (Haviser 1995).

New insights with regard to paleotsunami effects on early Amerindian populations

With regard to the effects of paleotsunami events on the Archaic Age and later Amerindian populations, as indicated in Figure 4.1, several new insights can now be suggested for the archaeological data, which significantly modify the previously held notions and provide us with a potential new scenario of prehistoric developments.

The first set of data relates to the identification of the Archaic Age populations on Curaçao and Bonaire as having arrived first on Curaçao, then later on Bonaire. Could it not be suggested that the earlier tsunami event of 4200 BP resulted in a depopulation of a small Archaic Age group on Bonaire? A tsunami event coming from the east could also have removed the physical archaeological evidence of earlier sites along the east coast, on which the only known Archaic Age site, that of Lagun, is situated on a hilltop at 18 m elevation (Haviser 1991).

The second paleotsunami event, that of 3500 BP, coming from the east, is reported to be of the greatest magnitude of force on Bonaire (by 3–10x); the Lagun site, the Early Archaic Age site on the island, is atop a knoll of sufficient height to have been protected from the full force of the wave. Another curiosity is that the oldest archaeological site on Curaçao is also on the vulnerable north coast, in a protected elevated (54 m amsl) terrace area. According to the new data from the 2010 survey, the currently known Archaic Age sites that could have survived the 3500 BP tsunami event are all located on south coast and inland bay areas of the two islands, away from the direct force of the wave. Indeed, the potentially surviving reef and shellfish areas adjacent to and in the Slagbaai-Gotomeer area at the northwest of Bonaire became the focal point for habitation in the Archaic Age (Haviser 2015).

A third unique correlation between the identified major paleotsunami event dates identified and the prehistoric populations of these islands pertains to the event of 1500 BP. It is very interesting that this event occurred at the same time the Ceramic Age peoples were reaching the Caribbean coast of Venezuela, after their river migrations from the interior. Indeed it is also of some interest to note that the earliest population of this Ceramic Age group reached Bonaire before reaching Curaçao from the east, and precisely in the time period of about 1500 BP . Thus, it could be suggested that the rapid eastward movement of the Ceramic Age peoples from coastal Venezuela was perhaps stimulated forward and outward onto the islands by such a tsunami event. Furthermore, as Ceramic Age agricultural farmers, their primary subsistence base, consisting of grown starches rather than on marine reefs, would have undergone a less significant impact than of the the Archaic Age populations. Nonetheless, the elimination of the reef areas, as a significant secondary food source area, could also have stimulated a movement further along the coast in search of new reefs.

The most recent major paleotsunami event noted for these islands is circa 500BP, a very significant time for the Amerindian populations due to the arrival of the Europeans around that period. If we try to understand an Amerindian perspective of that first encounter with the Europeans, then we must acknowledge that in their cosmology, a major natural event, like a tsunami, would have been interpreted as a signal of catastrophic changes within their cognitive view of the landscape. An experience perhaps with some similarities to the earlier cognitive variations caused by the encounter between the Archaic Age and Ceramic Age peoples. These cosmological fears of significant destructive change would be compounded by the further destruction of the few surviving reefs, which were a major food source from the sea. Thus, for the prehistoric populations, the impact of a major tsunami would have been both physically and psychologically impacting. What we eventually see, as the final result of the Amerindian cognitive responses to their diminishing world, is the population retreating to the deep interiors of the islands, safely away from invading enemies and the ravages of tsunami waves.

In closing, it can be suggested that during the Archaic Age on these islands, there was a direct and significant impact on the human population by paleotsunamis' destruction of the mangrove stands and coastal marine reefs as primary food source areas, and potentially also physical destruction of evidence for their east coast (Bonaire) or north coast (Curaçao) physical occupation sites. Clearly, with a hunter-gatherer-fishing subsistence system, any significant alteration of the environment, such as mangrove and reef destruction by a tsunami event, would seriously affect the population's ability to survive, and indeed would force new adaptations to the altered environment, such as shifting focus to the leeward-side inland bays. Furthermore, evidence exists that Archaic Age populations may have moved in a trans-Caribbean direction, directly from northwestern Venezuela to the western Greater Antilles, perhaps partially in response to the tsunami events. The implications of this are significant for better understanding of the broader, early human population movements within the Caribbean region, including the transportation of cosmological concepts of the universe expressed through rock art. These paleotsunami events would have also affected the fundamental cognitive interpretations of Archaic Age peoples, regarding both a disorientation of their perspective for the natural world, as well as their eventual relations with the Ceramic Age peoples, who had a different cognitive perspective of the events.

Furthermore, and perhaps equally important, from this research it can also be suggested that the actual understanding of the archaeological evidence of the Archaic Age has been seriously affected by the potential physical elimination of archaeological sites through geophysical and hydrodynamic factors, which may have resulted in the skew of previous interpretations of Archaic Age data for the Southern Caribbean. This fundamental impact on the physical archaeological record itself, our basic measure for interpretation, is of major significance for the understanding of the Archaic Age in the Southern Caribbean, yet it also opens a discussion about similar environmental impacts, both contemporary and diachronic, in the broader Caribbean region, and even on a global scale.

5

Natural and anthropogenic landscape change and the submergence and emergence of Archaic Age settlement on the eastern edge of the Anegada Passage

John G. Crock

Introduction

Natural and anthropogenic changes to the landscape have transformed the northern Lesser Antilles since the arrival of the first human colonists during the Archaic Age. Sea-level rise, volcanic activity, storm events, coastal erosion, farming and modern development all have altered the landscape, and destroyed or obscured archaeological evidence of early settlement. The effects of these post-depositional processes inhibit our ability to reconstruct the early human history of the eastern Caribbean (e.g., Hofman and Hoogland 2016b; Siegel *et al.* 2015). The destructive impacts of landscape change are particularly evident in the context of the northern Lesser Antilles (Crock 2003; Crock and Petersen 1999). Ironically, the same processes that have had negative effects on the archaeological record also are responsible for the exposure and accidental discovery of many of the few currently known Archaic Age sites. Sites emerging from actively eroding and disturbed contexts illustrate the threatened nature of relatively scarce Archaic Age resources. Due to the endangered status of recorded and as-yet-unidentified early sites, the identification, evaluation and preservation of these sites must be considered a high priority.

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 65-76.

The eastern edge of the Anegada Passage

The northern Lesser Antilles lie on the eastern side of the Anegada Passage, a stretch of open water that separates the small islands of the northern Lesser Antilles from the Virgin Islands and Greater Antilles to the west. The channel spans approximately 65 km east-west between the edge of the 35 m deep Anguilla Bank near Sombrero Island and the equivalent bathymetric contour marking the edge of the Virgin Islands Plateau east of Anegada Island. Between the edges of these shallow banks, the Anegada Passage drops off significantly to depths of as much as 2300 m below sea level, making it the deepest in the eastern Caribbean. Straits such as Anegada helped structure the distribution of naturally available plants and terrestrial animals (Newsom and Wing 2004, 137) and likely influenced the timing and frequency of crossings by Amerindians throughout human history. The eastern edge of the passage is defined by a transition to the shallows and reefs of the Anguilla Bank and its productive fishing and shellfishing grounds. In particular, the conch fishery (*Lobatus gigas*) appears to have been attractive to the first inhabitants based on archaeological evidence for the importance of conch for food and tool manufacture (e.g., Serrand and Bonnissent 2018; see also Hofman *et al.*, this volume for Curaçao). The numerous small islands and cays on the Anguilla Bank also hosted a variety of plant and avian resources that were important to highly mobile populations, as has been documented on islands nearby and elsewhere in the region (Hofman and Hoogland 2003; Hofman *et al.* 2006; Pagán-Jiménez 2013).

Radiocarbon dates and artifact assemblages suggest that the first people to cross the channel likely came from the Greater Antilles as much as a millennium after the colonization of Cuba, sometime between approximately 7000 cal BP (Ulloa Hung and Valcárcel Rojas 2013) and 6000 cal BP (Rouse 1992; Wilson 2007). It remains unclear if the stretch of open water east of the Greater Antilles and Virgin Islands played any significant role in the timing of the initial human migration into the northern Lesser Antilles. At present, the earliest evidence for human habitation close to either side of the Anegada Passage comes from the eastern side at the site of Red Pond in St. Martin, dated to approximately 5200 cal BP (Bonnissent 2008). The age of this site is similar to that of the earliest dated sites in Antigua farther south, where the oldest dates also range about 5000 cal BP (Davis 2000; Watters *et al.* 1992).

Other Archaic Age sites in the northern Lesser Antilles in St. Martin, Anguilla and Saba have yielded radiocarbon dates that are much more recent, in the 4500 to 3300 cal BP range (Bonnissent 2013; Crock and Petersen 1999; Hofman *et al.* 2006; Nokkert *et al.* 1995). These coastal or near-coastal sites include the Whitehead's Bluff site in Anguilla, discussed in detail below, and the Orient Bay and Norman Estate sites in St. Martin (Bonnissent 2001; 2009; Nokkert *et al.* 1995). Based on paleoclimatic reconstructions, they all appear to have been occupied during what was a dry period (Malaise *et al.* 2011) which undoubtedly influenced settlement and subsistence. Fauna recovered from each of the sites indicates a heavy focus on invertebrates and demonstrates the maritime orientation of populations during this period (Crock *et al.* 1995; Nokkert *et al.* 1995; Serrand and Bonnissent 2018). However, forest-focused settlement during roughly the same period, documented at the more upland site of Plum Piece in Saba illustrates a degree of mobility and economic diversity for small groups of fisher-collectors within a settlement system that likely included multiple islands and cays in the northern Lesser Antilles (Hofman *et al.* 2016; Hofman *et al.*, this volume).

Interestingly, the dates from the northern Lesser Antilles are earlier than the earliest dates recorded in the Virgin Islands at Krum Bay, ca. 3210 to 3000 cal BP (Lundberg 1989; Toftgaard, this volume). While it is tempting to suggest that these data might suggest a more direct connection to the Greater Antilles, the gaps in the archaeological record and chronology likely reflect more about site loss due to landscape change and a lack of archaeological sampling than the dynamics of island colonization and settlement. Based on the apparent evidence for regular interisland movement, however, regular crossings of the Anegada Passage also may have occurred. A pattern of frequent interregional movement during the Archaic Age, including between the Lesser Antilles and the Virgin Islands and Greater Antilles, may represent a more accurate reconstruction compared to more linear, unidirectional models.

Similar issues surrounding migration and movement of people during the Archaic Age pertain in the Windward Islands to the south. A lack of data in the southern Lesser Antilles north of Trinidad, where settlement dates to as early as 8000 cal BP (e.g., Boomert 2013, this volume; Pagán-Jiménez *et al.* 2015), has been used to suggest that these islands were bypassed by Archaic Age populations (e.g., Fitzpatrick 2006; Callaghan 2003). However, paleoenvironmental research illustrates the potential for identifying signatures of human impacts on islands that currently lack Archaic Age sites and/or radiocarbon dates (Siegel *et al.* 2015; Siegel *et al.*, this volume). This recent research helps focus attention on the incompleteness and inadequacy of the archaeological record and highlights the rarity and consequent high scientific and heritage value of Archaic Age sites, wherever present, for answering questions related to the islands' earliest colonists.

Sea-level rise, storm-related coastal change and the submergence of the Archaic Age

As has long been noted, sea-level rise influences long-term natural processes that result in the erosion, burial and/or exposure of coastal archaeological sites in the Caribbean (cf. Nicholson 1976). While some researchers have suggested that the amount of formerly exposed land that has been lost since humans arrived is insignificant (Callaghan 2013, 286), others estimate sea-level rise of as much as 5 m has inundated more than 15% of island landmass since the Caribbean was colonized (e.g., Cooper 2013; Cooper and Boothroyd 2011). Marine transgression, the submergence of formerly habitable land and the consequent erosion of archaeological resources has had the greatest impact on and around low-lying limestone islands. In these contexts, even slight increases in sea level can erode and drown low-elevation coastal sites in short periods of time.

On the Anguilla Bank, which hosts Anguilla, St. Martin, St. Barths and numerous offshore cays, the loss of habitable territory since the Archaic Age has been significant. Using a reconstruction derived from multisite mangrove peat and coral samples, Toscano and Macintyre (2003, 266, Figure 5) estimate that the sea level has risen nearly 3 m in the last 3500 years, during a tectonically stable portion of the Holocene epoch (Toscano and Macintyre 2003), when uplift was unlikely to have counteracted the rise of the ocean. In an area immediately surrounding Anguilla and its cays, including Prickly Pear, Scrub Island and Dog Island, more than 1000 ha is currently underwater at depths less of than 3 m. Even accounting for some variability between subregions in the estimated amount of rise, it must be assumed that an unknown and potentially substantial number of Archaic Age sites have either been submerged or lost to erosion in this portion of the northern Lesser Antilles.

While no submerged sites or artifacts unequivocally attributable to the Archaic Age have been found in the shallows around Anguilla, Ceramic Age artifacts have been recovered underwater near the shore and provide evidence of active erosion of more recent coastal sites. Reflecting on just the past 50 years, landowners report significant loss of shoreline property on both the southern (Rendezvous Bay) and northern (Island Harbour) coastlines (Crock and Petersen 1999). A study of coastal change in the Lesser Antilles conducted between 1985 and 1995 documents a rate of coastal erosion of 0.3 m/year, punctuated by more damaging major storm events such as Hurricane Luis, a category-5 storm that hit the island in 1995 (Cambers 1997). While most of the beaches recover from periodic storm-related encroachment (Cambers 1997), the annual reworking of the shoreline is not always conducive to site preservation (Crock 2003). Over the long term, the receding coastline represents the frontier of the effects of sea-level rise on the archaeological record.

In addition to sea-level rise, coastal development by subsequent populations has also reduced the remaining population of Archaic Age sites. Beginning with the establishment of larger villages during the Ceramic Age, Archaic Age habitations have been overwritten or at least rendered indistinguishable from more recent, comingled Amerindian deposits. More significantly, the effects of clearing, cultivation and development during the more recent colonial and modern eras have transformed the landscape and destroyed archaeological resources, including Archaic Age sites (e.g., Armstrong 1980).

A total of only three of the 55 Amerindian sites recorded in Anguilla and its offshore cays are attributable to the Archaic Age based on diagnostic artifacts and/or radiocarbon dates (Crock and Petersen 1999; Crock *et al.* 1995; Douglas 1991). Each site emerged from its archaeological context as a result of disturbance caused by natural and/or anthropogenic processes and, in each case, site identification can be described as accidental. While the relatively small sample of Archaic Age sites is, in part, a reflection of the mobile settlement patterns and small populations, it also is influenced by the differential effects of landscape change.

The rather haphazard methods that resulted in the discovery of the small number of Archaic Age sites in Anguilla is far from unusual in the northern Lesser Antilles. Until the relatively recent imposition of "preventative" cultural resource management archaeology in the region, mainly on neighboring French St. Martin (Bérard and Stouvenot 2011), the fortuitous identification of sites represented a primary source of site data. For example, sites found in gardens by landowners, as in the case of the Flower's Avenue site or the Plum Piece site on Saba (e.g., Hofman and Hoogland 2003), provide examples of the importance of local knowledge to the investigation of early Amerindian settlement. Collectively, these data also illustrate how few sites owe their initial discoveries to systematic site-identification surveys. Investigations conducted in advance of residential and commercial construction in St. Martin are encouraging in that they illustrate how the more methodical exploration of coastal areas, aided by machine, can result in the identification of Archaic Age sites in less accessible, buried contexts such as those found at Orient Bay and Red Bay (Bonnissent 2008). These sites and those such as the Sugar Factory Pier site in Saint Kitts (Armstrong 1980) suggest that as-yet-unidentified sites may still exist under dunes or volcanic deposits on other islands, despite the cumulative effects of natural and anthropogenic landscape change.

Anthropogenic change and the emergence of Archaic Age sites on the Anguilla Bank

In the northern Lesser Antilles, the closest island to the Virgin Islands and Greater Antilles is the isolated Anguillian island of Sombrero, which lies about 90 km east of Anegada and Tortola and about 54 km northwest of Anguilla. Critically important for nesting seabirds (Soanes *et al.* 2016), the island was likely a stopover during the Archaic Age and afterwards for people traveling either way across the Anegada Passage. Unfortunately, phosphate mining of the island's plentiful guano deposits in the late nineteenth century flattened its "sombrero" and, in the process, removed most of the island's surface and any archaeological evidence with it.

Dog Island is the next closest landmass to the channel, and is located approximately 38 km southeast of Sombrero and 15 km north of Anguilla. Also noted for its importance to nesting colonies of seabirds (Bright *et al.* 2014), the island has had only limited historic settlement and use for livestock pasturage, remaining undeveloped and uninhabited. A total of ten archaeological sites, at least eight of them Amerindian in origin, were found in 1979 during a feasibility study for the use of Dog Island as a U.S. Navy range (Tronolone 1979). One of these includes an Archaic Age component identified along the ridge that runs above the inland side of a salt pond (Crock and Petersen 1999). Artifacts were identified on the surface in an area denuded and eroded by the island's wild goats. While no radiometric dates are available for this site, an Archaic Age blade was recovered, in addition to cores and core tools, as well as flakes and core fragments. With the exception of one core of fine-grained chert, all of the artifacts are likely a local, weathered gray limestone.

The one blade recovered exhibits a slightly "stemmed" or tanged base and very slight retouch on one margin (Figure 5.1h). This specimen resembles Archaic Age specimens reported from Hispaniola (e.g., Veloz Maggiolo and Ortega 1976; Rouse 1992), Cuba (e.g., Kozłowski 1974) and Archaic Age sites in Belize (Wilson *et al.* 1998). At the time the site was occupied, the salt-pond area below may have been an exposed coastal plain.

Of the two Archaic Age sites known on the island of Anguilla, the Flowers Avenue site is situated in a similarly elevated setting above a level plain. The site is located farther inland, in the central portion of the island. The site lies within 1 km of two recorded cave sites, Airport Cave and Tanglewood Cave, each of which have produced lithic and coral artifacts of indeterminate age in addition to human remains and ceramics. While the use and significance of caves is more associated with Ceramic Age populations in Anguilla and the Caribbean more broadly, an Archaic Age burial is known from the cave of Morne Rita, Marie-Galante in Guadeloupe (Fouéré *et al.* 2015), and the exploration and use of caves during the Archaic Age has long been established in the Greater Antilles (e.g., Alegría 1955).

The Flowers Avenue site was discovered by a landowner who recovered a large, eared axe during landscaping activity on her property (Crock and Petersen 1999). The axe exhibits a broad bit, an expanding poll end and use wear along its dulled bit (Figure 5.1d). Another garden, about 100 m away, produced a "classic" Archaic Age

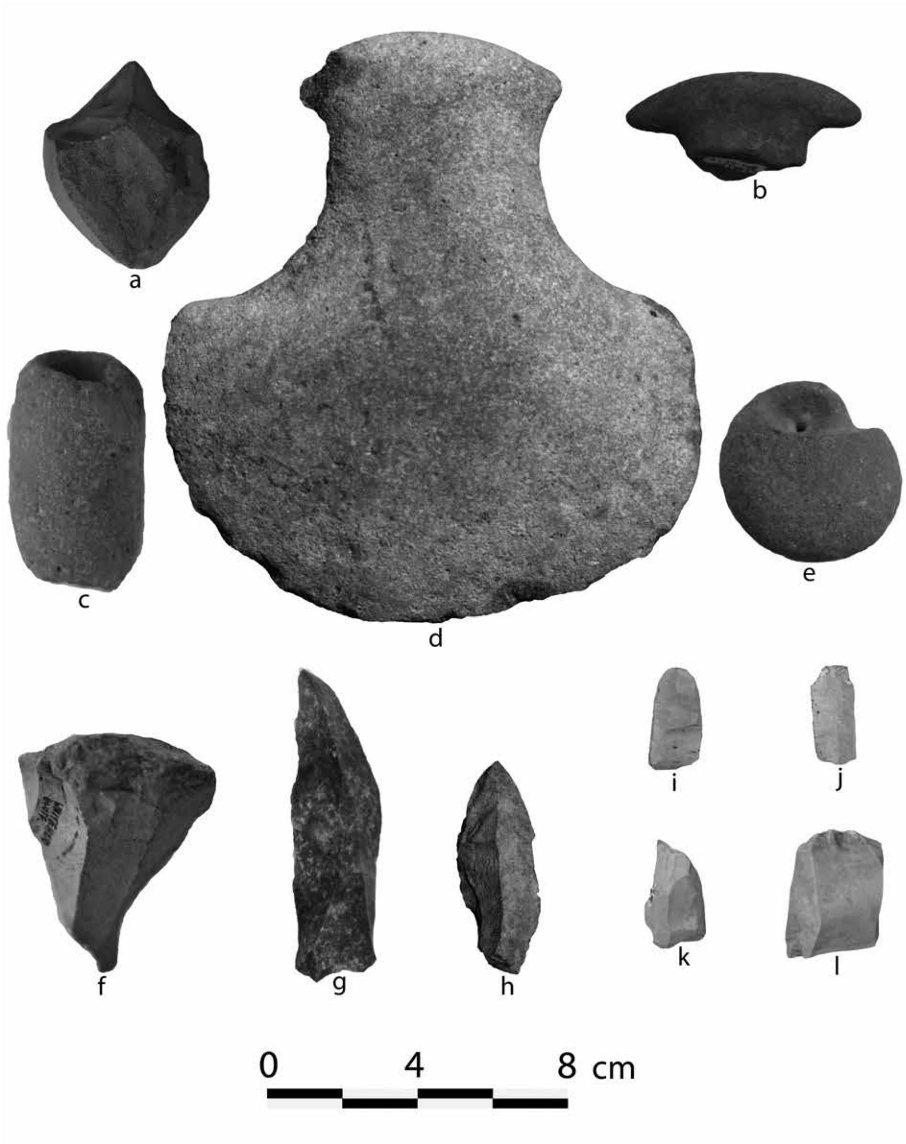


Figure 5.1. Archaic Age lithic tools and ornaments from Anguilla and Dog Island: (a) flaked- and ground-stone "punch" tool from the Whitehead's Bluff site; (b) ground-stone axe fragment from the Whitehead's Bluff site; (c) ground-stone axe from the Flowers Avenue site; (d) ground-stone "bead" from the Whitehead's Bluff site; (e) ground-stone ornament from the Whitehead's Bluff site; (f) chert blade core from the Whitehead's Bluff site; (g) chert blade from the Flowers Avenue site; (h) limestone blade from the Dog Island site; and (i-l) small chert cores from the Whitehead's Bluff site.

prismatic blade that was recovered from a garden plot on an adjacent property (Crock and Petersen 1999). The blade is approximately 8 cm long, exhibits three blade scars on its dorsal side and is manufactured from Antigua chert (Figure 5.1g). The location of the two isolated tools has never been systematically evaluated but may relate to a larger occupation in what can be considered an "interior" location for Anguilla (about

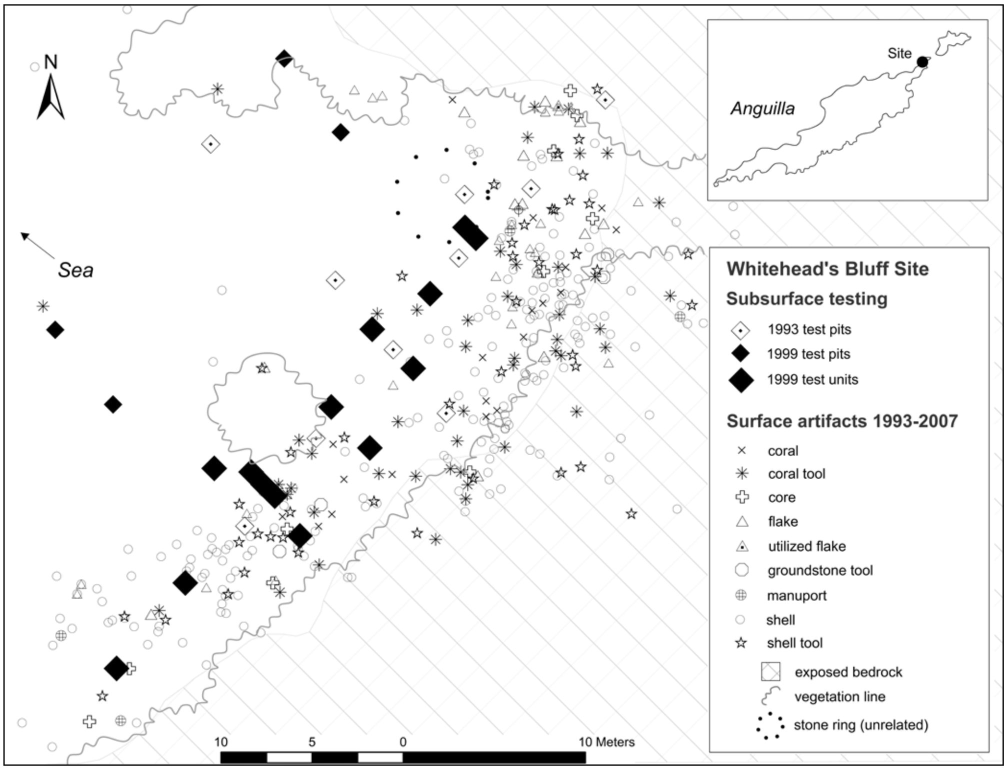


Figure 5.2. Map showing the distribution of subsurface testing and artifacts recovered from the surface at the Whitehead's Bluff site in Anguilla. Other, earlier collections by the Anguilla Archaeological and Historical Society were not mapped.

1 km from the coast). These artifacts are presumed to be attributable to the Archaic Age based on their morphology and, though limited, provide evidence for Archaic Age settlement in non-coastal settings on the island.

The best understood Archaic Age site in Anguilla, and the only one to have been systematically studied, is the Whitehead's Bluff site on the island's northeast coast (Crock *et al.* 1995). The site is not far from a large open sinkhole along the rocky shoreline that contains brackish water. At lower sea levels, the cave may have been a source of fresh water. A hiker found the Whitehead's Bluff site accidentally when he was drawn to a clearing, noticed a ring of stones and identified shell artifacts (Richard Whitehead, personal communication, 2013). Subsequently, more than 250 artifacts and ecofacts were recovered from the site by the Anguilla Archaeological and Historical Society (Crock and Petersen 1999; Douglas 1991).

Since its discovery, multiple periods of systematic fieldwork have resulted in a robust and diverse artifact inventory from the site. The first subsurface testing was conducted in 1993 by the author and the late James B. Petersen (Crock *et al.* 1995; Crock and Petersen 1999). Multiple episodes of surface collection followed, and additional subsurface testing was conducted by the University of Vermont in 1999 and 2005 (Figure 5.2). Artifacts have been recovered over approximately 1100 sq m from an area that slopes gradually northward to the sea. In addition to the unmapped AAHS collec-

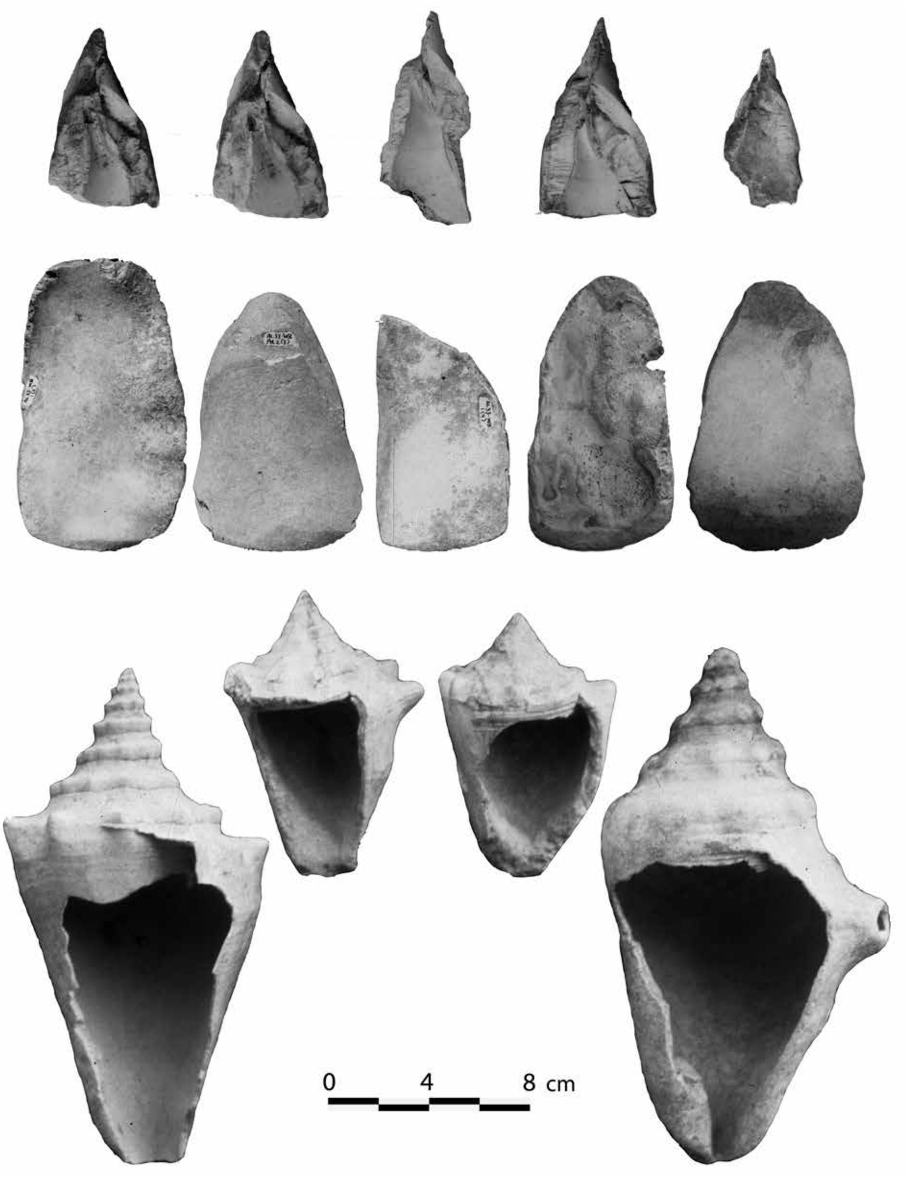


Figure 5.3. Shell tools (Lobatus) from the Whitehead's Bluff site in Anguilla. Top row: columella "picks"; middle row: celts or scrapers; bottom row: vessels.

tions, a total of more than 400 artifacts have been plotted on the surface and collected (see Figure 5.2). The light artifact inventory from 17.5 sq m of excavations generally matches the relatively low density of surface artifacts at the site from areas with the deepest remaining soils. The highest density of surface artifacts has been recorded in the areas that are most deflated, with some found directly on exposed bedrock. The ring of stones that originally drew attention to the site has been determined to be archaeologically recent and unrelated to the Archaic Age occupation. Excavations within and immediately outside of the ring of stones strongly suggest that the ring represents an Afro-Caribbean "coal keel," constructed to produce charcoal. Surface charcoal from this area was radiocarbon dated by the AAHS and returned an archaeologically modern date (Crock *et al.* 1995). Aside from this feature and the likely related clearing of vegetation, no other evidence of historic activity has been identified, and the site appears to be a single component Archaic Age site.

The evidence for colonial-era or more recent charcoal production and the evidence for gradual erosion of the site since its discovery provide a case study in the progressively damaging effects of anthropogenic and natural landscape change. The site has undergone increasingly severe wind scouring, evidenced by truncated soil profiles and a deflated, actively eroding surface. Once protected from prevailing wind from the south, the site gradually has become more and more exposed due to the mining of a massive sand dune once present along the shore to the south. Since our first fieldwork at the site, wind erosion has removed more than 30 cm of the site's surface. While sand mining has been illegal in Anguilla since the '80s, the ongoing use of the quarry near the site unfortunately is exempt and extensive mining activity has changed the local landscape dramatically.

Sea-level rise and major storm episodes have undoubtedly impacted the site and its environs post-abandonment as well. In addition to the effects of archaeologically frequent hurricanes, at least two tsunamis have hit the east end of island since the Archaic Age, and may have removed portions of the Whitehead's Bluff site and others. Dated to approximately 1500 and 500 BP respectively, these events were powerful enough to deposit boulders of over 20 MT along the shoreline directly in front of the Whitehead's Bluff site (Scheffers and Kelletat 2006, 192). Events such as these most certainly were devastating to living Amerindian populations on Anguilla and its cays, and undoubtedly had a negative impact on the preservation of the Whitehead's Bluff site and the archaeological record of other Archaic Age resources, particularly along the coast (e.g., Scheffers *et al.* 2009; see also Haviser, this volume).

The Whitehead's Bluff site has produced one of the most diverse Archaic Age assemblages in the northern Lesser Antilles and includes a broad representation of shell, coral and lithic tools, lithic flakes and shell subsistence remains. Typologically, the site exhibits a combination of artifacts that were once associated with separate cultural traditions, believed to represent northern, "Casimiroid," and southern, "Ortoiroid" origins (Rouse 1992). Notably, marine gastropods are heavily featured and indicate the importance of this resource within the subsistence regime and for the manufacture of vessels and tools. Shell vessels at the site exhibit the removal of the inner whorls of the shells of queen conch (*Lobatus gigas*) and milk conch (*Lobatus costatus*) (Figure 5.3), as well as king helmet (*Cassis tuberosa*), trumpet triton (*Charonia tritonis*) and cowrie. In addition to finished specimens, a number of fragmentary vessels also have been found at the site, broken during manufacture and providing evidence of on-site reduction. *Lobatus* celts or scrapers also are well represented in all stages of manufacture and indicate local production of these tools as well. Some of the finished specimens are so well ground that they do not exhibit any natural shell surface structure (see Figure 5.3).

The site also has produced more than a dozen *Lobatus* shell implements that can be characterized as "picks" or "points" and have also been found at other Archaic Age sites (e.g., Lundberg 1989). These artifacts are intentionally split base portions of the conch shell columella (see Figure 5.3). In addition to shell vessels and tools, *Lobatus* fragments also have been recovered from the surface and in excavations, attributable to both food processing and the by-products of shell-tool production.

Lobatus shell tools have produced all four of the Archaic Age radiometric dates that have been obtained for the Whitehead's Bluff site. The calibrated, two sigma range for the site is 3680 to 2790 cal BP (see Appendix, this volume).Two other dates – one, previously mentioned, that the AAHS obtained on surface charcoal, and the other on whelk shell excavated from a test pit – are both modern in age. The *Cittarium pica* shell that was sampled may have been carried to the site by hermit crabs (Crock and Petersen 1999).

Some of the *Cittarium* recovered in excavated samples likely is attributable to the Archaic Age occupation, however, as are other, smaller gastropods, including species of *Pupura*, *Nerita* and *Turbo*. Arcs (*Arca zebra*) are the best represented bivalve species and comprise a large percentage of subsistence shell in both surface-collected and excavated samples, along with chitons (*Acanthopleura*). No vertebrate remains have been recovered from the site, possibly reflecting peoples' focus on shellfish but more likely reflecting the poor preservation conditions at the site.

The Whitehead's Bluff site assemblage also includes a wide representation of flaked-stone artifacts and a number of ground-stone items as well. Prepared polyhedral cores indicate that blades were produced at the site (Figure 5.1f), and small block and bipolar cores (Figure 5.1i – l) provide evidence that small blades and micro flakes (less than 1 cm) were produced at the site. The cores and most of the flakes that have been recovered are made of weathered chert with a white patina. The use of limestone, likely local in origin, is illustrated by cores and core tools as well. Though faded, many of the chert tools and flakes reveal enough of their matrix to be identified macroscopically as heavily weathered Antigua chert. Along with studies at the raw material's source (e.g., Davis 2000; Van Gijn 1993), the presence of Antigua chert at Flowers Avenue and probably the Whitehead's Bluff site helps to reconstruct early patterns of mobility and exchange (see also Hofman *et al.* 2014b; Hofman *et al.*, this volume).

While blades likely represent singular tools, either hafted or handheld, the production of very small blades and micro flakes suggests the production of composite tools possibly related to plant harvesting/processing. A focus on plant processing is indicated by the ground-stone tools from the site, including a mortar and grinding stones, and heavier woodworking by the poll end of a ground-stone axe, similar to the form exhibited by the tool found at the Flowers Avenue site (Figure 5.1b). Other tools may relate to shellfish processing, such as a ground- and flaked-stone tool with a tapered point that may have been used to "punch" holes in gastropods to facilitate meat extraction (Figure 5.1a).

Coral tools round out the artifact inventory at Whitehead's Bluff, with large spatulate coral abraders being the most notable (Crock *et al.* 1995; Crock and Petersen 1999). These tools exhibit localized use wear and may have been used in the production of shell tools or artifacts made from perishable materials that do not survive to be studied. Unmodified coral recovered at the site may have been transported there by Amerindians, or some may have been distributed by the aforementioned tsunami events that spread corals and coarse sand across the island's east end (Scheffers and Kelletat 2006).

Today, the area immediately offshore from the site exhibits a sandy bottom at a depth of approximately 3 m that was likely part of the intertidal zone when the site was occupied. Interestingly, a number of shellfish species in the site inventory from Whitehead's Bluff typically inhabit rocky substrates in shallow contexts that do not exist in close proximity to the site today. Marine snail shells dominate the assemblage and indicate these were a foundational resource. With limited natural predators, conch and other high meat-weight gastropods such as whelks were likely abundant and easily collected near the site during the Archaic Age.

The cultural importance of gastropods to Archaic Age islanders may be reflected in a ground-stone ornament or line weight (with no evident line wear) from the Whitehead's Bluff site that appears snail-shaped (Figure 5.1e). Although adornments are relatively rare at Archaic Age sites, the Whitehead's Bluff collection also includes a perforated cylindrical artifact made of limestone, possibly a large bead (Figure 5.1c). These two artifacts are important in that they help expand discussion of Archaic Age material culture beyond subsistence-related activities.

Conclusions

The maritime focus of the setting, material culture and subsistence remains at sites such as Whitehead's Bluff in Anguilla highlights the role of the marine environment in helping form the identity of Archaic Age peoples on the eastern edge of the Anegada Passage. Though it is impossible to correlate its date of occupation with that of Whitehead's Bluff, the site on Dog Island is important for understanding the role of Anguilla's offshore cays for highly mobile Archaic Age populations, whether it be linked to these islands' geographic position on the edge of the strait or strictly related to their seasonally attractive concentrations of seabirds, eggs and other resources. Similarly, the more inland Flowers Avenue site in Anguilla demonstrates the presence of Archaic Age populations in more interior settings, but the isolated artifacts and their proximity to cave sites generates more questions about local Archaic Age land use and settlement patterns than can be answered with the available data.

Archaic Age sites in fragile settings also force us to confront the radically dynamic interface between land and sea, and between development and archaeological resources. We are left to estimate the effects of natural and anthropogenic landscape change, and guess at what pieces of the past are missing from the archaeological record. Since the islands were first colonized, millennia of rising sea levels, tropical storms and tsunamis have pushed shorelines inland. Deforestation, cultivation and construction have transformed the terrain. As a result, the sample of Archaic Age sites that remain to be studied on the small islands of the northern Lesser Antilles has been substantially reduced, and the landscape Archaic Age peoples once inhabited has been greatly transformed. While the same can be said of the archaeological resources and associated landscapes representing more recent periods, the effects on Archaic Age heritage have been more dramatic due to the small size of sites, the more ephemeral nature of occupations and the wholesale submergence of island area once available to habitation. The ongoing threats posed by climate change and the continued development of small islands critically endanger remaining sites. The rarity and threatened status of these resources elevates the significance and research value of known and yet-to-be-recorded sites, and advocates for greater research focus such as that summarized in this volume.

Acknowledgements

Thanks to the late James Petersen and to David Watters for the opportunity to study the archaeology of Anguilla and to the Anguilla Archaeological and Historical Society and Government of Anguilla for their support. In particular, I would like to thank the late Nik Douglas and Richard Whitehead for their identification of the Whitehead's Bluff site and Kenn Banks, Tim Hodge, Karim Hodge, Lennox Joash Proctor and Aileen Smith for their continued efforts on behalf of cultural resources in Anguilla. Many thanks as well to the anonymous reviewers and editors for their helpful comments on earlier drafts of this chapter.

6

Ecosystem engineering during the human occupations of the Lesser Antilles

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Introduction

For years, one bit of conventional wisdom was that the Neolithic farmers coming from the Orinoco Valley were the people who introduced horticulture, pottery, and landscape-modification practices to the West Indies by approximately 2500 BP (Rouse 1986, 1992; Wilson 2007). A corollary to this axiom was that the earliest Archaic Age settlers or the first human colonists of the islands had trodden lightly on the landscapes, inexplicably avoided many of the small islands of the Lesser Antilles, and followed adaptive strategies that were in such harmony with nature that they maintained the pristine character of landscapes as if they had been untouched by human hands for approximately 6000 years. Our research into island historical ecology puts to rest this Rousseauian caricature of the Archaic Age 'noble savage' or the 'Ecological Indian' (Harkin and Lewis 2007; Krech 1999). In fact, we demonstrate that these first settlers on the islands engaged in active programs of ecosystem engineering, thereby creating anthropogenic landscapes, which were then further modified and managed by later occupants of the same islands. Our project also produced primary environmental data revealing the significant impacts of early European colonial occupants on the landscapes.

We will summarize colonization processes and outcomes for selected time frames from the continuum of human history in the Caribbean, including early European occupations. In doing so, we must emphasize that this presentation in no way implies distinct, monolithic migration events. Rather, it is clear from the archaeological and paleoecological records that over the past 8000 years, humans were moving into,

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 77-88.

out of, and among various parts of the Caribbean in a continuous fashion (Hofman *et al.* 2007; Keegan and Hofman 2017; Siegel *et al.* 2015). By focusing on selected time frames from this continuum, we aim to illustrate alternative sets of conditions and variables that are relevant to the causes and consequences of ecosystem engineering by humans through the Holocene.

This chapter is a follow-up to our previous publications on island colonization history (Siegel 2018; Siegel *et al.* 2015). Rather than concentrating on colonization history per se, we will examine early exploration and subsequent colonization from the perspective of evolutionary ecology within a framework of human-environment relations through the Holocene. Our discussion is informed by research into niche-construction theory and ecosystem engineering (Laland *et al.* 2001, 2016; Odling-Smee *et al.* 2003, 2013; Rowley-Conway and Layton 2011; Smith 2011).

Environmental data were collected from nine islands between Venezuela and Puerto Rico to address historical-ecological relations across a variety of island ecosystems. Environmental cores were extracted from coastal to near-coastal wetlands and one interior lake. These are settings with good potential for preserved plant microfossils and organic matter.

Before demonstrating the utility of evolutionary ecology and niche-construction theory in Caribbean colonization history, it is necessary to clarify terms. The concept of 'niche' in ecology has a long history, ranging from the role and position of an organism in its local community (Grinnell 1924), to an organism's relationship to 'food and enemies' and interspecific competition (Elton 1927), to the universe of conditions within which organisms survive and reproduce (Hutchinson 1953), to an organism's habitat and specific behaviors (Odum 1959). Hutchinson (1957) defined an organism's niche as the *n*-dimensional hypervolume encompassing the full range of conditions (*n* dimensions) within which the organism survives and reproduces. The *fundamental* niche is the full range of optimal, idealized or *hypothetical* conditions in which an organism can successfully survive and reproduce. In contrast, the *actual* range of conditions defining an organism's existence is called the *realized* niche. Hutchinson's view of the niche is important because it requires the presence of an occupant (organism or population), as opposed to other views that allow for 'vacant' niches. In other words, the niche is defined by an organism's biotic and abiotic requirements as well as the organism's actual behaviors relative to those requirements. Importantly, too, Hutchinson considered niche properties (biotic and abiotic conditions, occupant behaviors) to be inherently changeable, thereby allowing for ideas of niche evolution. Hutchinson's ideas of multidimensional niche spaces and mutability of niche properties set the stage for modern niche theory and considerations of evolutionary ecology (Odling-Smee *et al.* 2003, 37–41; Pianka 1978; Schoener 1989).

Niche construction is based on the premise that as organisms modify habitats and realized niches, descendants of the ancestral organisms or new arrivals adapt to and further modify the niche. A classic example of ecosystem engineering and niche construction is seen in the dams built by beavers. By cutting down trees and building dams, beavers cause ponds and wetlands to form and increased sedimentation, all of which may result in dramatic and long-term (decades to centuries to millennia) changes in the plant and animal communities (Jones *et al.* 1994; Naiman 1988; Naiman *et al.* 1988; Odling-Smee *et al.* 2003). Concepts of evolutionary niches and ecological inheritance have been developed to characterize the dynamic interplay between organisms' behavior and niche characteristics (Laland *et al.* 2016).

Four categories of niche construction have been identified: inceptive perturbation, counteractive perturbation, inceptive relocation, and counteractive relocation (Odling-Smee *et al.* 2003, 44–50). Inceptive perturbation refers to physical changes in the environment or local habitat as a result of organisms modifying their surroundings. Counteractive perturbation is characterized by organisms physically altering their surroundings in response to prior environmental changes, similar to adaptive responses in standard evolutionary theory. Inceptive relocation occurs when organisms occupy a new environment ('invasion of a new habitat' [Odling-Smee *et al.* 2003, Table 2.1]). Counteractive relocation refers to organisms moving to a new place in response to environmental changes in their original home. It should be clear that these are not mutually exclusive categories of niche construction. For example, when organisms occupy a new environment (inceptive relocation), they will likely render changes to the new place (inceptive perturbation). Likewise, inceptive perturbations wrought by one class of organisms may result in other organisms moving out (counteractive relocation). To varying degrees, these categories of niche construction are applicable to a range of human behaviors, including colonization of new places, early plant and animal domestication, foraging and collecting strategies, the formation and maintenance of fixed territories, and the attendant social, political and economic formations associated with these behaviors.

Researchers are finding that niche-construction theory represents a compelling body of concepts to frame archaeological and paleoenvironmental evidence for landscape modifications and management, early domestication of plants and animals, and eventual agricultural practices (O'Brien and Laland 2012; Smith 2007, 2011, 2012, 2015a, 2016; Zeder 2016). Through active manipulation of biotic and abiotic properties, otherwise called ecosystem engineering, hunters and gatherers, foragers and collectors, low-level food producers, and full-blown agriculturalists have constructed niches ranging in scale from local habitats to extensive landscapes (Rowley-Conway and Layton 2011). Archaeological traces of ecosystem engineering by hunters and gatherers, foragers and collectors, and low-level food producers are difficult to identify because 'small-scale societies invariably [leave] a light footprint on the landscape, and patterns of human niche construction often closely mimic natural processes' (Smith 2016a, 315). The 'light [archaeological] footprint' of small-scale societies, especially those dating to the Pleistocene or Early to Mid-Holocene, may be difficult to discern owing to a range of taphonomic factors (Siegel *et al.* 2015). Integrating multiple lines of evidence from paleoenvironmental investigations allows for more reliable and accurate reconstructions and assessments of niche construction by humans dating to the transition between the Pleistocene and Holocene and the following Early and Middle Holocene periods.

Application of niche-construction theory to Caribbean colonization history

In our historical ecology project targeting islands between Venezuela and Puerto Rico, we have addressed trajectories of cultural niche construction throughout the full span of human history in the region. In the remainder of this chapter, we will demonstrate the applicability of evolutionary ecology and niche-construction the-

Figure 6.1. Map of the Caribbean Basin.

ory in the Caribbean from the first colonizers, ca. 8000 cal BP, up to and including European domination of the landscapes. By doing so, we intend to show how niche-construction theory is relevant to the full range of sociocultural integration, from small band-level communities to global world powers. Although this book is directed specifically to the Archaic Age period, we believe it is important to consider the continuous and cumulative nature and impacts of human activities on the landscapes of the Caribbean. This long-term perspective provides context for the specific outcomes of human decisions and sociocultural dynamics through the Holocene.

Through a program of environmental coring, proxies of environmental conditions and anthropogenic landscapes were collected from nine islands of the Southern Caribbean, Lesser Antilles, and the Virgin Islands (Figure 6.1). Trinidad, Grenada, Martinique, and Marie-Galante all produced evidence for early anthropogenic landscapes. Except for Trinidad, this evidence predates the earliest documented archaeological sites for the islands (Siegel *et al.* 2015).

It is a challenge to distinguish natural processes from culturally derived perturbations in the paleoenvironmental record, especially in the context of small communities or groups of hunters, fishers, foragers, and collectors (Smith 2016a). Linking dated assemblages of proxies for past environments (pollen, phytoliths, charcoal particulates, diatoms, isotope records, sediment chemistries) to paleoclimate reconstructions has become a method for identifying anthropogenic landscapes (Bush *et al.* 2000, 2015, 2016; McMichael *et al.* 2012; Siegel *et al.* 2015). In some cases, anthropogenic landscapes were identified from paleoenvironmental records prior

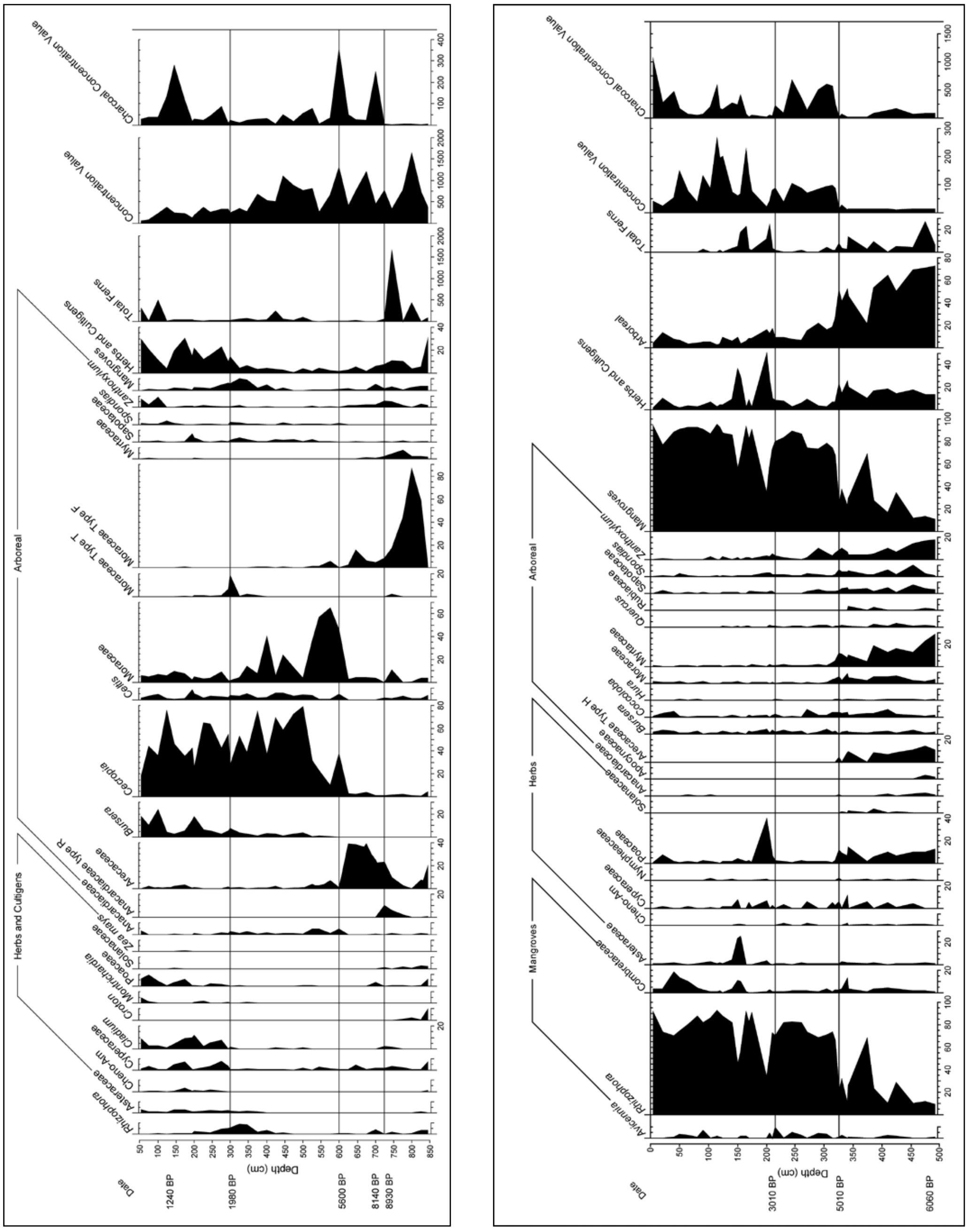


Figure 6.2. Pollen diagrams for the Grenada cores. The Meadow Beach core (right graph) was collected from a mangrove located along the northeast coast. Charcoal-concentration values spiked and remained elevated between c. 5010 and 3010 cal yr BP. Prior to c. 5010 BP, ethnobotanically useful taxa were relatively well represented, including Poaceae, Solanaceae, Arecaceae, Moraceae, Myrtaceae, Sapotaceae, and Spondias. The Lake Antoine core (left graph) reveals anthropogenic inputs from 600 cm (c. 5600 cal yr BP), including disturbance indicators of Cecropia and charcoal microparticulates. Ethnobotanically useful taxa include Anacardiaceae, Arecaceae, Moraceae, Sapotaceae, and Spondias.

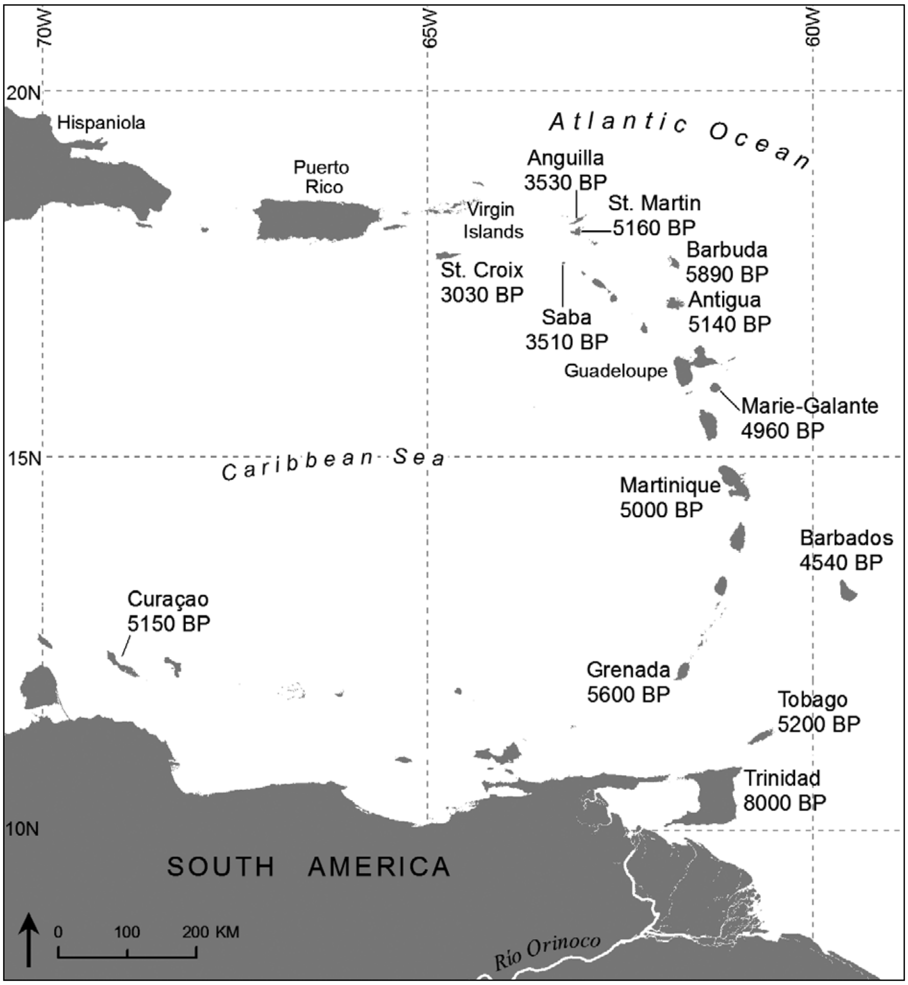


Figure 6.3. Map of the eastern Caribbean showing the earliest calibrated median radiocarbon dates associated with archaeological deposits or anthropogenic landscapes.

to locating contemporaneous archaeological sites in the same region (Burney *et al.* 1994).

Early to Mid-Holocene outcomes of human occupations

Comparing proxies for early human intervention and their timing on Trinidad, Grenada, Martinique, and Marie-Galante reveals variable trajectories of inceptive relocation by first colonists of those islands (Siegel *et al.* 2018, Table 14.2). Humans arrived on Grenada between ca. 5600 and 5000 cal BP, based on culturally derived disturbance indicators and radiocarbon dates (Figure 6.2; Siegel *et al.* 2015, Table 2). In most discussions of ancient niche construction, investigators emphasize the outcomes of human behaviors as enhancing ecosystems and selectively nurturing ethnobiologically useful plant and animal taxa to suit the needs of new colonists (Smith 2011, 2016). In the context of landscape learning, another potential outcome of first colonizers is to have deleterious impacts on

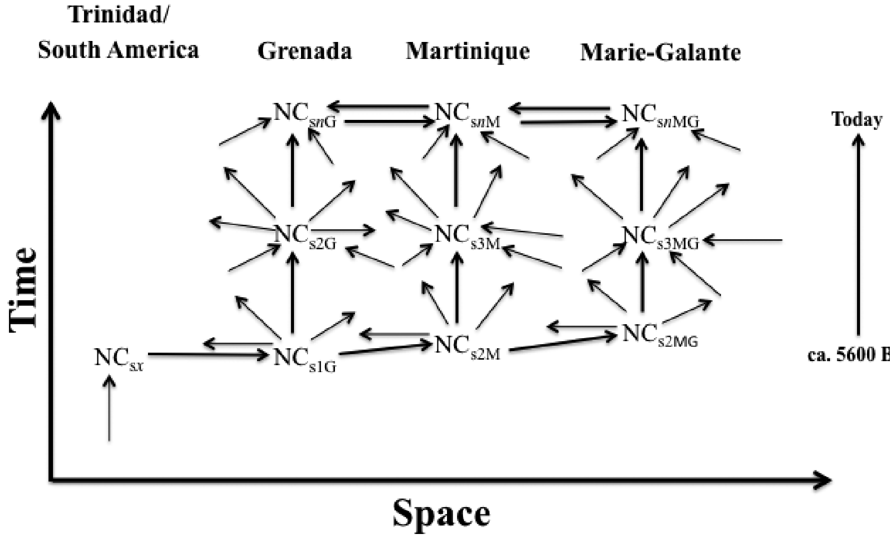


Figure 6.4. Model of evolutionary cultural niches in the Lesser Antilles. NC_s: Niche-construction strategy. NC_{sx} represents the time when the first human groups colonized Grenada from South America or Trinidad. Each of the islands progressed through an evolutionary continuum of niche-construction strategies with varying degrees of uniqueness, indicated by the island initials next to each strategy number. The complex web of inter- and intraisland interactions influencing niche-construction strategies is represented by the incoming and outgoing arrows for each island at different times in the trajectories. This model of evolutionary cultural niches is a variation on the chronological charts pioneered by Rouse (1986, 1992) in that changes in sequences are depicted geographically (x-axis) and diachronically (y-axis).

ecosystems, or niche deterioration (Rowley-Conway and Layton 2011), and this is what we documented in the environmental record for Grenada.

Prior to the arrival of humans, a suite of ethnobotanically useful taxa was well represented in the pollen and phytolith records of cores collected from Meadow Beach and Lake Antoine on Grenada. Following the arrival of humans on the island between approximately 5600 and 5000 cal BP, large-scale fires are documented in the record coinciding with the wettest period of the Holocene in the region. At the same time, considerable perturbation of local vegetation marks the activities of the earliest or near-earliest human colonists. Many of the ethnobotanically useful taxa declined significantly, although none were extirpated (Figure 6.2; Jones *et al.* 2018a). With the appearance of first colonizers, local habitats were permanently and dramatically altered. After ca. median cal 3010 BP, the uppermost zone in the Meadow Beach core revealed additional habitat changes likely to have been driven in part by human activities. Periods of sustained burning may coincide with the arrival of Saladoid settlers from the Orinoco Valley (Jones *et al.* 2018a).

Grenada was the first island colonized by humans in the Lesser Antilles during the Early to Mid-Holocene (Figure 6.3). These people undoubtedly recognized many similarities between the floristic communities of Grenada and their homelands of either mainland South America or Trinidad. However, the biogeographic differences in landmass scale between the small island of Grenada and Trinidad/South America would have represented a major readjustment in niche construction, ecosystem engineering and exploitation strategies. Survival strategies followed on the mainland for millennia may have been deleterious to the small-island ecosystems of the Lesser Antilles. We argued earlier that the landscape-learning curve was not steep for the first pioneering groups entering the islands (Siegel *et al.* 2015, 289). We still partially agree with that assessment based on similarities in plant taxa between the islands and the mainland. However, we would now modify our earlier conclusion in terms of ecosystem engineering strategies of the first colonists to the first occupied island in the Lesser Antilles (Grenada). These inceptive relocators must have learned that their mainland approaches to niche construction needed to be modified for the other small-island worlds of the Lesser Antilles. By the time groups occupied other islands of the Lesser Antilles, niche-construction strategies had shifted thereby enhancing landscapes for their needs and the needs of their descendants. In this regard, we may think of evolutionary niches geographically and diachronically (Figure 6.4).

Cores collected from Martinique and Marie-Galante produced evidence of early colonizers dating to approximately 5000 cal BP (Siegel *et al.* 2015, Figs. 5, 7, S4a, S4b). Except for the near-removal of *Rhizophora* (probably red mangrove) on Marie-Galante, there is no evidence for overexploitation of ethnobotanically useful taxa. Red mangrove is known to be an excellent fuel wood (Morton 1965). In contrast to Grenada, other useful plant taxa were selectively spared and nurtured.

Our model of evolutionary niches in the Lesser Antilles is based on environmental sequences dating from ca. 5600 cal BP (Grenada) through the European colonial era. As with chronological charts, the model is constructed geographically (*x*-axis) and diachronically (*y*-axis) (Figure 6.4). Based on project data, Grenada was the first island to be occupied by humans from Trinidad or mainland South America. The founding population of Grenada established an initial niche-construction strategy (Figure 6.4: NC_{s1G}). Descendants of the founding population, potentially with exogenous inputs from later migrants and/or natural environmental/habitat changes, modified their niche-construction strategy (NC_{s2G}) and so on through time (NC_{snG}).

As human groups colonized other islands in the archipelago, variable trajectories of evolutionary niches were expressed on an island-by-island basis. It is important to emphasize that these island trajectories of niche evolution were not self-contained unilineal sequences. Caribbean archaeologists have long recognized the importance of interisland networks of trade, exchange, and mobility (Crock and Petersen 2004; Gower 1927; Hofman *et al.* 2007, 2011; 2014b; Hofman and Bright 2010; Hofman and van Duijvenbode 2011; Laffoon 2013; Mol 2013; Rouse 1986, 1992; Wilson 2007). Through the complex web of interactions linked to the circulation of peoples, things, and ideas within and among islands, the evolutionary trajectories of niche construction undoubtedly varied. The niche-construction strategy on one island at a given point in time may have been and most likely was different than the strategies on other islands at the same time (Figure 6.4). Moreover, strategies may have varied within single islands, especially larger ones. Variations in niche-construction strategies are apparent in the current project when comparing the pollen and phytolith diagrams from island to island (Siegel 2018).

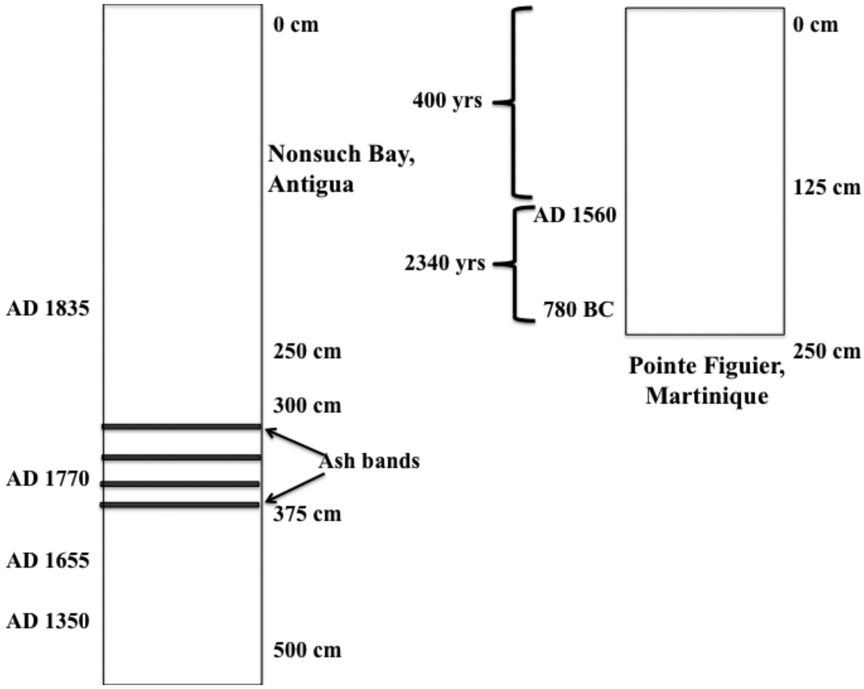


Figure 6.5. Depths of the Pointe Figuier, Martinique, and Nonsuch Bay, Antigua cores showing the calibrated median radiocarbon dates. In both cores, sedimentation rates increased significantly correlated with the establishment of large-scale sugarcane plantations.

Later Holocene outcomes of human occupations

Approximately six to eight millennia of human activities in the Caribbean resulted in cumulative records of landscape modifications and management prior to the arrival of Europeans. Once Europeans arrived in the West Indies with their views of globalization, market economies, and appropriate ways to benefit from these new lands and their occupants, they embarked on profit-driven strategies of niche construction. Integrating early eyewitness accounts of European colonial activities with primary environmental data reveals the devastating impacts of out-of-control globalizing niche-construction strategies. In particular, the English, French, and Dutch converted many of the previously forested islands of the Lesser Antilles into landscapes of single species of plants: tobacco (*Nicotiana rustica* or *N. tabacum),* indigo (*Indigofera suffruticosa*), and especially sugarcane (*Saccharum officinarum*) (Sheridan 1974; Watts 1966, 1987). On many of the islands, the sugar industry consumed ever increasing amounts of forest to clear land for cultivation, mills, and housing and to provide fuel wood for the mills and refineries.

Early colonial planters were under the misconception "that all West Indian soils exposed from beneath species-rich tropical rain-forest […] would be fertile, and would stay that way, for the whole landscape *looked* rich in resources," especially compared to the lands of their home countries (Watts 1987, 396, [emphasis in original]). Of course, within about a century of intensive plantation agriculture, many of these tropi-

Island, core location	Core number, sample depths	Percent of Total Depth in the Core	^{14}C Date Ranges (median cal dates, BP)	Percent of Total Date Range in the Core	Sedimentation Rate (cm/yr)
Martinique, Pointe Figuier	PF08–1, 0–128 cm	58%	0–390	14%	.3282
Martinique, Pointe Figuier	PF081, 128–222 cm	42%	390–2740	86%	.0404
Antigua, Nonsuch Bay	NS07–2, 0–221 cm	50%	0–115	19%	1.9217
Antigua, Nonsuch Bay	NS07–2, 221–349 cm	29%	115–180	11%	1.9692
Antigua, Nonsuch Bay	NS07–2, 349–398 cm	11%	180–295	19%	.4260
Antigua, Nonsuch Bay	NS07–2, 398–445 cm	11%	295–600	51%	.1540

Table 6.1. Sedimentation rates for the Martinique and Antigua cores.

cal landscapes were described as 'barren, rocky gullies, runaway land [eroded], waste land, and all the rest much worn out and not so fertile as it was […] [and] now lies waste[d]' (Anonymous 1710, cited in Watts 1987, 397). These early eyewitness accounts were corroborated in some of the coring results from our project.

On Martinique, a 2.5-m-deep core from Pointe Figuier produced a near-basal (223 cm) date of ca. 2730 cal BP (Figure 6.5). Another sample, from 128 cm, dated to ca. 390 cal BP. Over this approximate 2300-year span, 94 cm of sediments accumulated. The upper 128 cm of sedimentation occurred largely after the arrival of Europeans. The plantation system on Martinique was established in the 1670s. By 1736, 447 sugar plantations were documented and nearly the entire lowlands of the island had been cleared for cultivation. Over the last 400 years (14% of the time span since 2730 cal BP), 58 percent of the sediments in the Figuier core have resulted from colluvial erosional deposits (Table 6.1).

On Antigua, extensive timber felling 'took place from the 1730s […] in order to pave the way for the creation of new sugar estates […] [B]y 1750, virtually every district was under cane, there being no forest left on the island, a situation which was maintained at least until the 1790s, when Sir William Young reiterated that the "country is open, with very few trees or shrubs […] cultivation covers every acre" (Young 1801)' (Watts 1987, 434–435). A 1747 map of Antigua shows a thriving and intensive sugarcane industry on the island. By 1775, the island had been stripped of approximately 97 percent of its native vegetative cover (Technical Advisory Committee 2006; Watts 1987).

A nearly 5-m core was collected from Nonsuch Bay at the mouth of Ayers Creek, Antigua. Betty's Hope was one of the biggest cane plantations in the British West Indies and is located in the Ayers Creek watershed (Fox 2007, 2014). Based on its great depth and the presence of several volcanic ash bands, we were confident that a long record of environmental history was represented. It was with much surprise that the basal organic sample (445 cm) produced a date of median cal 600 BP, prehistoric but barely so (Figure 6.5). Three subsequent samples from selected depths in the column were successively more recent, all within the European colonial era. We see in this core evidence for what Douglas Armstrong (2013) has called 'an emerging landscape of power and enslavement' in the seventeenth through nineteenth-century Caribbean plantation economy.

Geoarchaeological research in the upper reaches of the watershed has also documented landscape impacts from the Betty's Hope plantation activities (Wells *et al.* 2015, 2016). Our coring data from Nonsuch Bay complement results from Wells *et al.*'s project (see also Wells *et al.* 2018). From the base of our core (445 cm) to 398 cm, the sedimentation rate was relatively low to moderate, spanning the late prehistoric to early colonial era for the eastern Caribbean. Organic sediment from 398 cm produced a median date of 295 cal BP, coinciding with the establishment of the Betty's Hope plantation (1651 [Fox 2014]). Between the median dates of 295 cal BP and 180 cal BP, the sedimentation rate increased by over 450 percent, dramatically illustrating the deleterious effects of European niche-construction strategies during the early colonial era. This high sedimentation rate has remained steady to the present at nearly 2.0 cm/year, the fastest rate documented in our nine-island survey of environmental history (Table 6.1; Jones *et al.* 2018b).

Conclusions

The Caribbean was the last region of the New World to be settled by Amerindians and the first to be occupied by Europeans. It is conceivable that Paleo-Indians set foot on Trinidad prior to its becoming an island, but to date there is no good archaeological evidence for this. Archaeological and paleoenvironmental evidence indicates that groups with a well-developed mixed economy of hunting, gathering, foraging, and collecting occupied Trinidad 8000 years ago (Boomert 2000; Pagán-Jiménez *et al.* 2015; Siegel *et al.* 2015). Given the biogeography of Trinidad, we may think of its early human occupants as following a mainland adaptation.

Niche-construction theory combined with models of landscape learning and island colonization represents an interpretive framework to assess the cumulative records of human-environment relations by groups ranging in scale from small preindustrial societies to components of globalizing Western European nation-states. In some respects, there are similarities between the first human settlers on Grenada and the early European colonists of the Lesser Antilles. Both followed strategies of ecosystem engineering that were environmentally deleterious, ranging in scale from overexploitation of some plant species (Early Archaic Age harvesting of ethnobotanically useful taxa) to the devastation of entire landscapes (European plantation economics).

The biogeographic context of the Lesser Antilles and mainland South America highlights the interconnectedness of niche-construction strategies through space and time. These findings are consistent with the culture-historical models of population movements inferred from cultural remains, as developed by Irving Rouse long ago (Rouse 1986, 1992).

Acknowledgements

This research was supported by two grants from the US National Science Foundation (Grants BCS-0718819 and BCS-0818372) and one grant from the National Geographic Society (Grant 8438–08) awarded to Peter Siegel. The Antoinette C. Bigel Endowment fund in the anthropology department at Montclair State University provided support for a student to participate in one round of fieldwork. The Dean's office in the College of Humanities and Social Sciences at Montclair State University provided a subvention for shipping of field equipment and graphics production. Several people provided assistance in field logistics and expedited government approvals: the late Peter Harris, late Keith Laurence, and David Maharaj (Trinidad), Ministry of Agriculture Mrs. Veda Bruno-Victor (Grenada), Reg and Nikki Murphy (Antigua), Benoît Bérard and Olivier Kayser (Martinique), and Christian Stouvenot and Michel Grandguillotte (Marie-Galante). The School for Advanced Research awarded Siegel a Research Team Short Seminar grant to convene the team in Santa Fe, New Mexico to discuss implications of the research results. Kathryn Carlson from the U-Spatial unit of the Research Computing Center at the University of Minnesota, Minneapolis prepared Figures 6.1. and 6.3. Paula Reimer in the School of Geography, Archaeology and Palaeoecology at Queen's University, Belfast provided Siegel with valuable input regarding the use of calibrated median dates.

7

On the way to the islands: The role of domestic plants in the initial peopling of the Antilles

Jaime R. Pagán-Jiménez, Reniel Rodríguez Ramos, and Corinne L. Hofman

Introduction

The insular Caribbean was initially settled in two main pulses. The earliest movement into the Antilles took place sometime between 8000 and 7800 cal BP, extending to the island of Trinidad (Boomert 2016; Pagán-Jiménez *et al.* 2015). This human relocation, which was apparently limited spatially and demographically, temporally converged with the initial spread of domestic plants by Amerindians in Central and South America, resulting in the gradual integration of these new food sources into different subsistence systems (Dickau *et al.* 2007; Pagán-Jiménez 2011; Pearsall 2009). It is widely known that between 10,000 and 8000 BP, people from two different regions of continental America – the lowlands of northeastern Central America and the central lowlands of South America – had already initiated the domestication of important economic plants: maize (*Zea mays*), common bean *(Phaseolus vulgaris*), chili pepper (*Capsicum annum*) and manioc (*Manihot esculenta*) (Piperno 2011; Piperno *et al.* 2009; Piperno and Pearsall 1998). Other regions and cultural areas of the Neotropics and beyond, such as southwestern and eastern North America, lower Central America, Northern and Northwestern Amazonia, the midlands and lowlands between Bolivia and Brazil, coastal Ecuador and the central Andes, also managed and eventually domesticated additional important economic plants between 9000/8000 and 4500 BP, including squash species (*Cucurbita* sp.), goosefoot (*Chenopodium* sp.), yampee (*Dioscorea trifida*), sweet potato (*Ipomoea batatas*), leren (*Calathea allouia*), arrowroot (*Maranta arundinacea*), achira (*Canna indica*), chili pepper species (*Capsicum* sp.), lima bean (*Phaseolus lu-*

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 89-106.

natus) and potato (*Solanum tuberosum*), among others (Pagán-Jiménez 2011; Pagán-Jiménez *et al.* 2015; Perry *et al.* 2007; Piperno and Pearsall 1998; Spooner *et al.* 2005).

The second stage of the initial peopling of the Antilles took place around 5500 to 4000 cal BP (Rodríguez Ramos *et al.* 2013; Siegel *et al.* 2015), almost 2300 years after the earliest human arrival on the islands. As opposed to the previous stage, this second peopling was characterized by sustained processes of population spread to the islands from northeast and northwestern South America, and perhaps eastern Central America as well. According to the available archaeological data, human groups reached various islands in the Lesser and Greater Antilles at different points in time (Davis 2000; Siegel *et al.* 2015). However, they formally only settled a few of them, mainly the ones to the northeast and northwest of the principal island arc (Hofman *et al.* 2014b; Hofman *et al.* 2018b; Rodríguez Ramos *et al.* 2013). As has been discussed elsewhere, this stage temporally coincides with a period in which domesticates and other important economic plants from distant places of the Americas were acquired and integrated into the diet at many human settlements across the Neotropics. These plants were prepared as foodstuffs in various ways, probably giving rise to new culinary traditions and phytocultural complexes that have been archaeologically recognized in different areas of the Americas (Pearsall 2009).

These two stages of the initial peopling of the Antilles have been traditionally associated with human groups with low cultural and technological development, labeled simply as the Lithic and Archaic Age peoples (Pagán-Jiménez *et al.* 2005; Rodríguez Ramos 2008; Rouse 1992). It was believed that these human groups entered and moved into the islands following what has been defined as a stepping-stone colonization model (Rouse 1992; Siegel *et al.* 2015). Therefore, islands close to the continental landmasses were supposedly targeted and reached first, after which people moved to other islands increasingly distant from the continental landmasses. It has generally been assumed that the technological and navigational skills of these peoples were limited. As a result, early human mobilization across the islands was mainly focused on reaching the nearest accessible landmass in order to gain access to different subsistence resources. In this sense, drawing from models derived from continental pre-Ceramic hunter-gatherers, Caribbean Lithic and Archaic Age peoples purportedly moved from one place to another driven mainly by logistic mobility principles linked to the search of wild food sources (Hofman *et al.* 2006; Newsom and Wing 2004; Rouse 1992; Veloz Maggiolo *et al.* 1978).

However, in contrast to previous sociocultural characterizations of the so-called Lithic and Archaic Age peoples, new lines of archaeological and paleoethnobotanical evidence have showcased that this early period of human dispersals into the Antilles was more complex than originally thought (Davis 2000; Newsom 1993; Pagán-Jiménez 2013; Pagán-Jiménez *et al.* 2005; Rodríguez Ramos and Pagán-Jiménez 2006; Rodríguez Ramos *et al.* 2013; Siegel *et al.* 2015). Domestic plants, cultivars and wild plants such as maize, sweet potato, chili pepper, achira, wild coontie or *marunguey* (*Zamia* sp.), wild ginger (Zingiberaceae), wild yam (Dioscoreaceae), jack bean (*Canavalia* sp.), bean (Fabaceae, cf. *Phaseolus* sp.) and possibly wild arrowroot (Marantaceae) have been identified at the archaeological site of St. John in Trinidad between 7790 and 5300 cal BP (Pagán-Jiménez *et al.* 2015). This site, ascribed to the first stage of the initial peopling of the Antilles, represents the earliest human incursion so far registered in the area. Within the second stage, other important archaeological sites include the coastal site of Maruca (4830–3500 cal BP) and the inland site of Cueva Ventana (4430–3460 cal BP; Rodríguez Ramos *et al.* 2014, this volume), both in Puerto Rico; the coastal site of Puerto Ferro (4380–3500 cal BP) on Vieques; and the inland site of Plum Piece (3385–3025 cal BP) on the island of Saba (Hofman *et al.* 2006; Hofman *et al.* 2018; Pagán-Jiménez 2013; Rodríguez Ramos 2014). These early sites from the northeast portion of the Antillean island arc have yielded a wider assemblage of domesticates, cultivars and wild plants, including maize, sweet potato, manioc, achira, domestic arrowroot (*Maranta arundinacea*), cocoyam (*Xanthosoma* sp.) and bean (Fabaceae; *Phaseolus* sp.) as well as possibly annatto (*Bixa orellana*), jack bean, coontie (*marunguey*), wild yam, greenbriar (*Smilax* cf. *coriacea*), palm fruit (*Acrocomia* sp.), wild ginger, garden ginger (*Renealmia* sp.), and wild calathea (*Calathea* sp.) (Pagán-Jiménez 2009, 2010, 2013; Pagán-Jiménez *et al.* 2005).

In this chapter, in contrast to previous works on this topic (Rodríguez Ramos *et al.* 2013), we expect to provide additional answers to the question of *why* humans initiated the peopling of the Antilles based on the zooarchaeological and paleoethnobotanical information available from the sites mentioned above. In particular, we would like to test if domestic plants were a potential triggering factor that influenced decisions surrounding the earliest processes of mobilization into the Caribbean islands, taking into consideration that most, if not all, of the earliest sites in the Antilles where paleoethnobotanical research has been conducted have registered the factual use of domestic plants. This, together with the important role that maritime navigation played in human and plant dispersals during this early period, will provide the basis to explore the feasibility of diet breadth (DB) and ideal free distribution (IFD) models for understanding these early human dispersals toward the islands. Together with other theoretical constructs derived from experiential philosophy and phenomenology, we will argue that the use of domestic plants by the earliest settlers of the Antilles was a primum mobile of the initial peopling of the region.

Diet breadth and ideal free distribution models

The diet breadth (DB) model is one of the main outputs of optimal foraging theory (OFT), which has been associated with neo-Darwinian evolutionary theory (Codding and Bird 2015; Gremillion *et al.* 2014) and with microeconomics (Smith 2015b). OFT is based on the principle that selective advantages for individuals are maximized if their behaviors are driven by optimization. Thus, one of the aims of OFT and human behavioral ecology (HBE) is to identify and qualify the adaptive function of different forms of behavior in order to make predictions for elucidating research problems like the one explored here. These predictions are generally rooted in economic principles that assess the ways in which people rationalize dietary choices in order to make decisions in favor of the most valuable (or highest-ranked) options (Keegan 1986). The DB model assumes that when the targeted high-ranking resources are abundant, diet breadth will narrow and foraging efficiency will increase (Zeder 2015). On the contrary, when these preferred high-ranked resources are scarce, diet breadth expands to compensate for their scarcity. As a result, when the overall return rate of targeted high-ranked resources falls below the return rate of low-ranking resources, the forager will begin to take low-ranked resources in order to maximize the overall return rate (Codding and Bird 2015).

Regarding early domestic plant dispersals and their eventual adoption in the continental Neotropics, we should take into account the types of preexistent subsistence systems into which domestic plants were integrated in order to understand how selection principles and related decisions were operationalized in different socioecological contexts, particularly those that were increasingly distant from the places of initial domestication (Zeder *et al.* 2006). Besides the many proposed explanations for the motivations or the cultural or environmental causes that led to plant domestication in the Neotropics, there is general agreement that this process and its results did not imply sudden changes to previous subsistence systems (Pearsall 2009). As such, and considering that domesticates were probably resources of low economic value during their first centuries or even millennia of existence, the DB model assumes that the decision to include this kind of resource in the diet is not necessarily based on its abundance or ranking among preferred food items, but on the abundance of other resources that are of higher importance (Kennett *et al.* 2006). Given that the dispersal of domestic plants after their initial domestication events probably took place mainly by means of down-the-line interactions among contiguous groups in continental regions (Dickau *et al.* 2007), it is likely that they were adopted by people who were already exploiting habitats characterized by an abundance of other preferred high-ranked resources. In other cases, they might have been adopted by people who were trying to compensate, by different means, for the scarcity of high-ranked resources by expanding their diet with more varied, low-ranked resources. The profitability of domestic plants in these new cultural contexts could have been initially put to the test by applying different low-level food production systems (Smith 2001), while the decision to adopt or to reject them could have been based on their marginal value. Marginal value, according to HBE, is the total sum of values that a resource can bring in short or large periods, regardless of whether the initial benefits offered by the resource are weak or poor (Kennett *et al.* 2006).

HBE and OFT provide heuristics for understanding the causes for human dispersal to new places. According to Kennett *et al.* (2006), the ideal free distribution (IFD) model is a framework suited to predict when and why individuals or groups will initiate their mobilization to a new habitat based on the density-dependent characteristics related to them. Behavior is dependent on habitat quality and suitability as these characteristics are assessed by humans according to factual resource availability and profitability considerations, as well as to predicted resource choices by means of marginal value rationales. Consequently, because humans are free in principle to move to different ideal habitats for securing their food intake, this model has been used for understanding fitness-maximizing human behaviors in varied research contexts (Giovas and Fitzpatrick 2014; Kennett *et al.* 2006, 2009). People will move to a new habitat if fitness benefits (i.e., the availability of high-ranked resources) in the currently occupied habitat diminish because of density-dependent socioenvironmental constraints such as resource depletion by overexploitation, population growth or uncontrolled climatic fluctuations (Keegan 1995). Thus, in terms of human adaptive behavior, DB is pivotal for understanding IFD because the former predicts that optimal behavior is driven by a set of decisions that favor the most valuable, high-ranked resources. If the most valuable subsistence resources become scarcer, making the current habitat less suitable, then two main decisions must be taken: to expand the diet by adding new low-ranked resources (DB) or to move to a new territory (IFD).

Our main limitation for understanding the environmental and sociocultural contingencies around the initial peopling of the Antilles is that we do not know exactly where in the continental landmasses these processes began. However, given that the sites here studied represent some of the earliest settlements so far registered in the islands, we will analyze their faunal and botanical assemblages with the aim of finding general trends or patterns that could pinpoint potential influential correlations between these food categories. This in turn would provide us with criteria to further evaluate the potential role of domestic plants as a triggering factor for encouraging the earliest peopling of the Antilles. In the next sections, we will put two primary basic assumptions of DB and IFD models to test. First, we will assess if the incorporation of domestic plants into the overall diet at the selected sites reflects important correlations with faunal items used as food. Second, because domestic plants have been identified as components of the diet at these early sites, we would like to assess if their presence as food items could have by any means influenced other foraging behaviors related to faunal exploitation and access to preferred habitats. This will allow us to determine if domestic plants, together with other faunal items of the diet, were part of a preexistent, continental subsistence behavior, consciously transported for culturally improving habitat suitability in new and previously unknown inhabited island environments.

Data management, limits and expectations

Domestic plants are portable human creations that provide and ensure an important source of energy intake. Some of these creations were part of the human diet at the studied sites. This implies that, rather than assessing habitat quality based on their natural suitability or hypothetically available resources, we are prompted to interpret the quality and functionality of the new anthropogenic habitats by means of the factual set of faunal and plant assemblages already identified at the studied sites. All of this will allow us to establish whether domestic plants had an influence on traditional foraging behaviors focused on the procurement of faunal resources. Therefore, beyond assessing the rate of food intake, we will pay attention to the range of faunal and plant food items consumed at the sites. According to human behavioral ecology (HBE), habitat quality is density-dependent because different natural and cultural constraints might induce positive or negative changes to its suitability. Consequently, by taking into account the range of faunal and plant food items used at the studied sites as well as the possible relations between these distinctive biotic groups, we are able to identify whether domestic plants could, to a certain degree, have influenced traditional foraging behaviors related to faunal exploitation. With such information, we will better understand the possible role that domestic plants might have had in the context of early human movements into the Antilles.

General lists of identified faunal taxa were compiled from zooarchaeological studies carried out at St. John (Ali 2012), Maruca (Narganes Storde 1997a, 1997b; Newsom and Wing 2004), Puerto Ferro (Narganes Storde 1991), Cueva Ventana (Narganes Storde 2012; Rodríguez Ramos 2014) and Plum Piece (van den Bos 2006; Hofman *et al.* 2006)

	Sites					Ubiq. (%)	Major habitat				
Taxa	St. John (Trinidad)[1]	Maruca (P. Rico)[2]	Puerto Ferro (Vieques)[2]	Plum Piece (Saba)[3]	Cueva Ventana (P. Rico)[4]	Ubiq. (%)	Terrestrial	Freshwater	Marine intertidal (rocky-muddy substrates)	Marine inshore (grass-sandy-muddy beds)	Marine inshore-offshore (reef-pelagic)
MAMMALS											
Manicou (*Didelphis marsupialis* spp. *insularis*)	X					20	X				
Nine-banded armadillo (*Dasypus novemcinctus)*	X					20	X				
Agouti (*Dasyprocta aguti*)	X					20	X				
Paca (*Cuniculus paca*)	X					20	X				
Collared peccary (*Pecari tajacu*)	X					20	X				
Red brocket (*Mazama americana* spp. *trinitatis*)	X					20	X				
Insular cave rat (Heteropsomys insulans)		X				20	X				
Bat (Chiroptera)					X	20	X				
Antillean fruit-eating bat (*Brachyphylla cavernarum*)					X	20	X				
Common fruit bat (*Artibeus jamaicensis*)					X	20	X				
Rodent (Rodentia, unidentified)					X	20	X				
Unidentified mammal		X	X		X	60	X				
MAMMAL TAXONOMIC RICHNESS	6	2	1	0	5						
BIRDS											
Hawk (Falconidae)		X				20	X				
Pigeon (*Columba* sp.)		X	X			40	X				
Dove (*Zenaida* sp.)		X				20	X				
Duck (Anatidae)		X				20	X				
Heron (Ardeidae), possibly *Ardea herodias* spp. *occidentalis*		X	X			40	X				
Audubon's shearwater (*Puffinus lherminieri*)				X		20	X				

Table 7.1. Presence/absence of faunal taxa from the selected sites according to zooarchaeological data. Notes: [1] Zooarchaeological data from Ali (2012). [2] Zooarchaeological data from Newsom and Wing (2004), based on primary data previously studied by Narganes Storde (1991, 1997a, 1997b) for Puerto Ferro and Maruca, respectively. [3] Zooarchaeological data from Narganes Storde (2012) and Rodríguez Ramos (2014). [4] Zooarchaeological data from van den Bos (2006). Table continues on following pages.

	Sites					Ubiq. (%)	Major habitat				
Taxa	**St. John (Trinidad)[1]**	**Maruca (P. Rico)[2]**	**Puerto Ferro (Vieques)[2]**	**Plum Piece (Saba)[3]**	**Cueva Ventana (P. Rico)[4]**	**Ubiq. (%)**	**Terrestrial**	**Freshwater**	**Marine intertidal (rocky-muddy substrates)**	**Marine inshore (grass-sandy-muddy beds)**	**Marine inshore-offshore (reef-pelagic)**
Booby (*Sula* sp.)				X		20	X				
Yellow-crowned night heron (*Nyctanassa violacea*)				X		20	X				
Common moohen (*Gallinula chloropus*)				X		20	X				
Tern (*Sterna* sp.)				X		20	X				
Scaly-naped pigeon (*Columba squamosa*)				X		20	X				
Zenaida dove (*Zenaida aurita*)				X	X	40	X				
Common ground dove (*Columbina passerina*)				X		20	X				
Bridled quail dove (*Geotrygon mystacea*)				X		20	X				
Mockingbird (*Mimus* sp.)				X		20	X				
Pearly-eyed thrasher (*Margarops fuscatus*)				X		20	X				
Red-tailed hawk (*Buteo jamaicensis*)					X	20	X				
Short-eared owl (*Asio flammeus*)					X	20	X				
Birds (Passeriformes)					X	20	X				
Unidentified bird					X	20	X				
BIRD TAXONOMIC RICHNESS	0	5	2	11	5						
REPTILES											
Lizard (Sauria)					X	20	X				
Lizard (cf. *Anolis* sp.)					X	20	X				
Puerto Rican ground lizard (*Ameiva exsul*)					X	20	X				
Iguana (Iguanidae)					X	20	X				
Iguana (*Cyclura* sp.)					X	20	X				
Green iguana (*Iguana iguana*)	X					20	X				
Tortoise/turtle (Testudines)				X		20	X				
Puerto Rican boa (*Epicrates inornatus*)					X	20	X				
Snake (unidentified)			X	X		40	X				
Sea turtle (Cheloniidae)			X	X		40			X		

	Sites					Ubiq. (%)	Major habitat				
Taxa	**St. John (Trinidad)[1]**	**Maruca (P. Rico)[2]**	**Puerto Ferro (Vieques)[2]**	**Plum Piece (Saba)[3]**	**Cueva Ventana (P. Rico)[4]**	**Ubiq. (%)**	**Terrestrial**	**Freshwater**	**Marine intertidal (rocky-muddy substrates)**	**Marine inshore (grass-sandy-muddy beds)**	**Marine inshore-offshore (reef-pelagic)**
Frogs and Toads (Anura)					X	20	X				
REPTILE TAXONOMIC RICHNESS	1	0	2	3	7						
MOLLUSCA											
Chiton (Chitonidae)				X		20			X		
Nerite (*Neritina* sp.)	X	X	X	X	X	100			X		
Apple snail (*Pomacea glauca*)	X					20		X			
Giant ramshorn snail (*Marisa cornuarietis*)	X					20		X			
Caribbean oyster (*Crassostrea rhizophorae*)	X	X	X			60			X		
Caribbean crown conch (*Melongena melongena*)	X					20			X		
Rock shell (*Thais coronata*)	X					20			X		
Trigonal tivela (*Tivela mactroides*)	X					20				X	
Dwarf tiger lucine (*Ctena orbiculata*)	X					20				X	
Tiger lucine (*Codakia* sp.)					X	20			X		
Thick lucine (*Phacoides pectinatus*)	X	X	X			60				X	
Land snail (*Plekocheilus aurissciuri*)	X					20	X				
Land snail (*Caracolus caracolla*)					X	20	X				
Land snail (*Caracolus marginella*)					X	20	X				
Land snail (*Megalomastoma croceum*)					X	20	X				
Land snail (*Polydontes* sp.)					X	20	X				
Magpie shell (*Cittarium pica*)		X	X	X		60			X		
Murex (*Chicoreus* sp.)		X	X	X		60				X	
Arc clam (*Arca zebra*)		X	X			40				X	
Pearl oyster (*Pinctata* sp.)		X	X			40				X	
Cross-barred venus (*Chione cancellata*)		X	X			40			X		
Conch (*Lobatus* sp.)		X	X	X		60				X	

Table 7.1. Continued.

Taxa	Sites					Ubiq. (%)	Major habitat				
	St. John (Trinidad)[1]	Maruca (P. Rico)[2]	Puerto Ferro (Vieques)[2]	Plum Piece (Saba)[3]	Cueva Ventana (P. Rico)[4]	Ubiq. (%)	Terrestrial	Freshwater	Marine intertidal (rocky-muddy substrates)	Marine inshore (grass-sandy-muddy beds)	Marine inshore-offshore (reef-pelagic)
Widemouth rock snail (*Purpura patula*)				X		20			X		
Deltoid rock shell (*Vasula deltoidea*)				X		20			X		
MOLLUSCA TAXONOMIC RICHNESS	10	9	9	7	6						
FISHES											
Shark (*Carcharhinus* sp.)			X	X		40					X
Shark (Lamniformes)				X		20					X
Mackerel/Tuna (Scombridae)	X			X		40					X
Grouper/Sea bass (Serranidae)	X	X		X		60					X
Snapper (Lutjanidae)		X	X	X		60					X
Triggerfish (Balistidae)				X		20					X
Porcupinefish (Diodontidae)			X	X		40					X
Catfish (Ariidae)	X					20		X			
Jack (Carangidae)				X		20					X
Goatfish (Mullidae)				X		20					X
Wrass (Labridae)				X		20					X
Needlefish (Belonidae)				X		20				X	
Squirrelfish (Holocentridae)				X		20					X
Parrotfish (Scaridae)				X		20					X
Grouper (*Epinephelus* sp.)				X		20					X
Grouper (*Mycteroperca* sp.)				X		20					X
Wrass (*Bodianus* sp.)				X		20				X	
Wrass (*Halichoeres* sp.)				X		20					X
Barracuda (*Sphyraena* sp.)		X		X		40				X	
Snook (*Centropomus* sp.)		X				20				X	
Snook (*Centropomus undecimalis*)					X	20				X	
Crevalle jack (*Caranx hippos*)		X	X			40				X	
Jack (*Caranx* sp.)				X		20				X	
Grunt (*Haemulon* sp.)				X		20					X

	Sites					Ubiq. (%)	Major habitat				
Taxa	St. John (Trinidad)[1]	Maruca (P. Rico)[2]	Puerto Ferro (Vieques)[2]	Plum Piece (Saba)[3]	Cueva Ventana (P. Rico)[4]	Ubiq. (%)	Terrestrial	Freshwater	Marine intertidal (rocky-muddy substrates)	Marine inshore (grass-sandy-muddy beds)	Marine inshore-offshore (reef-pelagic)
Bigmouth sleeper (*Gobiomorus dormitor*)		X			X	40				X	
Black margate (*Anisotremus surinamensis*)		X				20					X
Surgeon fish (*Acanthurus* sp.)				X		20					X
Parrotfish (*Sparisoma* sp.)			X	X		40					X
Parrotfish (*Scarus* sp.)				X		20					X
Bonefish (*Albula* sp.)				X		20				X	
Porcupinefish (*Chilomycterus* sp.)				X		20					X
Mountain mullet (*Agnomostomus monticola*)					X	20		X			
Species I (undetermined)				X		20					
Unidentified fishes					X	20		X			
FISH TAXONOMIC RICHNESS	3	7	5	26	4						
CRUSTACEA											
Blue land crab (*Cardisoma* sp.)	X	X	X			60			X		
Caribbean hermit crab (*Coenobita clypeatus*)		X		X		40	X				
Freshwater crab (*Epilobocera* sp.)		X			X	40		X			
Land crab (*Gecarcinus* sp.)				X		20	X				
Freshwater shrimp (*Atya* sp.)					X	20		X			
Unidentified crabs					X	20	X				
CRUSTACEA TAXONOMIC RICHNESS	1	3	1	2	2						
UNIFIED TAXONOMIC RICHNESS	21	26	20	49	30						

Table 7.1. Continued.

(Table 5.1). Because these studies have been performed by different researchers, quantification and classification criteria are dissimilar. Thus, organisms that have been classified at different taxonomic levels (family, genera, species) were quantified according to minimal number of individuals (MNI) (Ali 2012; van den Bos 2006; Narganes Storde 1991, 1997a, 1997b) or number of identified specimens (NISP) (Narganes Storde 1991, 1997a, 1997b, 2012). Both analytical units provide matchless data,

St. John[1]	Maruca[2]	P. Ferro[2]	C. Ventana[3]	P. Piece[4]
1) *Phacoides pectinatus* (mollusca) 2) *Crassostrea rhizophorae* (mollusca) 3) *Neritina* sp. (mollusca) 4) *Cardisoma* sp. (intertidal crab)	1) *Cardisoma* sp. (intertidal crab) 2) *Epilobocera* sp. (landcrab) 3) *Neritina* sp. (mollusca) 4) *Chicoreus* sp. (mollusca)	1) *Cittarium pica* (mollusca) 2) *Chicoreus* sp. (mollusca) 3) *Cardisoma* sp. (intertidal crab) 4) Landsnails (various sp.)	1) *Brachyphylla cavernarum* (mammal) 2) *Epilobocera* sp. (landcrab) 3) *Megalomastoma* sp. (landsnail) 4) *Neritina* sp. (mollusca)	1) *Gecarcinus* sp. (landcrab) 2) *Puffinus lherminieri* (bird) 3) *Epinephelus* sp. (fish) 4) *Acanthurus* sp. (fish)

Table 7.2. Estimated rank order of main faunal resources used as food in the studied sites according to MNI and NISP values. Notes: [1] Zooarchaeological data from Ali (2012). [2] Zooarchaeological data from Newsom and Wing (2004), based on primary data previously studied by Narganes Storde (1991, 1997a, 1997b) for Puerto Ferro and Maruca, respectively. [3] Zooarchaeological data from Narganes Storde (2012) and Rodríguez Ramos (2014). [4] Zooarchaeological data from van den Bos (2006).

though it can be assumed that total counts of individuals would roughly reflect the relative abundance of targeted taxa. Table 7.2 shows a rank order of the main targeted taxa for each site based on MNI and NISP values estimated by referred specialized studies.

Based on the above, we focused our attention on taxonomic richness, which is the total number of differentiated taxa at each site, independent of the total number of individuals or specimens per taxa. Each taxon was divided into six taxonomic groups: (a) mammals, (b) birds, (c) reptiles, (d) mollusks, (e) fishes, and (f) crustaceans. Taxonomic richness was calculated by simply adding the total number of individual taxa from each taxonomic group. We also created five broad habitat categories for faunal remains: (a) terrestrial, (b) freshwater, (c) marine intertidal (rocky and muddy substrates), (d) marine inshore (grass, sandy and muddy beds), and (e) marine inshore/offshore (reef and/or pelagic).

The data on plant taxa considered here (Table 7.3) have been compiled from previous ancient starch grain studies carried out at the same sites (Pagán-Jiménez 2009, 2010, 2015; Pagán-Jiménez *et al.* 2005, 2015). Archaeobotanical work focusing on macrobotanical remains has also been done for Maruca (Newsom and Wing 2004), though the data produced are not included here as no domestic or cultivated plants were identified. It should be noted that the study of ancient starches provides information about starch-rich plants that were ground or pounded with the studied food-processing or cooking tools. Consequently, other plants with non-diagnostic starches or starchy plants that were not processed with the studied tools may go unnoticed in specialized studies. Another possible bias is the body of botanical data itself. In our view, although general explanations already posited for ancient plant use in the Antilles are certainly relevant, our knowledge is not yet sufficiently deep and detailed to propose definitive statements about ancient botanical foodways. Nevertheless, previous starch grain studies in the area have been successful because the main economic plants of the region are starch-rich specimens that produce several diagnostic starches that allow secure identifications of their sources.

The starch grain studies that were conducted at each site followed the same identification and quantification criteria (Pagán-Jiménez 2007). Our current analysis is based on the total number of differentiated plant taxa at each site, regardless of the number of individual plants of each taxon that may have been used. By means of

	Sites					Management status				Origin status	
Taxa	**St. John, Trinidad**	**Maruca, P. Rico**	**Puerto Ferro, Vieques**	**Cueva Ventana, P. Rico**	**Plum Piece, Saba**	**General Ubiq. (%)**	**Wild**	**Cultivar**	**Domestic**	**Endo-genous**	**Exo-genous**
Seeds/Grains											
Zea mays	X	X	X	X	X	100			X		X
Canavalia sp.	X	X			X	60	X				X
Leguminosae/ Fabaceae (including *Phaseolus* sp.)	X	X	X	X	X	100	X		X	X	X
Bixa orellana					X	20		X			X
Fruits											
Acrocomia media			X			20	X			X	
Capsicum sp.	X					20			X		X
Rhizomes/ Leaves											
Canna sp.	X	X	X			60		X			X
Marantaceae	X	X			X	60		X			X
Calathea sp.					X	40	X				X
Zingiberaceae	X				X	40	X				
Renealmia sp.					X	20	X			X	
Smilax cf. *coriacea*				X		20	X			X	
Tubers/tube-rous stems and corms											
Dioscoreaceae	X	X		X		60	X			X	
Xanthosoma sagittifolium		X				20		X			X
Xanthosoma violaceum		X				20		X			X
Xanthosoma undipes				X		20		X			X
Manihot esculenta		X	X	X		60			X		X
Ipomoea batatas	X	X	X	X	X	80			X		X
Zamia sp.	X	X			X	60	X			X	
Zamia portoricensis			X			20	X			X	
Zamia erosa				X		20	X			X	
TAXONOMIC RICHNESS	10	10	7	8	10						

Table 7.3. Presence/absence of plant taxa from the selected sites according to starch grain analysis.

St. John[1]	Maruca[1]	P. Ferro[1]	C. Ventana[1]	P. Piece[1]
1) *Zea mays* (seed/grain) 2) Fabaceae (and *Phaseolus* sp., seed) 3) *Zamia* sp. (tuberous stem) 4) *Ipomoea batatas* (tuber)	1) *Zea mays* (seed/grain) 2) Fabaceae (and *Phaseolus* sp., seed) 3) *Manihot esculenta* (tuber) 4) *Ipomoea batatas* (tuber)	1) *Zea mays* (seed/grain) 2) *Zamia* sp. (tuberous stem) 3) *Manihot esculenta* (tuber)	1) *Zea mays* (seed/grain) 2) *Ipomoea batatas* (tuber) 3) *Zamia* sp. (tuberous stem) 4) *Xanthosoma* sp. (corm)	1) *Zea mays* (seed/grain) 2) *Ipomoea batatas* (tuber) 3) *Zingiberaceae* (rhizome) 4) Fabaceae (and *Phaseolus* sp., seed)

Table 7.4. Estimated rank order of the main starchy plants used as food at the studied sites according to ubiquity values. Note: [1] Archaeobotanical data can be consulted in the works of Pagán-Jiménez found in the reference list.

the ubiquity value of each individual taxon among the analyzed samples, the relative importance of some plants over others can be estimated by assuming the following: the more ubiquitous a taxon is among the universe of samples, the more versatile and more frequently it was used in different contexts. Based on the ubiquity of taxa, Table 7.4 shows an estimated rank order for the three or four main starchy plants processed and consumed at each site.

Plant taxa were ascribed to different taxonomic levels (family, genus or species) according to the quality and quantity of the diagnostic features observed in recovered ancient starches. Each taxon was grouped into the following general categories depending on potentially harvested organs: (a) seeds/grains and fruits, (b) rhizomes/leaves, and (c) tubers/tuberous-stems/corms. For each taxon, we provide its ubiquity among the number of studied sites to emphasize which plants were probably the most versatile or frequently used at the inter-site level. At the site level, we provide the taxonomic richness of the identified botanic resources, which is the total number of differentiated taxa at each site, independent of the total number of individuals or used specimens per taxa. We also classify plants according to their degree of management by using the following broad criteria: (a) wild plants, (b) cultivars (semi-domesticated), and (c) domesticated plants. Finally, because some domestic plants are easily transportable resources, their origin status is indicated according to two broad categories: (a) endogenous (local) and (b) exogenous (nonlocal or introduced). It should be noted that in this chapter we focus our attention on the group of identified plants based on their degree of management, aiming to uncover potential feedback relationships between domestic plant taxa and identified fauna.

Foraging and phytocultural behavior during the initial peopling of the Antilles

Faunal and archaeobotanical data sets of interest were submitted to analysis of variance (ANOVA) and hierarchical cluster analysis in order to evaluate a set of null hypotheses (H_0) that seeks to discover whether or not there are significant relationships between the consumption of domestic plants and foraging behaviors associated with the procurement of faunal resources. The results of the one-way ANOVA rejected the first H_0, which states that domestic plants did not influence foraging behaviors associated with faunal taxa. The alternative hypothesis (H_1) shows that at all early

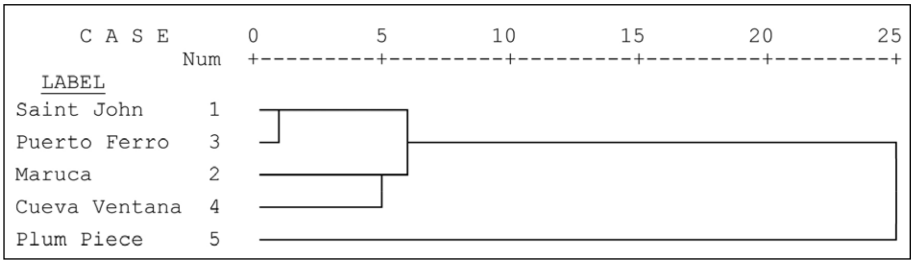


Figure 7.1. Hierarchical dendrogram between groups (sites) and linkage of domestic plants and faunal taxonomic richness.

sites, a positive intra- and inter-group correlation did exist (p = 0.018, adjusted r^2 = 0.844; defined significance level is 0.05) between mean values of procured faunal taxa (dependent variable) and the number of domestic plant taxa (factor). Thus, we consider that the management and consumption of plants such as maize, manioc, bean and sweet potato affected foraging behaviors related to the procurement of faunal taxa as follows: the greater the number of domestic plant taxa is, the lower the variation of procured faunal taxa.

In order to know the similarity of the combined behavior of foraging and domestic plant use among the studied sites, we also performed a hierarchical cluster inter-group analysis based on both the number of differentiated domestic plants consumed and faunal taxa richness per site (Figure 7.1). Of the four clusters formed, meaningful correlation coefficients (r) associated with referred combined behaviors have been noticed between the sites of St. John and Puerto Ferro (r = 1), and subsequently between St. John and Maruca (r = 4) and St. John and Cueva Ventana (r = 7.5). The most distant correlation among formed clusters occurs between St. John and Plum Piece (r = 24.771). Although all the studied sites are positively correlated according to the analysis of variance, cluster analysis has revealed that at four of the sites (St. John, Maruca, Puerto Ferro and Cueva Ventana), the inhabitants developed very similar combined behaviors of foraging and domestic plant use, while the inhabitants from Plum Piece practiced combined behaviors distinct from the ones developed at the other sites.

Moreover, when assessing domestic plant use at each site (Figure 7.2), taking into account the coefficients of variation (cv) resulting from used plant organs (i.e., seed/grain, fruit, rhizome/leave, tuber/tuberous-stem/corm) and preferred faunal taxonomic groups, we notice a marked relationship between domestic plant taxa (mainly the consumption of tubers, maize and bean) and faunal taxa, most notably at the early sites from Puerto Rico and Vieques, regardless of their geographic location: Maruca (coastal site), Puerto Ferro (coastal site) and Cueva Ventana (inland site). Although it is feasible to think that the relationship between the geographic location of these sites and their surrounding habitats could differently affect the combined behaviors of foraging and domestic plant use, our results reveal identical coefficients of variation (cv = 0.917) on them. This suggests that the consumption of domestic plants (mainly tubers and grains) at any of these sites induced the reduction of procured faunal taxa. On the other hand, the interdependence values between domestic plant taxa and faunal taxa at the coastal site of St. John (cv = 0.25) and the inland site of Plum Piece (cv = 0.333) are the least meaningful among all studied sites. We consider that the observed divergence

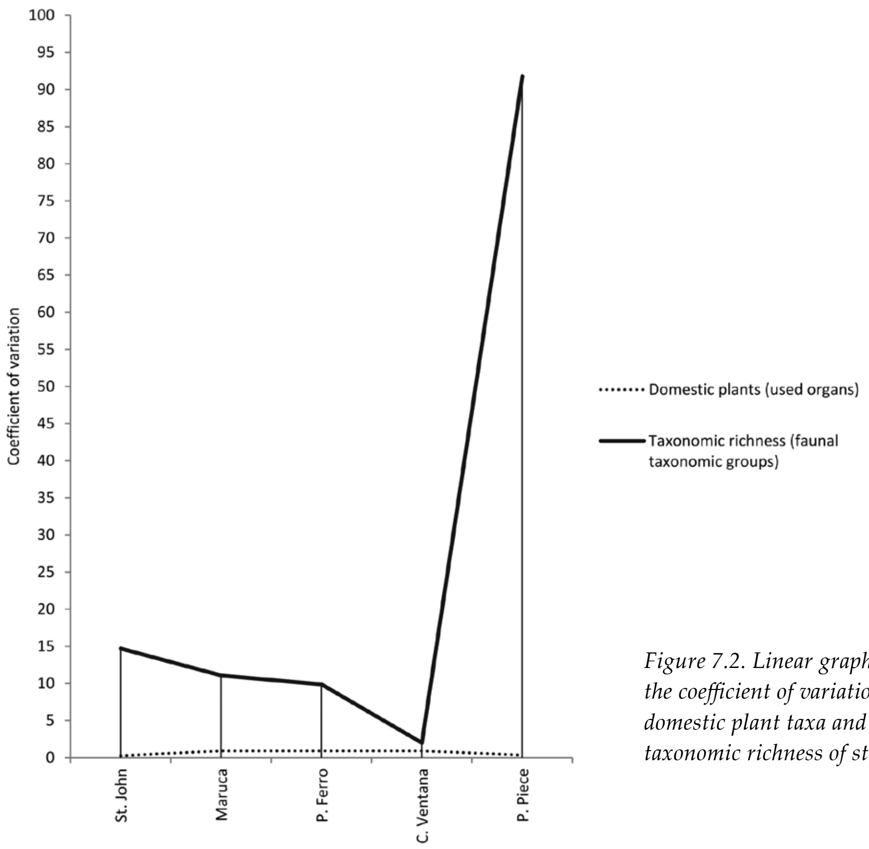


Figure 7.2. Linear graph showing the coefficient of variation for domestic plant taxa and faunal taxonomic richness of studied sites.

shown by Plum Piece when juxtaposed with other sites is related to the already posited interpretation of this site's functionality (Hofman *et al.* 2006). That is, Plum Piece clearly reflects the activities of more mobile human groups that settled at this location with the main objective of exploiting a high-ranked animal that is available in a single season of the year: the bird known as Audubon's shearwater (*Puffinus lherminieri*). Consequently, because this site was probably used as a seasonal settlement for conducting highly specialized activities, it seems plausible to think that other subsistence activities were developed at other settlements of the same group, either on the same island or others nearby.

Furthermore, we assessed five other null hypotheses by means of one-way ANOVA using different variables and combinations of plant taxa (factor) against mean values of procured faunal taxa (dependent variable). The results indicate that: (a) cultivars did not influence foraging behavior on faunal taxa (p = 0.956, adjusted r^2 = -0.332; defined significance level is 0.05); (b) wild plants did not influence foraging behavior on faunal taxa (p = 0.228, adjusted r^2 = 0.345; significance level is 0.05); (c) cultivars and domestic plants (combined) did not influence foraging behavior on faunal taxa (p = 0.636, adjusted r^2 = 0.221; significance level is 0.05); (d) domestic and wild plants (combined) did not influence foraging behavior on faunal taxa (p = 0.381, adjusted r^2 = 0.013; significance level is 0.05); and (e) cultivars and wild plants (combined) did not influence foraging behavior on faunal taxa (p = 0.293, adjusted r^2 = 0.133; significance level is 0.05). Two additional null hypotheses were tested to assess various potential influences between different variables of plant taxa: (f) domestic plants (factor) did not influence the consumption of wild plants (dependent variable) (p = 0.126, adjusted r^2 = 0.461; significance level is 0.05); and (g) domestic plants (factor) did not influence the consumption of cultivars (dependent variable) (p = 0, adjusted r^2 = 0; significance level is 0.05). In sum, it can be stated that all these null hypotheses are validated by the available data.

Primal inspirations for moving beyond the known

In this chapter we have shown that the foraging behavior at the studied sites was always influenced by the availability and diversity of consumed domestic plants. However, the data obtained do not allow us to define the combined rank order of food resources (plant and faunal) at the studied sites with a reasonable level of confidence. The foraging and phytocultural behaviors just described indicate that domestic plants were positioned in a higher rank order than many of the identified animal species. It is important to note that the broad spectrum of identified faunal resources did not demonstrate that domestic plants were integrated into the overall diet to compensate for the scarcity of other resources. On the contrary, domestic plants seems to have been important and consciously maintained resources, while low-ranked faunal items were likely integrated into the diet sporadically for increasing the overall return rate at key moments of the production cycle of plants.

The wild plants and fauna identified at the studied sites are resources of immediate return rates. On the other hand, domestic plants are delayed-return-rate resources that require tending and longer periods of energy investment. Even if the production of maize, manioc and sweet potato was a secondary economic activity at the studied sites, it should be expected that these activities of delayed returns reduced human mobility and, therefore, access to food resources of immediate return rates located in farther places. In this regard, other lines of archaeological evidence (Pagán-Jiménez *et al.* 2005; Rodríguez Ramos 2010) have shown that some of the earliest settlers of the Antilles exercised varied modes of relationability with their lived places, consistent with more sedentary lifestyles including burial practices, ceramic production and the confection of ritual objects, among other elements.

First and second stages of the initial peopling

During the first and second stages of the initial peopling of the Antilles, people moved into the islands accompanied by a suite of continental domestic plants that were probably used to minimize the initial risk inherent in human translocation to far and unknown places (Pagán-Jiménez 2013). After 7890 cal BP, the human and plant dispersal dynamics in Trinidad were continuous through time and space, particularly between this island and the nearby continental territories (Siegel *et al.* 2015). Within this context, the adoption and eventual translocation of domestic plants from the continental landmass to St. John on Trinidad might have responded to optimization behaviors such as the ones predicted by DB and IFD models. In this case, plants such as maize had likely been previously assessed by marginal value means and were eventually integrated into preexisting foraging dynamics characterized by the abundance of other resources with higher importance (Kennett *et al.* 2006). Domestic plants, in this context, were potentially seen as easily mobile resources with predictable, though low return rates.

Given the possibility that the second stage of the initial peopling of the islands could have begun somewhere between Puerto Rico and Antigua by around 5600 to 4000 cal BP (Rodríguez Ramos *et al.* 2013), a radically different scenario regarding early human and domestic plant dispersals should be expected. In the first place, this dispersal may have happened by means of direct voyaging across the Caribbean Sea from anywhere in the mainland to the northeastern Antilles. Secondly, long-distance voyaging to unknown places might have prompted thorough assessments of the available food choices for making later decisions regarding which of them should be translocated to guarantee a successful enterprise. Beyond predictions about what resources might have been present and available on the unknown side of the sea, domestic plants and other cultivars (fruits and tree seeds) were perhaps the only transportable items with known, predictable and manageable characteristics. They can be transferred to new places and planted to obtain products on a regular and measurable basis. In this sense, useful plants might have been selected over other resources after assessing the marginal value of overall available and known resources at the target locations. If moving to the far and unknown is a risky and costly enterprise (Kennett *et al.* 2006), and if there is no archaeological information supporting any 'push' explanation as a causal factor for the colonization of far and unknown places, then other sets of sociocultural rationalizations, or what some authors has minimized as a 'hodgepodge of inductively derived just-so stories' (Gremillion *et al.* 2014), could have played an important part in these decision-making processes.

The transportation of objects as well as the translocation of domestic plants previously integrated into the system of values of migrants could have served to overcome an initially hostile and alien encounter with new and far places. The transference of routinized daily practices, according to Bourdieu (1977), or the continuous presence of past cumulative experiences in new places (de Certeau 1984) can alleviate uncertainty (by increasing predictability) and ensure comfort while trying to provide a preferred, previously constructed diet (Pagán-Jiménez 2013). Our results showcase that people transferred an entire suite of ideas, objects (including domestic plants) and other subsistence practices from the 'known' to the 'unknown' islands to develop and sustain their settlements – or to humanize new landscapes. This principle is consistent with the theoretical framework of cultural niche construction applied to the study of human evolutionary processes, which sees it as an important driver of evolutionary change regardless of whether resource depression is manifested (Smith 2015b; Zeder 2015).

Despite the previous discussion, we consider it extremely difficult to answer the question of why humans initiated the peopling of the Antilles between ca. 8000 and 4000 cal BP with a complete degree of certainty. For example, Rodríguez Ramos *et al.* (2013) have suggested that two potential pull factors could have encouraged initial human mobilization from the mainland: (a) the presence of important raw material sources linked to consumption and exchange practices during this early period, and (b) nonutilitarian mobility that promoted traversing long liquid horizontal distances for spiritual or even recreative purposes (see also Helms 1988). In either case, archaeological data show that traditional push-factor explanations such as reduction in carrying capacity, environmental change or conflicts between groups were of no considerable importance in the surrounding mainland by around 8000 to 7800 cal BP, or by 5500 to 4000 cal BP. Consequently, regarding the first scenario, it has been demonstrated that seafaring to new lands in search of raw materials for consumption and exchange was an important attractor during the second stage of the peopling of the Antilles (Rodríguez Ramos 2010; Hofman *et al.* 2014b; Hofman *et al.*, this volume). For this same time period, active circuits for mobility and human interaction have also been consistently registered in southern Central America and northwestern South America (Dickau *et al.* 2007; Ranere and López 2007). In the second case, it has been suggested that the social ascent of individuals or groups in coastal contexts may have been legitimized by means of their capacity for engaging in long-distance maritime translocations (Rodríguez Ramos *et al.* 2013). This, together with the quest for raw materials from contexts located beyond the horizon, and the interisland mobilization largely supported by a transported phyto-scape, were important elements that probably served to enhance and consolidate rising social asymmetry by and after 5500 cal BP, both on continental landmasses and in the Antilles. Obviously, all these aspects require further evaluation by different theoretical/analytical means.

In short, our basic testing of DB and IFD models through factual zooarchaeological and archaeobotanical data from five early sites in the Caribbean indicate that domestic plants may have significantly influenced the main foraging behaviors at all the studied sites. However, even though these plants were crucial to the initial peopling of the Antilles, either by their own merits or because they were pivotal to other social dynamics, maybe the earliest settlers of the Antilles ventured such a risky journey to the unknown because of a more ordinary inspiration: "keep moving," a typical human behavior that has challenged the limits of the known since time immemorial.

Acknowledgements

This work was conducted thanks in part to the NEXUS1492 project, which has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007–2013)/ERC Grant Agreement No. 319209. Rodríguez Ramos's research at Cueva Ventana (Puerto Rico) has been financed in part by a Historic Preservation Fund Grant (#2014–155062) from the National Park Service of the Department of the Interior, USA and the Universidad de Puerto Rico-Utuado. The content and opinions in this work do not necessarily reflect the policies or opinions of the funding agencies.

8

Subsistence strategies and food consumption patterns of Archaic Age populations from Cuba: From traditional perspectives to current analytical results

Yadira Chinique de Armas, Roberto Rodríguez Suárez, William M. Buhay, and Mirjana Roksandic

Starch and stable isotopic analyses have changed our understanding of the subsistence strategies and food consumption patterns of the "pre-Arawak" indigenous populations from Cuba (commonly associated with the "Archaic" Age in the Antilles). The term "Archaic" has been traditionally used to denominate "pre-Arawak" groups with supposedly small population densities, high mobility, a lack of agriculture or ceramic production (Rodríguez Ramos *et al.* 2013) and whose archaeological culture was characterized by ground-stone tools and shell implements (Rouse 1992). In the Cuban context, these groups have been designated by different names such as *Ciboney* (Tabío and Rey 1966), *Preagroalfareros* (pre-Agroceramists) (Tabío 1984), or *Apropiadores* (Appropriators) (Guarch 1990). These characterizations are roughly equivalent to what it is represented as Archaic Age for the rest of the Antilles. Regardless of nomenclature, these classification systems reflected a traditional conception of nomadic populations of fisher-gathers without management of cultigens that had been conventionally associated with the Antillean "Archaic" Age groups (Pagán-Jiménez 2013). Recent findings based on starch and stable isotope analyses (Chinique de Armas *et al.* 2015, 2016; Rodríguez Suárez 2007, 2011) have challenged traditional perspectives regarding the role of plants (including cultigens) in "Archaic" Age diets and the homogeneity of subsistence strategies and food consumption practices among Cuban "Archaic" Age groups.

Until the nineties, traditional paleodietary reconstructions in Cuba were based on macroremains found at archaeological sites (e.g., Alonso 1991; Guarch and Vázquez

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 107-118.

1991; Pino 1980) and the typology of archaeological artifacts (Alonso 1995; Pino 1970). Based on macroremains, the role of plants in the Cuban indigenous diet was initially underestimated, supporting the idea that pre-Arawak subsistence strategies were exclusively associated with fishing, hunting and gathering wild resources, particularly mollusks. This inference was mainly due to the fact that plant tissues do not preserve as well as animal remains within archaeological contexts, especially in tropical environments (Mickleburgh and Pagán-Jiménez 2012; Pestle 2010). Consequently, while the remains of bony animals and shells were frequently found, plants were rarely recovered, with the exception of some macroscopic remains such as the seeds of palms and peanuts (Delgado *et al.* 2000; Hernández and Navarrete 1999; Rodríguez Suárez *et al.* 2006).

The consumption of plants was thus associated with the typology of archaeological artifacts, the presence/absence of ceramics (and its characteristics) and European chronicles (in the case of the populations that were encountered on the island during the contact and colonization period). Accordingly, some authors suggested the probable use of wild plants among some "Archaic" Age groups based on the abundance of recovered stone artifacts commonly associated with the processing of plants, such as edge-ground cobbles and milling-stone bases (Alonso 1995; Hernández and Navarrete 1999). At the same time, the cultivation of domesticates as a cultural practice was associated with the later Ceramic groups (commonly grouped under the term Taíno). This follows the popular notion that before the Saladoid expansion, the Antillean indigenous groups were fisher-hunter-gatherer populations without ceramics or agriculture (Rouse 1992; Wilson 2007). As for the rest of the Antilles, this absence of pottery, which was usually directly linked to the assumption of agricultural practices, was one of the main indicators to associate these human groups with the exclusive management of wild plants (Pagán-Jiménez 2013).

The absence of ceramic production in Cuban "pre-Arawak" groups was first questioned in the forties (e.g., Herrera Fritot 1943; Pichardo Moya 1945). This was mainly motivated by the appearance of the so-called "simple Ceramic" in association with the typical artifacts of "Archaic" Age groups. This phenomenon was considered to signify a new cultural manifestation, named "*Protoagricolas*" by Tabío (1984), and believed to represent a transitional group from non-Ceramic, pre-Arawak groups to later agricultural populations (Pérez Carratalá 2013; Tabío 1984). Consequently, the presence of ceramics was accepted as a diagnostic element for identifying the beginning of plant cultivation (considered "incipient cultivation" for *Protoagricolas*), in spite of the criticisms that this received (e.g., González Herrera 2012; Rodríguez Ramos 2010; Ulloa Hung and Valcárcel Rojas 2002). Within this new construct, "pre-Agroceramist" populations (*sensu* Tabío 1984) continued to be understood as fisher-gatherer groups that exclusively gathered wild plants (and undertook the intentional propagation of their seeds).

Notions of the diversity of "pre-Arawak" dietary traditions have received important input since the incorporation of starch and stable isotopic analyses to Cuban archaeological practices. These novel techniques not only allow us to identify dietary differences within a population, but also among groups of individuals from different archaeological sites. Differences among "Archaic" Age populations had previously only been described based on their material culture (e.g., Guarch 1990; Tabío 1984;

Tabío and Rey 1966). Despite these distinctions, there has been a tendency toward masking possible biological and cultural differences by including them in the same broad categories (Ciboney, pre-Agroceramists, Appropriators) when referring to their subsistence strategies (e.g., Tabío 1984) or biology (e.g., Coppa *et al.* 2008; Lalueza-Fox *et al.* 2003).

Recent findings indicate greater cultural differentiation among pre-Arawak populations in Cuba than previously acknowledged, as evidenced by their dietary traditions (Chinique de Armas *et al.* 2016). In this chapter, we describe how the incorporation of starch and stable isotope analyses have contributed to modifying outdated conceptions of the importance of plants and the homogeneity of dietary practices among "Archaic" Age populations. In addition, we explore the first insights into the differential consumption of plants among "Archaic" Age groups in Cuba. The integration of our results into the Antillean context has the potential to contribute to the discussion regarding migrations and the complexity of biocultural interactions that took place among Circum-Caribbean "pre-Arawak" populations in precolonial times.

Plants and people during the "Archaic" Age: The paleoethnobotanical evidence

The Circum-Caribbean area

The development of paleobotany, with the inclusion of starch and phytolith analyses in the archaeological practice of the Circum-Caribbean area, has dramatically changed our understanding of the role of plants in aboriginal diets during the "Archaic" Age. Current evidence indicates that cultigens and other botanical resources have been used by populations in the central and Pacific areas of Central and South America (Dickau *et al.* 2007; Pearsall *et al.* 2004; Piperno 2011) and the Caribbean coast of South America (Pagán-Jiménez *et al.* 2015) since the Early Holocene (Figure 8.1).

For example, maize (*Zea mays*) was reported in Mexico as early as 7000 cal BC (Piperno *et al.* 2009; Ranere *et al.* 2009). Remains of the plant have also been found in Panama at 5850 BC (Dickau *et al.* 2007), in coastal Ecuador dating to 6100–5870 cal BC (Piperno 2011) and in the interior of Colombia dating as late as 4730 cal BC (Aceituno and Loaiza 2014). Recently, maize was identified close to the Caribbean coast at the Eva 2 site (French Guyana), on the surface of archaeological artifacts associated with contexts as old as 4140–3790 cal BC (Pagán-Jiménez *et al.* 2015).

Other vegetable sources, both cultigens and wild varieties, have been identified in Central and northern South America. Plants such as manioc (*Manihot esculenta*), yam (*Dioscorea* sp.), Maranta (*Maranta arundinacea*), marunguey (*Zamia* sp.), and beans (Fabaceae, including *Phaseolus* sp.) were reported for archaeological contexts in Panama dated to 1650 cal BC (Dickau *et al.* 2007). Starches of sweet potatoes, marunguey, jack bean (*Canavalia* sp.), chili pepper (*Capsicum* spp.), and possibly arrowroot (cf. Marantaceae) have also been identified by Pagán-Jiménez *et al.* (2015) at the Eva 2 site (French Guyana 4140–3790 cal BC). For a further summary of early plant distributions in the mainland Americas, see Pagán-Jiménez (2011).

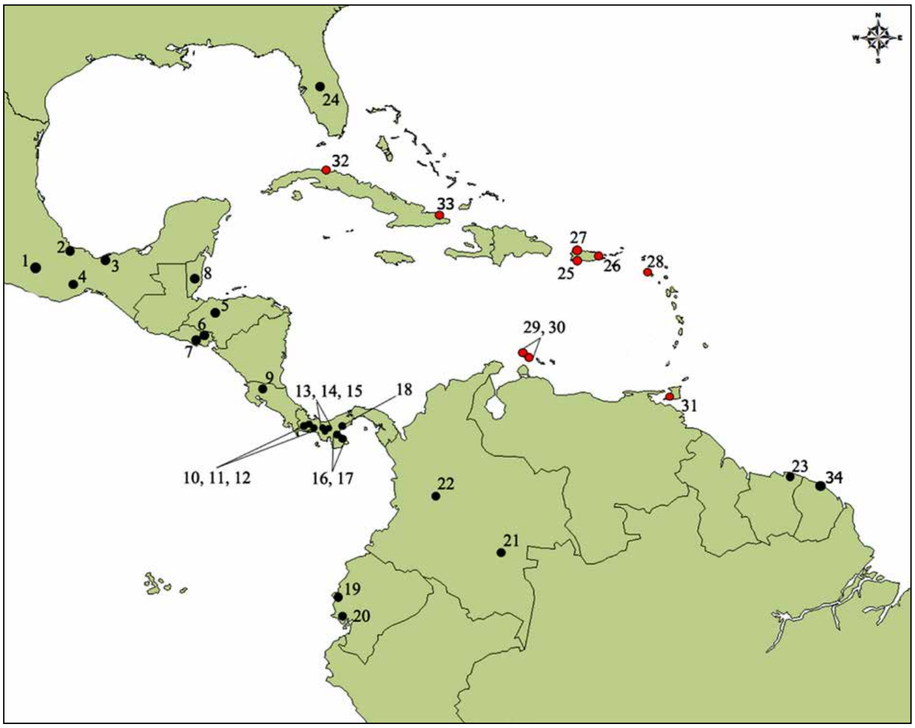


Figure 8.1. Selected Circum-Caribbean archaeological sites where micro botanical remains have been reported. 1. Xihuatoxtla, 2. Veracruz, 3. San Andrés, 4. Guilá Naquitz (Mexico), 5. Aguada Petapilla (Honduras), 6. Laguna Verde, 7. El Carmen (El Salvador), 8. Cob Swamp (Belize), 9. Laguna Martínez (Costa Rica), 10. Trapiche, 11. Ca sita de Piedra, 12. Hornito, 13. Cueva de las Santanas, 14. La Yeguada, 15. Aguadulce, 16. La Mula, 17. Monagrillo, 18. Ladrones (Panama), 19. Loma Alta, 20. Real Alto (Ecuador), 21. Pena Roja, 22. Jazmín, Guayabito and Campo Alegre (Colombia), 23. Chemin Saint Louis (French Guyana), 24. Fort Center (USA), 25. Maruca, 26. Puerto Ferro, 27. Maisabel (Puerto Rico), 28. Plum Piece (Saba), 29. Canashito, 30. Malmok (Aruba), 31. St. John (Trinidad), 32. Aguas Verdes, 33. Canímar Abajo (Cuba), 34. Eva 2 (French Guyana). (Modified from Pagán-Jiménez 2011).

The use of cultigens and wild plants in the Lesser and Greater Antilles: New evidence from Cuba

Direct evidence for maize in the insular Caribbean has been recorded on Hispaniola, Puerto Rico, and the Lesser Antilles (Mickleburgh and Pagán-Jiménez 2012; Pagán-Jiménez *et al.* 2005, 2015). Maize starch granules were found on the surface of all archaeological artifacts sampled at the St. John site (Trinidad). These tools were associated with archaeological contexts dated between 5840–5720 cal BC and 3510–3350 cal BC, which constitute the earliest date for maize in the southern Caribbean (Pagán-Jiménez *et al.* 2015, 242). A relatively high number of maize starch grains were also documented in the dental calculus of one individual from Canashito (Aruba) whose remains were associated with a nearby burial dated to cal 350 cal BC – AD 150 (Mickleburgh and Pagán-Jiménez 2012, 2472). In the Greater Antilles, maize was identified on the surface of coral and stone artifacts at the sites of Maruca, Puerto Ferro, and Cueva Clara in Puerto Rico (2890–390 cal BC)

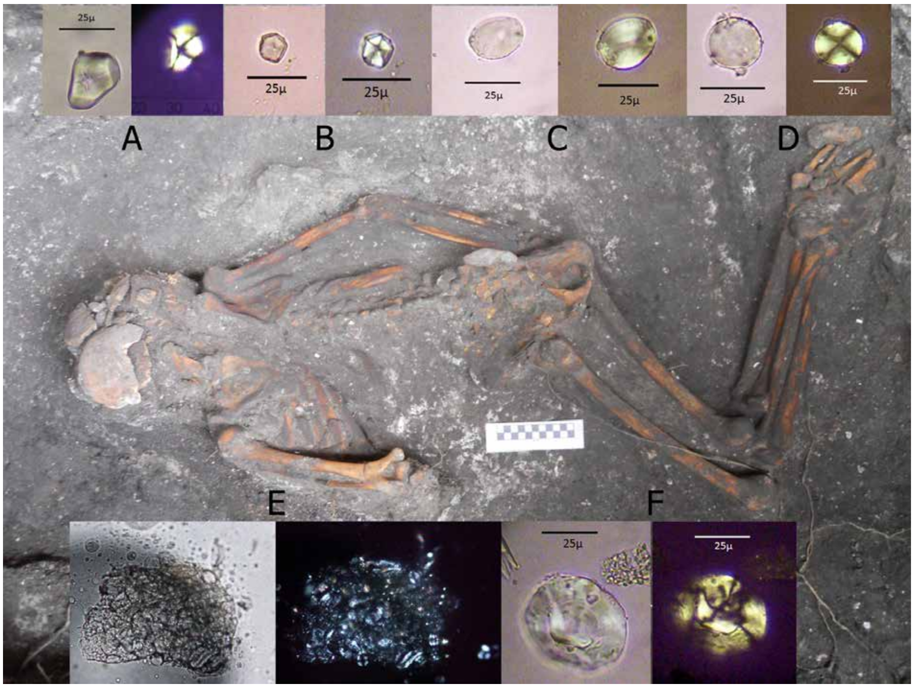


Figure 8.2. Selected starch granules found in the dental calculus of E-105 (990–800 cal BC) (Roksandic et al. 2015, 759). A: cf. Zea mays (unpublished); B: cf. Ipomoea batatas; C: cf. Phaseolus sp.; C: cf. Zamia sp.; E: cf. Phaseolus vulgaris; F: Zamia sp. (Chinique de Armas et al. 2015), (Montane Anthropological Museum collection, Cuba. Courtesy L.M. Viera Sanfiel, photographer).

(Pagán-Jiménez *et al.* 2005; Pagán-Jiménez 2009). These findings demonstrate that the crop was first introduced to the region during the "Archaic" Age, and not with the later Saladoid expansion, as had been previously believed (Rouse 1992).

Other plants such as sweet potatoes, beans, yam, and marunguey were circulating in the Antilles during the "Archaic" Age as part of a broad-based spectrum diet (*sensu* Berman and Pearsall 2008; Mickleburgh and Pagán-Jiménez 2012). In St. John (Trinidad), the earliest date for sweet potatoes is as far back as 4700–4380 cal BC. Also identified at the site were other plants such as beans (including *Canavalia*), wild yam, chili pepper (5840–5720 cal BC), marunguey (the earliest report of the plant for the Americas, at 5840–5720 cal BC) (Pagán-Jiménez *et al.* 2015), achira (*Canna* sp., before 4704 cal BC), and possibly arrowroot (*Maranta arundinacea*). The analysis of 43 lithic and coral artifacts from Plum Piece in Saba and Maruca, Puerto Ferro, and Cueva Clara in Puerto Rico demonstrate that, in addition to maize, "pre-Arawak" populations at this time managed a suite of domestic and wild plants such as manioc, sweet potatoes, arrowroot, common bean (*Phaseolus vulgaris*), arrowhead (*Sagittaria lancifolia*), bijao (cf. *Renealmia alpinia*), and the autochthonous Antillean marunguey (*Zamia* sp.) (Hofman *et al.* 2018b; Pagán-Jiménez 2009).

When we consider the central position of Cuba in the ethnographic Caribbean – which allows access from different neighboring regions – along with the demonstrated mobility of pre-Arawak groups (Hofman and van Duijvenbode 2011), we can logically assume that the populations that migrated to Cuba in the Archaic Age carried with them a cache of available botanical resources from the mainland and the surrounding islands. This hypothesis is supported by the study of starch granules on the surface of recovered archaeological artifacts and in individuals' dental calculus from the site of Canímar Abajo in Cuba (Figure 8.1). Based on techno-typological considerations – including the absence of ceramics – populations buried at Canímar Abajo have been classified elsewhere as fisher-gatherer groups (Appropriators, Ciboney, or Preagriculturalists). However, starch granules of maize, sweet potato, beans (including *Phaseolus* sp. and beach bean, *Canavalia* sp.), marunguey, cocoyam (*Xanthosoma* sp.), and yam (*Dioscorea* sp.) were identified on the surface of eight archaeological artifacts from the Canímar Abajo found between 0.40 cm and 1.80 cm depth (Morgado 2014; Rodríguez Suárez 2007).

Since the archaeological evidence demonstrates a long-term occupation at the site of Canímar Abajo (Roksandic *et al.* 2015), it is difficult to ascertain the actual dates of these archaeological artifacts and to associate their accompanying paleobotanical evidence with a particular segment of time. In this respect, the identification of starch granules in the dental calculus of the individuals buried at the site, whose bones have been directly radiocarbon dated, provides us with the necessary chronological reference for the major cultigens and wild plants identified on these artifacts (for an example see Figure 8.2). The dental calculus extracted from the excavated individuals, when combined with stable isotopic studies, indicated that exotic cultigens such as the common bean, maize and sweet potato were potentially available for Canímar Abajo groups (Chinique de Armas *et al.* 2015).

Bean starches consistent with the common bean and maize were identified in the dental calculus of individuals dated to 1380–800 cal BC (Roksandic *et al.* 2015), providing direct evidence of the early use of these plants in the Greater Antilles (dental calculus and ^{14}C dates from the same individual) (see Figure 8.2) (Chinique de Armas *et al.* 2015). In terms of dietary balance, maize and beans were often grown and consumed together in the precontact New World (Pagán-Jiménez *et al.* 2015), as beans provide plant proteins, such as the amino acid lysine, that are not abundant in maize (Bonavia 2013). Wild plants such as marunguey and beans (including *Canavalia* sp.) were also identified in the early and/or later occupations of the site (Chinique de Armas *et al.* 2015). Both the starch analysis and the isotopic evidence suggest that populations with similar dietary traditions contributed to the formation of the two cemetery components present at Canímar Abajo (despite a separation of approximately 1000 years; Roksandic *et al.* 2015). This indicates that dietary traditions, including the techniques associated with processing these plants, may have been passed on from generation to generation relatively unchanged over thousands of years.

In eastern Cuba, the starch analysis study on the surface of grinding tools from the Aguas Verdes site, Baracoa, Guantánamo (Figure 8.1) indicates that this population, traditionally classified as proto-Agriculturalists, actively used cultigens and wild plants as part of their diet. This is evidenced by the presence of starches from plants such as maize, sweet potatoes, beans (including *Phaseolus* sp. and *Canavalia* sp.), cocoyam, yam (*Dioscorea trifida*), and marunguey identified on artifacts recovered from the site (Rodríguez Suárez 2011). In contrast with "Archaic" Age groups, the presence of the so-called "simple Ceramic" in the assemblages of "proto-Agriculturalist" groups has led some authors to suggest a low level of plant management ("incipient agriculture") for these populations (e.g., Guarch 1990; Martínez *et al.* 1993). Additionally, the use of plants has been corroborated for the Biramas site (Sancti Spiritus, Central Cuba), where seeds of calcined peanut (*Arachis hypogaea*) dated to cal AD 1155–1275 were found (Angelbello *et al.* 2002; Delgado *et al.* 2000; see Appendix, this volume). The starch analysis results obtained for Aguas Verdes provide a more complex understanding of the range of plants that were used by these early inhabiting groups. These paleobotanical results contradict previous dietary assumptions (e.g., Martínez *et al.* 1993), and demonstrate that key cultigens, such as maize, formed part of their dietary traditions.

The results stated above suggest a higher level of economic and social complexity than previously acknowledged for "Archaic" Age populations from Cuba, which is in agreement with previous results from other Antillean islands (Mickleburgh and Pagán-Jiménez 2012; Pagán-Jiménez 2009; Pagán-Jiménez *et al.* 2015). As Pagán-Jiménez (2011) has asserted, early populations who migrated to the Antilles likely carried with them traditional dietary knowledge that included the cultivation, processing and consumption practices of a broad range of plants, including exogenous cultigens such as maize, sweet potatoes, and the common bean. These botanical resources, which were circulating in the Circum-Caribbean area since early times, were likely propagated by these early colonizing populations during migrations into the Antilles as a means of producing predictable environments and providing a culturally preferred diet in their new settings (Berman and Pearsall 2008). They also incorporated the natural resources of these newly inhabited islands (such is the case for some endemic varieties of zamia documented by Jaime Pagán-Jiménez in Puerto Rico) as means of adaptation to their new environments.

Based on current evidence, it is clear that plants – both cultigens and wild varieties – were part of the "Archaic" Age diet, and that the outdated concepts that characterized the previously accepted nomenclature need to be revised. With this new understanding, we must now address a set of new research questions, such as: what was the relative importance of cultigens, in comparison with other resources, in the diets of "Archaic" Age populations? Were some plants more important in their economy than others? Was maize a staple crop? Was maize restricted to some individuals? To what extent can grades of dietary diversity be observed among Archaic Age diets? Although further research is necessary before we can fully answer these questions, stable isotope analysis have provided us with the first insights by which to explore possible variations in dietary traditions within and among "Archaic" Age populations in Cuba.

Dietary diversity: The isotopic evidence

The position of Cuba in the Caribbean likely facilitated migrations from different Circum-Caribbean regions. It is likely that different populations from different mainland territories and islands migrated to Cuba during the "Archaic" Age period, bringing with them their dietary traditions. These dietary traditions may have been enriched as these "Archaic" Age groups interacted with their new environments and with other groups from neighboring Circum-Caribbean areas (see Smith 2016b). Since Cuban geographic territory is relatively narrow, it is possible to easily access different ecosystems by walking or traveling through the network of navigable rivers that connect inland and costal ecosystems. With this in mind, we argue that the observable differences in the subsistence strategies and food consumption patterns among populations are likely the result of variations in their dietary traditions, and not due to differential accessibility to resources.

A recent study using carbon and nitrogen stable isotopes for paleodietary reconstruction supports the notion that at least two different food consumption patterns were present among "pre-Arawak" populations in western Cuba (Chinique de Armas *et al.* 2016). This evidence indicates that the population of Canímar Abajo depended mainly on marine/riverine fish and a mixed C_3/C_4 plant diet, which is consistent with previous results obtained by the combination of both isotopes and starch analysis (Chinique de Armas *et al.* 2015). In contrast, the contemporaneous populations of Cueva del Perico I, Pinar del Río (cal AD 380–573), Cueva Calero (cal AD 566–715), and Guayabo Blanco (cal AD 526–647), Matanzas, had a diet based predominantly on terrestrial resources and possibly only C_3 plants (Chinique de Armas *et al.* 2016; Chinique de Armas and Laffoon forthcoming). As noted by the authors previously mentioned, these three populations coexisted with the later Canímar Abajo cemetery (cal AD 360–950), indicating that both food consumption patterns were present on the island at the same time.

The coexistence of different dietary traditions in the Matanzas region of Cuba is significant when we take into account the closeness of these sites. This is further demonstrated by the case of two contemporary and closely situated burial sites, Cueva Cristales and Canímar Abajo, which are connected by the Canímar River. The isotopic analyses of bone collagen from the individuals from these sites indicate that the population that used Cueva Cristales as a burial place and the Canímar Abajo populations shared the same ecological area while taking advantage of different resources as staple foods (Figure 8.3). A similar situation can be observed in the cases of the Cueva Calero and Florencio sites, which are relatively close and connected to the Canímar Abajo site through the rivers and costal ecosystems north of Matanzas. Interestingly, a recent study described intentional dental modifications in six individuals (all female or likely female) buried in the Canímar Abajo cemeteries (Alarie and Roksandic 2016; Roksandic *et al.* 2016). The modifications for all six individuals involved filing the upper central incisors to produce an inverted "V" shape that resembles a similar form of dental modification found among certain Arawakan (Farabee 1918) and Chibchan groups (Stewart 1942). Such modification was not detected in the Cueva Calero, Cueva del Perico I or Guayabo Blanco skeletal populations (Kaitlynn Alarie, personal communication, 2016). This constitutes a new indicator of possible cultural differences, in addition to the different dietary patterns described above, between Canímar Abajo and the Cueva del Perico I, Cueva Calero and Guayabo Blanco populations.

Regarding the consumption of plants, the main difference between Canímar Abajo and the Cueva del Perico I, Cueva Calero, and Guayabo Blanco populations is probably a lower frequency of C_4 plant consumption in the latter three groups (Chinique de Armas *et al.* 2016). Maize is the only C_4 plant so far identified during the "Archaic" Age in Cuba (at Canímar Abajo and Aguas Verdes), although other C_4/CAM plants such as century plant (*Agave antillarum*) or pineapple (*Ananas comosus*) could contribute to these human isotopic values. The comparison of the Cuban sites with other Antillean populations suggests that the depleted values observed in the Cueva del Perico I, Cueva

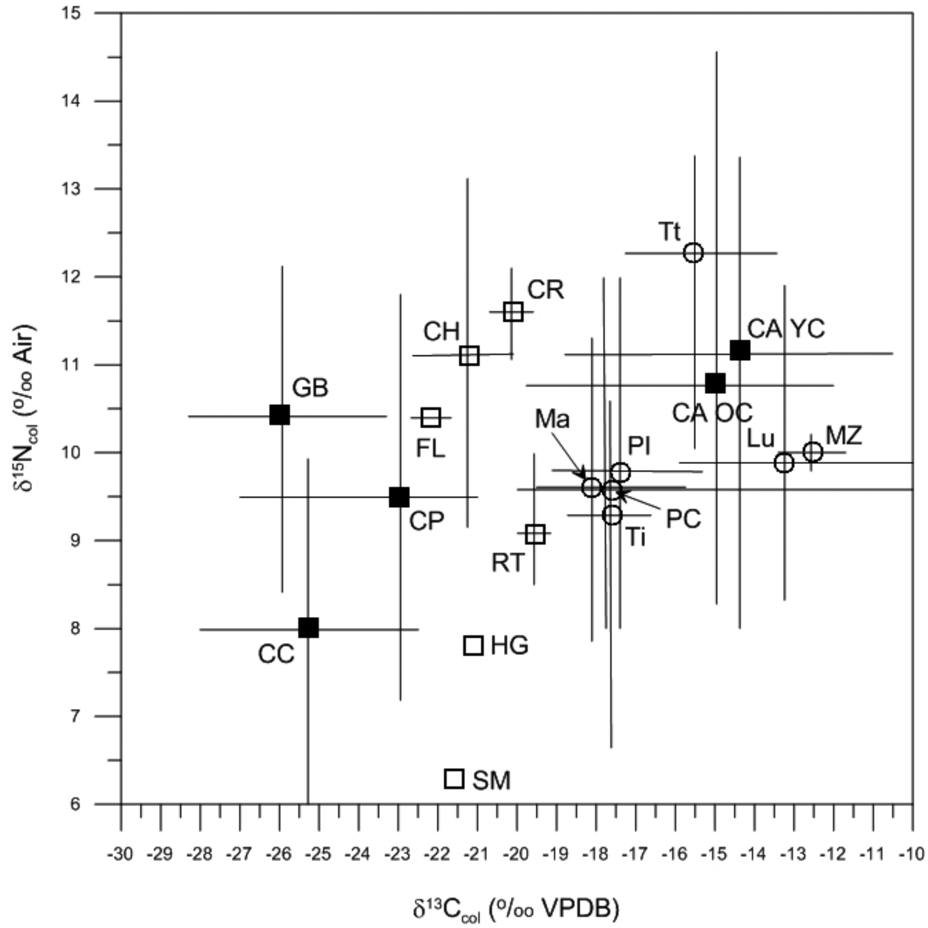


Figure 8.3. Comparison between the average mean values of $\delta^{13}C_{col}$ and $\delta^{15}N_{col}$ for Cuba and other Caribbean sites. CA OC: Older cemetery at Canímar Abajo; CA YC: Younger cemetery at Canímar Abajo; CC: Cueva Calero; GB: Guayabo Blanco; CR: Cristales (unpublished data); FL: Florencio (unpublished data) (Matanzas, Cuba); CP: Cueva del Perico I; SM: Solapa del Mogote (unpublished data); HG: Cueva de los Hornos Guajaibón (unpublished data) (Pinar del Rio); CH: Charcón (Villa Clara) (unpublished data); PC: Punta Candelero; RT: Río Tanamá; Ma: Maisabel; Ti: Tibes; PI: Paso del Indio (Puerto Rico) (Pestle 2010); Lu: Lucayos (Bahamas) (Keegan and DeNiro 1988); Tt: Tutu site (Virgin Islands) (Norr 2002); MZ: Manzanilla SAN 1 (Trinidad) (Healy et al. 2013), (Modified from Chinique de Armas et al. 2016).

Calero, and Guayabo Blanco populations (Figure 8.3) were influenced by a diet in which only C_3 plants were abundant (more depleted isotopically). As stated previously, the isotopic evidence indicates that terrestrial resources were the main source of protein for these Cuban populations, as is similarly the case for the agricultural populations of Punta Candelero, Paso del Indio and Tibes in Puerto Rico (Pestle 2010). However, the Puerto Rican sites – with a mixed C_3/C_4 plant diet – did not show the depleted isotopic values observed for Cueva del Perico I, Cueva Calero, and Guayabo Blanco, which supports the idea that people from these Cuban sites are likely eating only C_3 plants (Chinique de Armas and Laffoon forthcoming). Although we cannot securely state that the observed differences between Canímar Abajo and the Cueva del Perico I, Cueva Calero and Guayabo Blanco populations are influenced by a differential consumption of C_4 plants (including maize), it seems likely that plant consumption is a key aspect. Further studies involving a bivariate regression model with both collagen and apatite isotope data (e.g., Froehle *et al.* 2010) are necessary to better explain the observed differences.

Considering the presented evidence, why did Canímar Abajo consume C_4 plants (such as maize) while other contemporaneous Cuban populations (some of them very close to Canímar) did not? Were they different biological and/or cultural populations? As stated elsewhere, populations from Canímar Abajo had been engaged in cultivation practices, at least as low or mid-level food producers, since ca. 1200 BC (Smith 2001; Smith 2016b). For the other Cuban sites (with depleted carbon values; see Figure 8.3) it is difficult to speculate about whether purported C_3 plants were wild or domesticated varieties, as their isotopic signals would overlap (Warinner *et al.* 2013). The cultivation of tubers and the control and propagation of wild plant varieties have been reported for populations who depend mainly on natural resources (Greaves and Kramer 2014; Smith 2001). However, while tubers can be easily grown in small gardens and require little time investment, maize cultivation is more time-consuming, as it requires more careful and specialized attention throughout the year (Greaves and Kramer 2014). It is understood that subsistence strategies not only fulfill basic dietary needs, but they also play an important role in the archaeological understanding of identity. During the process of production, preparation, cooking, distribution, and consumption, food becomes an object of culture and performance (Sørensen 2000). In other words, the dietary differences observed between Canímar Abajo and the other Cuban sites (Figure 8.3; note that Cuban sites cover a broad isotopic spectrum) provide further insights into the diversity of cultures that migrated and coexisted in Cuba in precolonial times.

Although maize has been documented in many of the "Archaic" Age archaeological contexts where starch analysis studies have been conducted (e.g., Chinique de Armas *et al.* 2015; Mickleburgh and Pagán-Jiménez 2012; Pagán-Jiménez *et al.* 2005, 2015; Rodríguez Suárez 2007, 2011), there is still controversy about the role of the plant in Antillean diets. Maize was initially thought to be a supplementary food restricted to ritual ceremonies or high-status contexts (Newsom 2006, Newsom and Wing 2004). However, recent studies have challenged this hypothesis, suggesting that the crop was part of a broad-based diet (Berman and Pearsall 2008; Mickleburgh and Pagán-Jiménez 2012; Pestle 2010). The combination of two lines of evidence – starch analysis and carbon and nitrogen stable isotopes – for the dietary reconstruction of the Canímar Abajo populations supports this new hypothesis of maize representing a significant crop in a broad-based diet (Chinique de Armas *et al.* 2015). As stated before, maize was found in most of the archaeological artifacts recovered from the Canímar Abajo site (Rodríguez Suárez 2007, Rodríguez Suárez *et al.* forthcoming). The isotopic evidence also supports the presence of maize in the diets of most individuals from Canímar Abajo, although its contribution to diet seems to have been lower than that of other plant resources, such as legumes and root cultigens (Chinique de Armas *et al.* 2015). It is also possible that collagen stable isotope ratios underestimate the contribution of carbohydrate sources, since carbon collagen is incorporated from intact amino acids in dietary protein (maize is only 10% protein), with relatively less carbon coming from other macronutrients (Froelhe *et al.* 2010; Schwarcz 2000). The isotopic evidence indicates that maize was not a staple food for the Canímar Abajo populations but definitely part of their varied mixed diet. This is supported by the fact that Mesoamerican groups – highly dependent on maize – show carbon collagen values of 9‰ (Wright *et al.* 2010), in contrast with the 15‰ of Canímar Abajo (Chinique de Armas *et al.* 2015). As stated before, our findings do not show any regularity regarding the restriction of maize among Canímar Abajo adults. However, our recent results suggest it is unlikely that C_4 plants were consumed by Canímar Abajo juveniles under five years of age (Chinique de Armas *et al.* 2017). While maize appears to have been part of the juvenile diet at the Kaminaljuyú site in Guatemala (700 cal BC – cal AD 1500) (Wright *et al.* 2010), it seems to have been absent from the diets of juvenile individuals from the Antillean sites studied by Mickleburgh and Pagán-Jiménez (2012). A recent study of the breastfeeding and weaning practices of Caribbean populations found statistically significant differences in $\delta^{13}C_{co}$ between Mesoamerican agriculturalists and Antillean indigenous groups, which indicate that Antillean weanlings had dietary supplements with lower carbon isotopic values than Maya juveniles (Chinique de Armas and Pestle 2018). This would appear, at least in part, to be a consequence of low maize consumption among the Antillean juveniles. The use of C_3 plants such as fruits and root cultigens to wean infants has been reported for other groups in the area (Du Tertre 1667; Taylor 1938, 1946; Hill and Muirden 1956; Wilbert 1972a). Antillean and Mesoamerican agriculturalists had different strategies and food subsistence patterns that are reflected in the weaning process. This further emphasizes the important role of cultural perceptions and cultural dietary practices in breastfeeding and weaning practices.

Studies of juvenile paleodiets are rare for the Caribbean, making it impossible to ascertain whether the lack of maize in juvenile diets suggested here is representative of a more widespread phenomenon. Our results, while not conclusive, are consistent with some kind of restriction of maize consumption among juveniles, at least in some currently examined Caribbean indigenous populations (Mickleburgh and Pagán-Jiménez 2012). More research on juveniles is required before we can explain the absence of maize in both Canímar Abajo juvenile diets and among juveniles of other Antillean populations where there is indication of the plant presence in the diet.

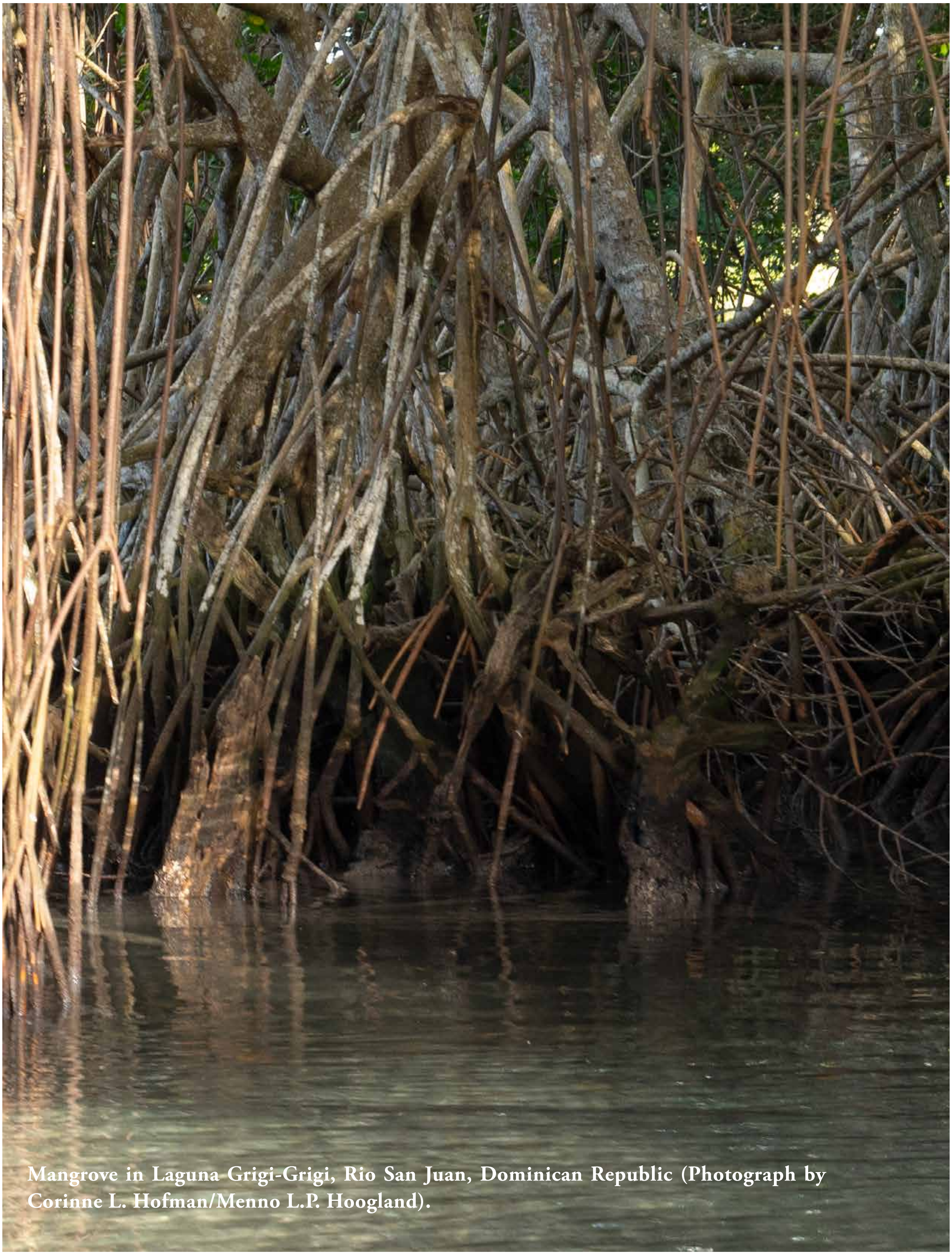
Final remarks

The inclusion of starch analysis and stable isotopes in Cuban archaeological practice has challenged the traditional view of "Archaic" Age populations from Cuba. Our understanding of the dietary practices of these "Archaic" Age populations has shifted from considering them exclusively as fisher-gatherer groups, to populations with a broad-spectrum diet comprised of cultigens and wild plants that are similarly important for other Neotropics economies in the Americas. As Rodríguez Ramos *et al.* (2013, 133) has stated, the adoption of cultivation practices was not simply the addition of certain foods to the Archaic Age diet, but represents a systemic change that incorporated a "delayed return" of nutritional investments. With this in mind, critical revisions of the current classification systems operating in Cuba and the Antilles are necessary in order to recognize a greater economic and social complexity of "Archaic" Age groups.

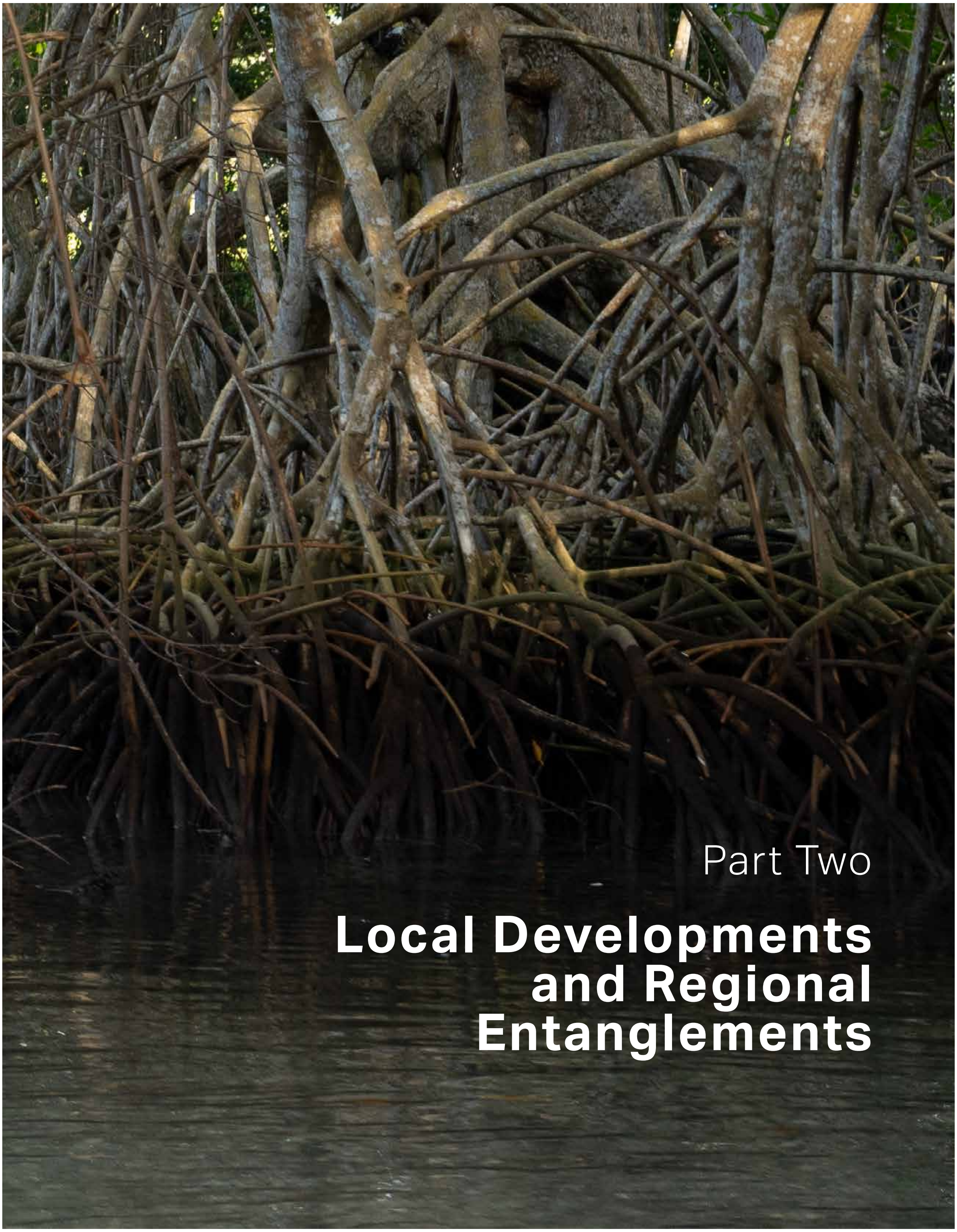
It seems apparent from the current evidence that a greater level of dietary diversity than previously acknowledged existed among "Archaic" Age populations in Cuba. The isotopic values available for Antillean sites show a wide range of consumed resources, as well as their likely differential exploitation among local groups. In the case of Cuba, the position of the island in the Caribbean likely facilitated migrations from different regions of the Circum-Caribbean, resulting in a mosaic of dietary traditions. These diverse traditions coexisted and were likely enriched through exchanges of food resources and cooking techniques between "Archaic" Age groups as part of the dynamic cultural interactions taking place over thousands of years in the Circum-Caribbean region.

Acknowledgements

The authors would like to thank Corinne Hofman and Andrzej Antczak for inviting us to contribute to this book. We would also like to thank Luis Manuel Viera Sanfiel for help with the elaboration of Figures 8.1 and 8.2. This research was funded by the Social Sciences and Humanities Research Council of Canada (Standard Research Grant SSHRC 410–2011–1179 and SSHRC Postdoctoral Fellowship 756–2016–0180).



Mangrove in Laguna Grigi-Grigi, Rio San Juan, Dominican Republic (Photograph by Corinne L. Hofman/Menno L.P. Hoogland).



Part Two

Local Developments and Regional Entanglements

9

The first settlers: Lithic through Archaic times in the coastal zone and on the offshore islands of northeast South America

Arie Boomert

At the onset of the Holocene, the northern part of South America was occupied by widely scattered bands of Lithic small-game hunters, fishers, and foragers. Focusing on a broad-spectrum subsistence strategy, these residentially and logistically mobile groups appear to have seasonally exploited a wide range of plant and animal resources in a variety of habitats within restricted territories. Semi-permanent camp sites, cave shelters, and workshops inhabited or utilized by family-level groups of this Canaima/Atures/Sipaliwini tradition have been encountered sparingly in the relatively open landscapes of the Orinoco Basin and the Guiana Highlands, often in the vicinity of water sources. Few of these camp sites or transient activity areas have been sufficiently excavated. Canaima, situated in the Upper Caroní Valley, yielded convex scrapers; flat, bifacially worked knives; stemmed projectile points; and hammerstones made of jasper. Comparable workshops have been discovered in the Lower Caroní area, on the Upper Orinoco and in southern Suriname. Most sites of this tradition are restricted to individual finds of such relatively large, finely pressure-flaked stemmed or concave-based projectile points, which may have been used for tipping wooden shafts to be employed in conjunction with spear-throwers. They are made of fine-grained rocks with conchoidal fracture, such as chert, jasper, chalcedony, or crystal quartz (Plew 2009; Roosevelt *et al.* 2002; Sanoja and Vargas 2006).

An accidental find of a bifacially chipped stemmed spearhead, made of local, dark brown chert, is known from Biche in central-east Trinidad (Figure 9.1). At the time of its production, movement between the mainland and Trinidad was easy, as a land bridge still connected the southwestern part of the island with Venezuela at that time. Comparable stemmed points of quartz or quartzite have been encountered as individual finds on Margarita, a similar continental island that became detached

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Figure 9.1. Bifacially chipped stone spearhead, found at Biche, central-east Trinidad, dating to the Lithic Age, ca. 8000 cal BC. Length 9.2 cm. Coll. the University of the West Indies, St. Augustine, Trinidad.

from the mainland during the Early Holocene sea-level rise. The Biche find is suggestive of the intermittent presence of sparse groups of Lithic hunter-foragers in Trinidad perhaps as early as about 8000 cal BP. However, it should be noted that only few radiocarbon dates are available for the mainland Lithic sites in question. Moreover, although firmly dated to approximately 10,000 to 9000 cal BC at the Caverna da Pedra Pintada site on the Lower Amazon, stemmed ("tanged") points may have remained in use in the Guiana Highlands and beyond for a considerable time period thereafter (Boomert 2000).

Archaic Age peoples of the mainland and Trinidad

By 6500 to 6000 cal BC, Archaic Age hunter-fisher-collector populations, perhaps the remote descendants of the Canaima/Atures/Sipaliwini peoples, had colonized the estuaries, lagoons, and mangrove swamps of the Caribbean and Atlantic coasts in eastern Venezuela and the western part of the Guianas, as well as Trinidad (Figure 9.2). These semi-sedentary family-hamlet groups showed specialized subsistence adaptations aimed at far-reaching food resource differentiation, combining hunting, fishing, and collecting with incidental horticulture and the managing of wild food plants. It was at this time that the curve showing the eustatic sea-level rise began to flatten out. The previously existing land bridge between Trinidad and the mainland had been flooded by then, but the Gulf of Paria had not yet attained its present level and configuration. Clearly, seafaring and navigating with large dugouts formed part of the cultural heritage of the Early Archaic Age colonists of Trinidad and the adjacent parts of the mainland.

Established by about 6200 cal BC, the Early Alaka tradition of northwest Guyana (formerly British Guiana) is characterized by over 30 shell midden sites, probably central base camps, occupying a series of residuary hills at the southern edge of the vast brackish to marine swamps of red mangrove stretching along the Atlantic littoral in this period. Various sites yielded remains of clay hearths and weathered heating stones, as well as lumps of burnt beeswax, which were possibly used as torches. The major subsistence strategies consisted of hunting terrestrial animals; estuary and freshwater fishing; crab fishing; and collecting both shellfish – notably zebra nerites and mangrove oysters – and wild, managed, or perhaps domesticated vegetable foods. Typical tools included crude percussion-made, multifunctional stone artifacts, such as flake wedges and scrapers, core choppers, and perforators; ground- stone tools including milling stones, line sinkers, whetstones, and manos, made of amphibolite schist and quartz; and bone fishhooks and fishbone awls. Red ocher was used for body-painting (Plew and Daggers 2015; Williams 2003).

More or less simultaneously, another Archaic Age tradition, the El Conchero complex, crystallized in an environmentally comparable situation in the east Venezuelan

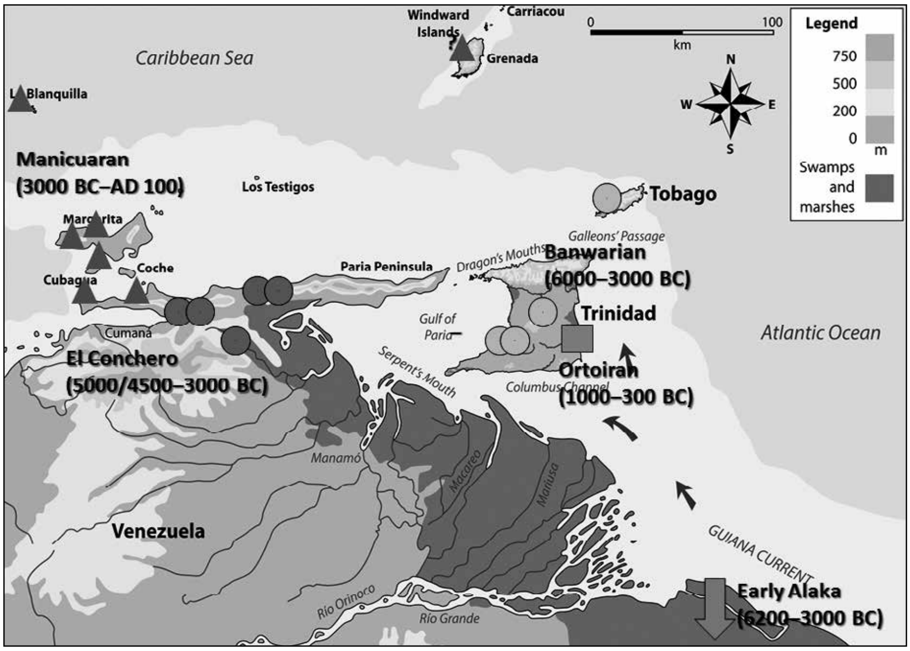

Figure 9.2. Map of northeast Venezuela, Trinidad, and the Margarita archipelago, showing the distribution and dating of sites of the Ortoiroid series, Archaic Age.

coastal zone. Postholes observed at the Conchero Guayana site suggest that the El Conchero habitations consisted of simple windbreaks, inclined toward the south. Hearths were located in front of these structures. Another site of this tradition, Remigio, formed a semicircle composed of accumulations of mangrove oysters and West Indian crown conchs, surrounding an open plaza. The El Conchero stone assemblage predominantly consists of crude choppers and unifacial flakes of quartzite, possibly for woodwork; sandstone perforators; ground-stone pestles; arrowshaft polishers; and side (edge) grinders, all quite similar to those of the Early Alaka lithic industry. Bone projectile points are rare (Sanoja and Vargas 1995). A highly conspicuous type of handheld grinding implement is the "side" or "faceted" grinder (also known as "edge-ground cobble"), which shows traces of grinding exclusively around the (narrow) edges. It served for grinding and/or mashing both root and seed crops. Indeed, the most noticeable artifacts of the El Conchero lithic tool kit can be adequately grouped as an "edge-ground cobble/millingstone complex," which, as Rodríguez Ramos (2013) notes, characterizes all early plant processing assemblages of the South and Central American tropical lowlands.

Archaic Age immigrants from the mainland also settled in Trinidad, occupying hillocks at the edge of swampy terrain characterizing the valley of the Oropouche River in the southwest of the island. The Oropuche Lagoon debouches into the Gulf of Paria and is brackish near its mouth, supporting an extensive mangrove stand. Two major shell midden deposits, Banwari Trace and St. John, have been encountered here. Together with the Alaka and El Conchero complexes, this Banwari Trace complex has been assigned to the Ortoiroid series, called after the (much later)

Archaic Age site of Ortoire in southeast Trinidad (Rouse 1992). The Banwari Trace site shows an intricate bifold stratification. In its lower levels, to be dated between 6000 and 5100 cal BC, it yielded mainly fresh water to estuarine mollusks such as pond snails and nerites, while in its upper portion, which accumulated about 5100–4350/4000 cal BC, it yielded predominantly brackish water to primarily mangrove-adapted marine species, including Caribbean oysters and West Indian crown conchs. This apparent alteration in shell-collecting habits can be correlated with the full submergence of the Gulf of Paria by about 5150 cal BC, as a result of which the distance between its shore and the site lessened considerably. St. John is situated closer to the gulf and consisted entirely of marine mollusks.

Large amounts of broken and crumbling stones, mostly soft sandstones, have been recovered from both the Banwari Trace and St. John middens. Most likely they functioned as heating (cooking) stones, used in hearths for cooking large fish, game meat, and edible tubers. At St. John, a possible hearth was found, consisting of a thick sand bed with a clay center. It resembles the dome-shaped clay hearths that the present Warao Indians of the Orinoco Delta and northwest Guyana are accustomed to constructing in their pile dwellings (Wilbert 1972b, 95–96). The Banwarian stone and bone tools comprise various artifacts associated with hunting and fishing, such as bone projectile points for tipping hunting and fishing spears, bipointed pencil fishhooks, and similarly used beveled peccary teeth. Moreover, several ground-stone tools were manufactured especially for the processing of vegetable foods: large conical pestles; pitted stones or anvils for cracking palm nuts; grinding slabs; and side (edge) grinders (Boomert 2000, 58–61; Boomert *et al.* 2013, 59–67). In addition, the Banwarian middens yielded small stone mortars, used for grinding red ocher in order to obtain pigment for e.g., body-painting, while sizable grooved ("shovel"-type) axes/adzes served for the felling of trees and the manufacture of dugout canoes. Crude percussion-flaked choppers were perhaps utilized as handheld woodworking tools. Finally, the Banwarian lithic assemblages include a large variety of small, irregular and unmodified flake tools of quartz or chert produced by direct percussion flaking or by using the bipolar technique. Each of these was expediently used for a certain purposes. Pointed antler tips and bone needles may have been used as perforators.

Concurrently with the shift in shell species gathered at Banwari Trace, there was also a change in the intensity of exploitation of the two most extensively utilized ecosystems at both Banwari Trace and St. John, i.e., the locally dominating deciduous seasonal forest and the marine, inshore/estuarine habitat of the Gulf of Paria. During the existence of these shell midden deposits, there was a decline in the hunting of primarily terrestrial game – e.g., red howler monkeys, common opossums, armadillos, spiny rats, agoutis, pacas, peccaries, iguanas and red brocket deer – which in turn made way for fishing, especially of sea catfishes. Crabs, mostly blue crabs and hairy crabs, were (seasonally) caught throughout the entire time span shown by both sites. Although a variety of ground-stone tools intended for processing vegetable foods has been found at the Archaic Age sites of Trinidad and the El Conchero and Early Alaka shell middens, it is only recently – thanks to starch grain analyses – that more has become known of the edible plants consumed by the Ortoiroid peoples. These appear to have included wild, managed, and cultivated root and seed crops, fruits, palm nuts, and perhaps palm starch. Starch grains found adhering to milling stones and pestles from Trinidad's

St. John site revealed that maize, sweet potato, achira, beans, chili peppers, and possibly also arrowroot and wild yam were cultivated, while stands of coontie (*Zamia*), a highly toxic cycad yielding edible tubers, were also managed (Mickleburgh and Pagán-Jiménez 2012; Pagán-Jiménez *et al.* 2015).

The Banwari Trace and St. John shell midden deposits of Trinidad are suggestive of a long-established pattern of littoral adaptation and a certain degree of sedentary existence. Most likely, both sites functioned as central base camps, i.e., dwelling sites that formed the loci of the major procurement activities shown by a "collector" population of the family-hamlet type. Most Banwarian ground-stone artifacts are made of rock materials that are locally found in Trinidad. However, a minority of ground-stone tools are produced from overseas rock materials, deriving either from the mainland or Tobago. A unique fragment of a serpentinite bowl encountered at Banwari Trace definitely originates from the continent. It may represent a "social valuable" that was obtained by means of ceremonial exchange with an Archaic Age community on the Paria Peninsula of Venezuela. Some handheld grinding stones probably derived from this same area, while a greenstone pestle from Banwari Trace may have been obtained from the Guiana Highlands. Two ground-stone implements from St. John are definitely Tobagonian in origin. The high proportion of overseas rock materials is indicative of the geographical expansion of Banwarian procurement strategies and their wide-ranging seafaring capabilities. Clearly, the Archaic Age Amerindians of Trinidad were skilled canoe builders and competent navigators.

The methods of corpse disposal and the accompanying ceremonies of the earliest Archaic Age peoples of the region point to a strong cultural continuity with the mortuary ritual of the subrecent Amerindian population of the Guianas and Amazonia. A primary human burial, the flexed skeleton of a sub-adult woman who was placed on her left side along a northwest axis, was found in the upper portion of Trinidad's Banwari Trace site. A smooth oval pebble was deposited close to her skull and a bone needle point near the hip. Groups of human bones, apparently bundled for secondary interment, were found as well. All of this suggests a certain sense of territoriality as formal disposal areas are typically associated with increased forms of residential stability and permanent claims, sanctified by the ancestors, to the use and control of the area's critical resources (Parker Pearson 1999, 136–138). The burial customs of the Alaka and El Conchero peoples show close correspondences with those of Banwari Trace. Interments took place in domestic areas as well. The Alaka shell middens have yielded haphazardly scattered secondary burials of human skulls or long bones. Skeletons are sometimes strongly flexed, as if bound, with the head often pointing west; burial gifts are lacking. Unusually thick and heavy skulls and long bones of great robustness are reported from the Waramuri and Siriki sites. Some of them show red coloring, perhaps intended to imitate the reddish body paint of the living.

The growing number of ground-stone tools – notably celts, adzes, mortars, side grinders, pestles, and grinding stones – for pounding, grinding, and mashing during the Late Alaka and El Conchero periods suggests the steadily increasing importance of the consumption of wild and perhaps domesticated vegetable foods. The available data suggest a high diversification of subsistence activities and the exploitation of a wide variety of environmental niches, resulting in a truly broad-spectrum diet. Moreover, the Las Varas shell midden of the coastal zone of the Gulf of Cariaco in Venezuela, dated to about 3500/3000 cal BC, yielded a lithic and bone industry continuing the El Conchero tradition, but possibly adding hoes, biconical bolas (for terrestrial hunting), and grooved net sinkers to the repertoire, as well as shell gouges (*gubias*) made of the outer whorls of helmet or conch shells. These were most likely used for the manufacture of dugout canoes. A few artifacts from Las Varas perhaps had ritual or ceremonial functions. These include a winged pendant and phallic- and vagina-like objects of mica schist, as well as a biomorphic pendant made of shell. A small, perforated bowl of polished sandstone encountered at the site may have functioned as a container for hallucinogenic drugs (Sanoja and Vargas 1995, 1999).

A possible Banwarian campsite where plant foods and/or vegetable fibers were collected and processed has been found at Poonah Road in the interior of central-west Trinidad (Boomert 2000, 75). Its stone artifact inventory is slightly different from those of Banwari Trace and St. John as, apart from grooved axes, mortars, and side (edge) grinders, it also yielded highly distinctive bottle-shaped pestles (Figure 9.3). All are made of local quartzitic sandstone except for a small celt of phyllitic rock originating in Trinidad's Northern Range. Poonah Road is probably younger than the Banwarian shell middens of the Oropouche Lagoon; it may date from about 3500/3000 cal BC.

Ortoiroid movement into the Lesser Antilles and the Margarita archipelago

The situation between 3500 and 3000 cal BC is one of exceptional dynamism in the region: it is the period of the first Ortoiroid entry into the Windward Islands and beyond, as well as that of the settlement of the Margarita archipelago off the coast of Venezuela. The first reconnaissance attempts of the Ortoiroid in the Lesser Antilles may have occurred inadvertently, when canoes traveling along the mainland shore or to nearby islands such as those of the Margarita archipelago and Tobago were caught in storms, blown out to the sea and deposited haphazardly on the shores of the southernmost islands of the Windwards, Los Testigos or Barbados. Leapfrogging migrations such as those of the Ortoiroid peoples must have been facilitated by advance scouts who explored favorable locations, collected information and relayed it to potential migrants in the homeland (Curet 2005). Paddling along the Lesser Antillean island chain is not an extremely hazardous venture especially, since all the islands as far north as the Anegada Passage are intervisible, and even Grenada can occasionally be viewed from Trinidad, Tobago, and the Paria Peninsula. The Ortoiroid movement may have been propelled by many different motives, both utilitarian as well as social. As with all human migrations, the Ortoiroid entry into the

Figure 9.3. Bottle-shaped stone pestle, Banwarian Ortoiroid subseries, found at Poonah Road, central Trinidad, dating to the Archaic Age, ca. 3500–3000 cal BC. Length 7.6 cm. Harris Collection, Pointe-a-Pierre Wildfowl Trust, Trinidad.

Lesser Antillean archipelago must be seen not as a single event, but as a long-lasting process during which small groups oriented to specific goals and targeting known destinations proceeded gradually along familiar routes into the archipelago.

Ideally, the entry of Ortoiroid groups into the Lesser Antilles should be reconstructed by identifying Banwarian artifact complexes throughout the islands. Unfortunately, this is possible only to a limited extent, as in the Windward Islands, such assemblages, characterized by the edge-ground cobble/millingstone complex, are rare. Moreover, in spite of its proximity to Trinidad, the earliest Archaic Age assemblage of Tobago, the Milford complex, cannot be considered to represent the oldest Ortoiroid lithic assemblage north of Trinidad, as its tool kit is related to the latter island's Poonah Road complex, not to the older Banwarian cultural expressions. Milford is known from a coastal shell midden deposit and a series of individual finds in southwest Tobago. It is characterized by bone awls and ground-stone artifacts such as conical and especially bottle-shaped pestles, pitted anvils, and grinding stones made of local igneous and metamorphic rock materials, as well as crude flakes obtained by direct percussion, including a few crystal quartz specimens. Milford has been dated by radiocarbon to 3350/2500 cal BC at the earliest, or possibly later (Boomert 2000, 75–77; Steadman and Jones 2006). Recently, an extensive coring project led by Peter Siegel has yielded proxy evidence for the chronological placement of the Ortoiroid series in the Windward Islands; this evidence has shown that by about 3500 to 3000 cal BC, the pristine ecological makeup of the Windward Islands had been profoundly altered due to human-induced burning, which at the same time radically destabilized the vegetation of these islands, a circumstance that led to the wide expansion of herbaceous plants, ferns, and palms (Siegel *et al.* 2015; Siegel *et al.*, this volume). Most likely, this earliest anthropogenic meddling with the environment of the Windwards can be related to the first appearance of Ortoiroid settlers in the Lesser Antillean islands.

Almost simultaneously, a comparable process took place in the Margarita archipelago where the Archaic Age Amerindians of the Manicuaran Ortoiroid subseries, i.e., the descendants of the El Conchero complex of the Paria Peninsula, showed a growing emphasis on the manufacture of conch shell artifacts (Figure 9.2). The first habitation of the Margarita archipelago by Archaic Age settlers took place by about 5000 cal BC (Antczak *et al.*, this volume). Obviously, these migrants were the descendants of the people of the Las Varas complex, who occupied the Gulf of Cariaco shore ca. 3300 cal BC, as their lithic, shell and bone tool kit represents a typical continuation of the Late El Conchero industry as it is known from this site. Various shell midden sites on the islands of Margarita and Cubagua, the Araya Peninsula and the Carúpano area of the Paria Peninsula have yielded Manicuaran remains, suggesting a lively interaction between the Margarita archipelago and the neighboring coastal stretches of Venezuela in Late Archaic times (Rouse and Cruxent 1963; see also Antczak *et al.*, this volume).

The Manicuaran sites are up to 5 m deep, suggesting a high degree of sedentarism. Most deposits are situated just at the back of sandy beaches. Their food remains reflect a strongly maritime emphasis and include the bones of unspecified (aquatic?) animals, fishes, and echinoderms, as well as shells living on beach rocks and marine sandy or grassy bottoms. A Manicuaran camp of possibly seasonal character, Caño Garantón, has been encountered on the islet of La Blanquilla, northwest of Margarita (Antczak and Antczak 1991). Secondary human burials have been found scattered haphazardly in the Manicuaran shell middens. A sequence of four generally subsequent Manicuaran complexes can be distinguished. The two oldest complexes, Cubagua, and Manicuare, are dated by radiocarbon to about 2800 and between 1900 and 1250 cal BC, respectively. The third complex, Carúpano, is assumed to have been generally contemporaneous with Manicuare, while the youngest complex, Punta Gorda, is associated with pottery dating to the last centuries cal BC.

The Manicuaran subseries is characterized by quite a diversified tool kit, which combines an industry of tiny, percussion-made quartz and quartzite flake artifacts with ground-stone and bone implements and a proliferation of diagnostic shell tools. The Manicuaran exploitation and perhaps the management of wild vegetable foods is suggested by the presence of anvils for cracking palm nuts, grinding stones, and manos. It has been suggested that the latter tools were used for the processing of e.g., wild agave (*maguey*), possibly a "protocultivated" vegetable food source, still widely eaten in the Venezuelan coastal zone (Rouse and Cruxent 1963, 45). Manicuaran artifacts related to hunting, fishing, and collecting include Banwarian-like bone points and bipointed fishhooks, stone net sinkers, and shell picks, as well as biconical stones that were probably used as bolas. Stone adzes, shell gouges (*gubias*), and shell hammers made of the outer whorl of helmet or queen conch shells obviously functioned as woodworking implements. Shell celts of roughly oval shape, made of queen conch wings, appear in the latest complex, Punta Gorda. Other noteworthy artifacts are shell receptacles; bone and shell spatulas; needles made of stingray spines; and mortars for grinding red ocher. A boulder showing a series of small pits may have had a ceremonial function. The origin of characteristically Manicuaran tools such as shell gouges and stone bolas can be traced back to the Las Varas complex (Sanoja and Vargas 1995, 1999). The latter artifacts are especially interesting as individual finds of similar biconical sling stones are known from Grenada (de Booy 1916, 23), suggesting that the Manicuaran Amerindians were well acquainted with at least the southern Windward Islands.

Retrospect

Although from the outset the first inhabitants of the Americas must have been accomplished oarsmen, since they most likely entered the continent via a coastal route from Asia (Braje *et al.* 2017), it took a few thousand years before the scattered bands of small-game hunters, fishers, and foragers of the tropical lowlands in northern South America definitively adjusted their ways of life, adapting to the estuaries, lagoons and mangrove swamps of the coastal zones of Venezuela and the Guianas, as well as moving to the offshore continental islands. Here the Amerindian capacity for seafaring and navigating with large dugouts allowed them to establish wide-ranging contacts for the purposes of trade, ceremonial exchange and kinship, encompassing the entire region. As a logical corollary, by 3500/3000 cal BC, their acquaintance with the local currents and wind directions finally allowed them to expand their range of coastal and insular habitation from Trinidad and the Margarita archipelago to Tobago and the Windward Islands, thus initiating the first and foremost exploration and exploitation of the southern Antilles.

10

Early indigenous occupations of Margarita Island and the Venezuelan Caribbean

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Introduction

Post-Pleistocene environmental commonalities have been amply documented on the coasts and islands of the Southeastern Caribbean (Álvarez Espejo 1987; Landau *et al.* 2008; Macsotay and Cacéres Hernández 2005; Peter 1972; Rull *et al.* 1999). This region also shows remarkable uniformity as part of the Colombian – Venezuelan – Trinidadian biogeographic subprovince (Woodring 1974). However, the perception of the area as a historically contingent socionatural unit within a larger Caribbean macroregion is much more recent (Antczak and Antczak 2006; Antczak *et al.* 2017; Newsom and Wing 2004). Historically and culturally, these coasts and islands have been portrayed as a crossroads of people, goods and ideas moving to and from among Amazonia, the Andes, and the insular Caribbean (Kidder 1944, 1948; Osgood and Howard 1943; Rouse and Cruxent 1963; Spinden 1916; Steward 1948; Willey 1960). Changes observed in the archaeologically recovered material culture have mainly been attributed to sequential waves of migration, not long-term local continuity. This approach categorizes archaeological assemblages by means of time and space. It does not inquire how indigenous peoples might have enacted change and transition in the course of their own daily lives.

This chapter first discusses the archaeologically recovered early human signatures on four northeastern islands in the Venezuelan Caribbean: La Blanquilla, Margarita, Cubagua, and Coche. Next, we consider the whole of the coast and islands of present-day Venezuela. Finally, we identify some commonalities while also pointing out certain gaps persisting in our knowledge of the Archaic Age in the Southeastern Caribbean region (Figure 10.1). The region in question includes Curaçao, Aruba, and Bonaire (formerly parts of the Netherlands Antilles) in the west, and Trinidad in

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 131-146.

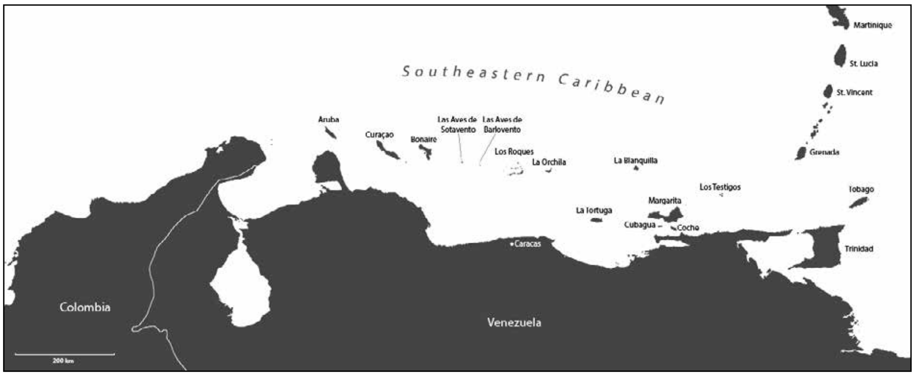

Figure 10.1. Map of the Southeastern Caribbean region with the indication of main archaeological sites discussed in this chapter (Drawing by Oliver Antczak).

the east. The Las Aves, Los Roques, and Los Hermanos island groups, as well as La Orchila, La Tortuga, and La Blanquilla Islands, are all Venezuelan calcareous formations separated from the South American mainland by channels several hundred meters deep. The most important non-calcareous groups are Los Monjes, Los Testigos, Los Frailes, and Margarita, although the latter island is partly calcareous (Alexander 1958; Jam and Méndez Arocha 1962; Schubert and Moticska 1972, 1973). During the Last Glacial Maximum (ca. 21,000 BP), the sea level of the Cariaco Basin, off the northeastern coast of Venezuela, was estimated to be ca. 120 m below the present datum. The Cariaco Trench was likely a deep lake isolated from the sea (Lin *et al.* 1997). Margarita (Coche and Cubagua), Aruba, and Trinidad, all of which lie on the South American shelf, became continental islands only due to sea-level rise after the Pleistocene (Álvarez Espejo 1987). Estimates suggest that at 8000 cal BP, eustatic sea level in coastal Venezuela was 15 m below the present datum. The sea then rose rapidly (0.5 cm/yr) until 6000 BP, when the tempo slowed; by 4000 cal BP, it had stabilized to only 0.025 cm/yr, where it remained until nearly the end of the twentieth century (Rull 1999, 2000; Rull *et al.* 2010). Similar figures were found for the Caribbean as a whole and the Atlantic coast of South America (see Rivera-Collazo, this volume). Milne *et al.* (2005) documented a rapid rise of 0.7–0.8 cm/yr during the Early Holocene, a rate that slowed significantly after 7000 cal BP (Peltier and Fairbanks 2006; Siegel *et al.* 2015). Ongoing tectonic activity originating from the colliding Caribbean and South American plates influenced not only the paleogeography of the region, but also determined the distribution and accessibility of lithic resources (Escalona and Mann 2011). A consequence of this geological context has been occasional earthquakes, often resulting in tsunamis (Engel *et al.* 2010; Scheffers *et al.* 2009; see also Haviser, this volume). Although the Southeastern Caribbean islands lie outside the hurricane corridor (Malaizé *et al.* 2011), they are not immune to damage from occasional strong tropical storms (Meyer *et al.* 2003). Nevertheless, with the exception of Trinidad, the Southeastern Caribbean coasts and islands feature low precipitation and high evaporation rates, leading to the predomination of xerophytic thorn-scrub, cacti and mangroves (Lahey 1973). Dry conditions became prevalent around 3200 cal BP, although the beginning of the Holocene featured a wetter paleoenvironment (Haug *et al.* 2001; Hodell *et al.* 1991; Macsotay and Caceres 2005; Tedesco and Thunell 2003). Marine- and coastal-related temperature and moisture estimates fluctuate on seasonal and multi-year time scales, but such estimates are more stable for inland areas (Iriondo 1999). Although the current topography of this region is to a certain extent a product of more recent tectonic uplift, subsidence, and volcanic eruptions (Peter 1972), the abovementioned sea-level rise starting at the end of the Pleistocene (Murray-Wallace and Woodroffe 2014) brought major changes to the area's marine and coastal environments. During the first half of the Holocene, when the rising was substantial, the region underwent ongoing land loss and constant change of paleoshorelines and associated littoral biotopes. The seafloor and intertidal topographies, each associated with floral and faunal communities, were considerably affected (Alongi 2015). During this time, several coastal sites occupied by early human groups must have disappeared underwater (Siegel *et al.* 2015). By the Mid-Holocene, lagoon systems, sand beaches, mangrove swamps and river outlets were stabilizing to the east and west of the mountainous central coast of Venezuela (Maloney 1965; Rull *et al.* 1999). Signatures of these environmental as well as sociocultural permutations (e.g., the use of fire) appear in the Caribbean archaeological record (Cooper and Peros 2010; Fitzpatrick and Keegan 2007; Hofman and Hoogland 2015; Rodríguez Ramos *et al.* 2013; Siegel *et al.* 2005), even in the absence of direct artifactual evidence (Siegel *et al.* 2015; Scherjon *et al.* 2015). In this chapter, we argue that hundreds of generations of flesh-and-blood people embodied these large-scale and long-term environmental changes. They acted according to their continuously renewed understanding and experience of the cultural places they inhabited, places that ought not be viewed in the abstract as merely ecologically functional spaces (Harris and Robb 2015; Ingold 2000a; Sassaman 2016). Our aim is to explore some of these places in the Venezuelan Caribbean.

The earliest human signatures

Deposits, including Pleistocene megafauna remains, abound along the Venezuelan coast (Carrillo *et al.* 2008; Gruhn and Bryan 1984; McDonald *et al.* 2013; Rincón *et al.* 2009; Sánchez-Villagra *et al.* 2010). To the west, in present-day Falcón State, the earliest signatures of human presence, dating to between ca. 14,000 and 12,500 BP, have been found at the Muaco and Taima Taima sites (Cruxent and Rouse 1956; Ochsenius 1980; Ochsenius and Gruhn 1979). These remains include butchered animal bones, other large bones that were used as anvils or chopping blocks and one that shows traces of intentional breaking, grooving, cutting and burning. Some bones were associated with lithic projectile points of the so-called El Jobo tradition (Cruxent 1961, 1962). The recovery of combined paleontological and archaeological evidence yielded the first insights into the lives of these Late Pleistocene hunter-gatherers (Bryan *et al.* 1978; Oliver and Alexander 1990; Rouse and Cruxent 1963; Veloz Maggiolo and Martín 1983).

The transition from hunting the large mammals of the Pleistocene in El Jobo times to that of modern fauna was associated with the presence of stemmed projectile points and their derivatives, encountered in the so-called Canaima complex (Boomert 2000, 51; Rouse and Cruxent 1963). Such bifacially chipped and stemmed spearheads have been reported on two continental islands: Margarita (de Booy 1916, Figure 10; mentioned as "chipped quartzite arrowpoint" by Osgood and Howard 1943, 113; see also Cesari 1995) and Trinidad (Boomert 2000, Figure 6; Boomert, this volume). Similar artifacts were also found in northern continental Venezuela (Cruxent 1962; Cruxent and Zucchi 1964; Dupouy 1945; Sanoja 1982, Figure 76), in Venezuelan Guayana (Cruxent and Rouse 1956, 1958; Cruxent 1971; Rouse and Cruxent 1963), on the Upper Orinoco (Barse 1989, 1990, 1995) and in the Gran Sabana (Dupouy 1957, 1960). The absence of material signatures of the Late Pleistocene and Early Holocene peoples on the non-continental islands of the Southeastern Caribbean suggests that these populations might have been lacking either the necessary technological capacity or an interest in utilizing it. For the rest, flexible technology would have allowed the South American continent's first indigenous colonizers to occupy diverse environments without clearly preferring any (Borrero 2015; Bryan 1973; Pearson and Bostrom 1998). Technological homogeneity coupled with increasing subsistence strategy heterogeneity suggests, according to Jaimes (1999), that the technoeconomy common to the Joboid and Canaiman peoples escapes the narrow definition of an early "archaic style of life" (Dillehay *et al.* 1992). It defies the "black-boxing" of these peoples as rapidly migrating specialized megafauna hunters and as bearers of an ancestral tradition that had evolved on the North American Plains (Haynes 1969; Martin 1973). The environmental changes of the Holocene fostered increasing dependence on the sea as a resource provider and highway linking the peoples of the Southeastern Caribbean coast to faraway contacts. Slowly emerging coastal uniformity in topography, climate and biota helped develop a generalized Archaic Age life of marine-oriented fisher-hunters, gatherers and plant managers. These three modes materialized in a series of shell middens that identify habitation-burial areas in the otherwise boundless paleolandscape (Antczak and Antczak 2008; Antczak *et al.* 2007).

The Holocene in the Venezuelan Caribbean

Coastal shell middens are deposits of up to several meters deep composed mainly of bivalves, fish bones and echinoderms, suggesting a certain degree of sedentarism. However, systematic off-midden sampling is virtually null. Bone projectile points used for fishing replaced the stone points employed in hunting Pleistocene game. Lithic assemblages regularly include tools used for plant processing, such as anvils for cracking palm nuts as well as grinding stones (manos) possibly for processing vegetable resources, coarse salt or pigments (Cruxent and Rouse 1958, I, 95).

The mainland coast

Dates associated with Mid-Holocene populations range between ca. 6625–6120 cal BP and 6175–5755 cal BP at the shell middens of Cerro Iguanas in the Tucacas area to 3965–3380 cal BP at El Heneal on the west-central coast (Rouse and Cruxent 1963, 47, 155). A date of 2740–2345 cal BP is associated with a series of shell middens at the Pedro García site to the east (Rouse and Cruxent 1963, 38). A series of shell middens along the northeastern coast was encountered at Ño Carlos, Guayana and Remigio; the last of these sites was dated to ca. 8310–7835 cal BP and 7565–7305 cal BP (Sanoja and Vargas 1999a, 148) in its median and upper layers. This sequence also includes the shell middens of the Manicuaroid series discussed in the section dedicated to Cubagua Island (see below). According to Sanoja and Vargas (1982, 1995, 1999a, 1999b; Sanoja 1982), the Archaic Age societies of northeastern Venezuela formed part of an arc extending from the Gulf of Paria to Trinidad, then onwards along the coast of the Guianas as far as Brazil.

The islands

The western Venezuelan archipelagos of Las Aves and Los Roques, as well as solitary La Orchila, lying at 135 km (Los Roques) to 155 km (Las Aves) over deep open sea from the coast, have revealed only late precolonial materials to date (Antczak and Antczak 2006, 2015). Thus far a similar archaeological scenario prevails on La Tortuga Island and the Los Testigos archipelago (at 76 km and 63 km from the mainland, respectively; Guzmán Quevedo 1988). However, the absence of material signatures does not mean that some of these islands, visible on the horizon from the highest tops of the mainland mountains, were not incorporated into the perceptual landscape of the mainland indigenous peoples for many centuries before they landed on their beaches (Antczak and Antczak 2006).

Three Archaic Age complexes have been defined on the northeastern coast and islands: Cubagua, Manicuare and Punta Gorda (Cruxent and Rouse 1958; Ginés *et al.* 1946; Rouse and Cruxent 1963). Shell middens at Manicuare on the mainland Peninsula of Araya and at Punta Gorda on Cubagua Island constitute typical remains of the sea-oriented bearers of the Manicuaroid series. The chronology begins on Cubagua Island with the Cubagua complex, dated to ca. 4850–4445 cal BP, and follows with the mainland Manicuare complex, dated to ca. 4240–3560 cal BP and ca. 3000–3400 cal BP. The record finishes, back on Cubagua Island, with the Punta Gorda complex, where pottery of the Saladoid El Mayal style, dated between 1890–1545 and 1710–1305 cal BP, appears (Rouse and Cruxent 1963, 155–156). The most distinctive artifacts of the Manicuaroid series are bone projectile points. However, lithic tools abound, including flat milling stones which might have been used with grinders to process the maguey plant (*Asparagaceae*) (Hoyos 1985, 195–198). The main difference among the three complexes consists in an increasing use of shells as a raw material for artifact production (Rouse and Cruxent 1963, 44–45).

La Blanquilla. This island, situated 160 km east of the island of La Orchila and nearly 100 km northwest of Margarita, yielded a total of 15 precolonial sites (Antczak and Antczak 1991). All but three yielded ceramic materials. At the three non-ceramic sites, cultural deposits are shallow and contain scatters of turtle, fish and mollusk remains. Lithics include quartz flakes of various sizes. More flakes were found superficially dispersed along the southwestern coast of the island, in addition to three multifacial percussors obtained from quartz pebbles, rounded by frequent use. These artifacts, forming part of the Garantón complex, were tentatively related to the abovementioned Manicuaroid series (Antczak and Antczak 1991). At the southeastern tip of the island, a series of cave-like shelters in the limestone cliff, carved by seawater, was found. Excavations were performed in the southernmost of these shelters, known as Las Cuevas de La Cabecera (max. interior height 1.3 m) (Figure 10.2., upper row). There was no visible separation between the cultural strata inside and outside the shelter. Signs of bioturbation resulting from iguana and goat activity were found all around.

Figure 10.2. Partial views of Cuevas de la Cabecera site on La Blanquilla Island (upper row) and a selection of bone unipoints and lithic microperforators from this same site (lower rows).

Therefore, it can be reasonably argued that all the materials from this site should be assigned to a single Ceramic Age component dated to ca. 960–555 cal BP (Antczak and Antczak 1991). However, deep inside the cave and in the basal layer of the cultural strata (ca. 30 cm), 22 bone projectile points, several quartz flakes and three micro-perforators were recovered. Potsherds, quartz flakes and animal remains were ubiquitous in the remainder of the site. Given the depositional circumscription of these artifacts and based on the defining character of bone points for the Manicuaroid series, these objects were provisionally included in the Garantón complex (Figure 10.2., lower rows; see also Boomert 2016, Figure 12).

Margarita and Coche. Margarita, the largest Venezuelan island at 1071 km^2, is located 22 km from the mainland. It has yielded a large collection of largely lithic, Archaic Age finds. The relative abundance of these materials masks the fact that after some early finds in the first half of the twentieth century (Cruxent and Rouse 1958; de Booy 1916; Rouse and Cruxent 1963), all later collected materials have been isolated casual finds resulting from amateur or student explorations (Castañeda Malavé 2006; Cesari 1995; Naranjo 2007; see also Ayala Lafée 1994). For example, the Paraguachoa complex has been proposed as a unitary label comprising various quartz artifacts such as unifacial choppers (some of them up to 2 kg in weight), as well as a large variety of finely elaborated projectile points, including pedunculated arrowheads and dart and spear points (Cesari 1995). However, this category lumps together materials collected from short-lived and superficial sites of largely unknown contexts. As such, they are of little use for Archaic Age dating or for in-depth reconstructions of these populations' settlement patterns, sociopolitical lives, gendered activities, subsistence, ethnicity and beliefs, unless the information discussed in this chapter of newly collected data is considered.

Archaeological data pertaining to the Archaic Age human presence on the islands of Margarita and Coche has been methodically collected since 2008, and especially since 2014. The later phase comprises part of the systematic surveys directed by the first author in the context of the ERC-Synergy project NEXUS1492 based at Leiden University. It is noteworthy that the prospection of Cubagua Island had barely begun and did not continue because the results of the Carballo's survey (2014) were released in 2014. Although the space allocated to this chapter does not permit any deeper elaboration on the results of these ongoing investigations, some interesting results may be mentioned. Figure 10.3. shows some of the possible Archaic Age locations on the islands of Margarita and Coche and others that have already been confirmed as such. Some of these sites are inland-located superficial scatters of lithic materials. Many were previously interpreted as lithic workshops and provided large collections of decontextualized tools and debitage described by amateurs (Cesari 1995). However, some other sites present stratified accumulations of marine shells associated with a wide range of faunal remains, lithic artifacts and manufacture debris, human burials and hearths. Though they await systematic excavation and reliable dating, some remarkable findings may be mentioned here. For example, the Quebrada de Guacuco site (NE24), located on the Península de Macanao (western part of Margarita Island), is a large shell midden composed mainly of *Tivela mactroides* (guacuco) valves accompanied by shells of *Donax denticulatus, Anadara* sp., *Arca zebra, Crassostrea rhizophorae, Lobatus gigas, Cassis* sp., *Charonia variegata, Murex pomum, Cypraecassis* sp., *Melongena melongena,*

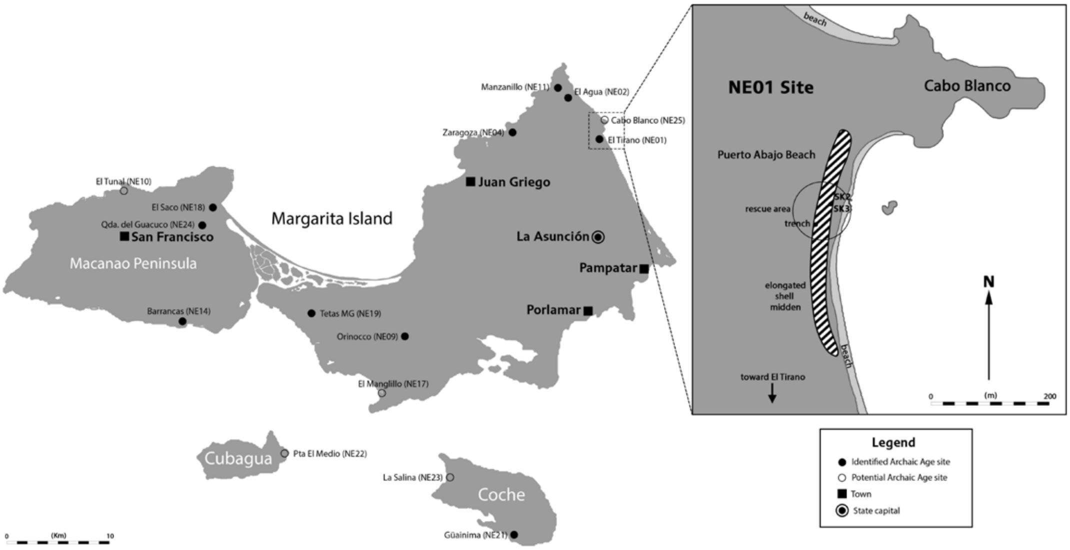

Figure 10.3. Selection of Archaic Age sites on Margarita, Coche and Cubagua islands surveyed thus far by the ERC-Synergy project NEXUS1492.

Purpura patula, and *Cittarium pica*. This variety indicates that gathering was carried out in diverse marine environs: in shallow sea beds covered by marine phanerogams, on rocky intertidal beaches and in inner lagoons bordered by mangroves. In the test pits that reached a depth of 80 cm and with strata continuing deeper below, fish vertebrae and fragments of land mammal bones were also found. Although the absence of collagen in these bones precluded their use for ^{14}C dating, a date of 7065–6895 cal BP was obtained from one *Melongena melongena* shell extracted from the same depth of 80 cm. The richness of these well-preserved deposits and their early date pose new and fascinating challenges for matching this site with its Archaic Age counterparts in the insular Caribbean and on the adjacent mainland. Furthermore, the very first archaeological survey carried out on the island of Coche revealed at least one site of Archaic Age category. The Güainima site (NE21) is a scatter of shells (largely *Melongena melongena*) nearly one square kilometer in size, accompanied by dozens of small scatters of quartzite nuclei, cores and flakes and hearths, reaching a depth of at least 30 cm. One *Melongena melongena* shell yielded a date of 3355–3200 cal BP. Yet another site on Coche Island, La Salina (NE23), situated on the border of the salt pan, yielded abundant flakes removed from quartzite cores, *Melongena melongena* shells and semi-charred turtle bones in the absence of pottery. Although one shell from this site gave a date of 895–735 cal BP, future research may indicate that the sample is not representative of this site, which presents probable Archaic Age characteristics. Leaving the abovementioned data for future elaboration, the following sections will focus on the Archaic Age findings at the site of El Tirano, on Margarita Island.

In 2008, earth-moving machinery accidentally unearthed archaeological materials on the northeastern coast of Margarita Island. Unfortunately, the works continued. Rescue archaeology performed by the authors was the only way to recover three human burials and associated cultural materials (Lemoine Buffet *et al.* 2015). The site (NE01)

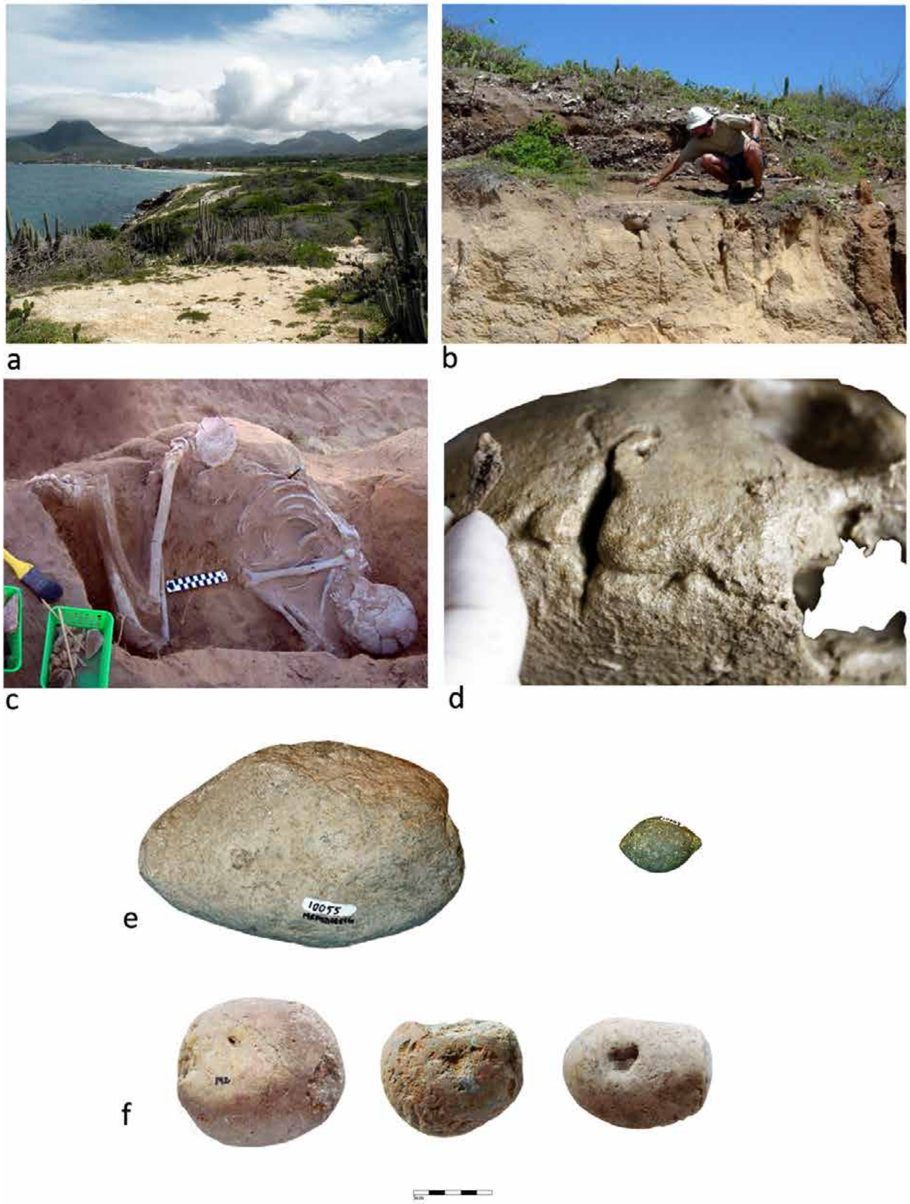

Figure 10.4. Views and materials of El Tirano (NE01) site: (a) Puerto Abajo bay, El Tirano village and Cerro Guayamurí in the back; (b) the NE01 site at the very beginning of the rescue archaeology project; (c) human remains (SK2) during rescue excavation; (d) possible wound on the frontal bone and parallel to the coronal suture of the SK2 skull; (e) lithics recovered at Trench A, NE01 site; (f) selection of superficial lithic findings from NE01 site.

is situated in the bay adjacent to Puerto Abajo, about 1 km north of the village of El Tirano (Puerto Fermín) (Figures 10.2 [right] and 10.4a). It extends 700 m along the coast in a 350 m-wide strip covering a total of some 24.5 hectares. Before the mechanical disturbance of the site had begun, part of the strip was covered by a 600x25 m-wide shell midden with a height between 0.3 and 3.5 masl. Scatters of potsherds, shells and animal bones were visible on the surface (Figure 9.4b).

The site, flat along the seashore, gradually rises as it moves inland, reaching a maximum elevation of 18 masl. The bay of Puerto Abajo is one of the best natural ports on the island, providing easy access to both shallow and deep open waters as well as coral reefs, rocky shores, inner saline lagoons and mangrove swamps. Moreover, NE01 is situated in the area characterized by the highest precipitation on the entire island and shows a relative potential for agriculture (Hoyos 1985, see maps pp. 26, 34). It also offers optimal access to varied terrestrial and marine ecosystems as well as associated resources including a series of endemic subspecies (Sanz 2007). The adjacent Cerro Guayamurí (470 masl), featuring rainforest and freshwater sources on top, has unquestionably figured as a landmark in the cultural landscape from earliest precolonial times to the present (Hoyos 1985, 49–51). The earth-moving machinery, going from south to north, cut one third of the shell midden lengthwise, unearthing human bones. Some appeared scattered on the surface. We examined the edge of the cut where, at an approximate depth of 3 m from the top of the shell midden, abundant lenses of red ocher and human bones appeared. This led to the excavation of two test pits in the slightly disturbed area as well as the recovery of the remains of two human skeletons, SK2 and SK3. These remains were lifted together with the surrounding soil, carefully wrapped up and transported to the laboratory. Such measures succeeded in preserving the bones and made possible the further recovery of micro-remains. Trench A, measuring 1x6 m, and two additional test pits of 1x1 m were hastily excavated and led to the recovery of Ceramic Age human remains (SK1), mentioned here only with reference to the SK2 and SK3 burials. Soon afterwards, the entire area was leveled by machinery and the site destroyed.

The most complete and anatomically articulated bone remains (SK2) pertain to a 25- to 35-year-old female that was between 152 and 160 cm tall (Figure 10.4c). The body was placed on the left side in a crouched position, and oriented east – west with the head facing inland and the feet directed toward the sea, respectively. The left arm was under and supporting the left side of the head, and the right arm was over the right side of the head with the hand over the right shoulder. Cranial indexes show an elongated skull (dolichocran), high with respect to length (hypsicran) and to the breadth (acrocran). Upper incisors are shovel-shaped and of the Sinodont type (Buikstra and Ubelaker 1994, 64). On the frontal bone and parallel to the coronal suture, a 38 mm-long by 6.6 mm-wide wound was found (Figure 10.4d). Anthropophysical observations by X-ray analysis could not reliably determine whether the injury was caused antemortem or postmortem. However, other observations suggest that it might have been antemortem and possibly caused by a lithic weapon. The corroboration comes from friable evidence of the active remodeling of the bone, suggesting that the wound might have been inflicted some days before death. Moreover, a small fragment of schist was found inside the skull. This elongated piece perfectly fits the fracture in the skull. Therefore, the wound might have been caused by a club-like weapon consisting of a pole with shafted schistose "blades assembly" at its distal end. In fact, a few lithic artifacts found associated with SK2 were elaborated with laminar metamorphic flakes of schist-quartz of laminar exfoliation. These artifacts could have been used as weapons rather than as domestic tools. Without use-wear analyses, the flakes can easily go unnoticed in archaeological excavations and be confused with natural rock fragments. If some of these flakes were de facto used as weapons, then the death of the SK2 woman could have been caused by septicemia due to the fragment of the lithic weapon that was left encrusted in the wound.

SK2 also shows a series of other pathologies. There is a labial abscess on the right side of the mandible under tooth 30 (M1). Tooth 27 (C) is chipped on the labial side. A tuber (Torus) 5.6 mm long, 4 mm wide and 2 mm high was found on the first intermediate foot phalange, and an exostosis shaped in form of a "cauliflower" on the distal phalanx of the first finger (toe) of the left foot. The pathology present on the left foot could have caused difficulty in walking on firm ground, and it is possible that the female walked with a limp.

The head and legs of SK2 were covered with small flakes of local stone. The burial contained powder and fragments of red ocher scattered around the pelvis and right femur, while some other pieces were placed on the abdomen. Five shells (*Tivela mactroides*) were found joined to the right-hand bones, humerus head and scapula of the skeleton. The adherence of the shells to the hand bones suggest that they might have been contained in the hand of the dead woman. The remains of SK2 are semi-fossilized and despite several attempts, no collagen could be extracted to be dated by ^{14}C. However, one of the *Tivela* shells from the "in-hand group" gave a date of 2530–2340 cal BP. Shells of *Perna perna*, *Melongena melongena* and *Tivela mactroides*, fragments of barnacle (*Balanus* sp.) and sea urchins (*Diadematidae*) and a few unidentified remains of fish and crustaceans may be interpreted as funerary offering or signatures of mortuary rites.

Some 20 cm south and 20 cm above the pelvis level of SK2, an incomplete skeleton (SK3) was found. Both legs, including femora, tibiae, left patella and fibulae, were found. Notwithstanding, it was possible to establish that SK3 was most probably a 20-year-old man between 165 and 168 cm tall. Flat and robust tibias and femurs suggest significant strain on his legs during his life. The collagen extracted from these bones yielded the date of 2350–2290 and 2270–2160 cal BP.

Trench A was excavated forty meters west and 50 cm below the depth of SK2. The remains of a hearth were found in the lowest strata of the layer, as was a series of lithic materials. A sample of charcoal from the hearth furnished a date of 4090–3900 cal BP. The lithic artifacts include one possible adze, bi-point, pitted stone (anvil?), grinding stone (mano?), unifacial quartz chopper, unifacial limestone chopper with possible signs of shafting (club?), six metamorphic artifacts of quartz-schist with laminar exfoliation (sharp and brittle) and one adze with percussion-use wear and a chipped fracture (Figure 10.4e). Two gouges made of *Lobatus gigas* shell were also found. Judging by the color and texture of the soil matrix that surrounded SK2, SK3, the hearth and the associated artifacts, all these materials seem to pertain to similar non-ceramic strata.

Further data indicate that NE01 continued to be relatively steadily inhabited for more than a millennium. Some 200 cm above SK2, the soil turns from yellowish to a dark brown sandy matrix typical of some other shell middens located on Margarita Island. A complete skeleton (SK1) of a 12-year-old (probably female), dated to 790–670 cal BP, was recovered from this layer, buried supine over a turtle carapace fragment. The skull shape looks similar to SK2; however, the incisors lack the shovel-shape feature. In addition, a sample of charred material from an associated hearth above the level of SK1 produced the date of 500–310 cal BP (both dates are 2 σ estimations). This dating shows that the indigenous presence at this site extended into colonial times. Some quantities of plain and well-fired potsherds were found in the SK1 context, as well as in the upper strata, accompanied by thick pockets of marine shells. While *Tivela mactroides* was predominant in the lower strata, *Perna perna* was most common in the higher strata. This suggests shifts in environmental conditions, in gathering strategy or both. Lithic tools change in size from larger to smaller as the strata ascend, and quartz becomes the predominant raw material. Shell gouges and grinding stones (manos) are present in both upper and lower strata.

It is notable that burials in shell middens (SK2 and SK3) have been observed for the same period in other Caribbean islands (Aruba, Cuba and Trinidad), and even on the continent, as far south as Patagonia (Alfonso-Durrurty *et al.* 2011). If the shell middens indicate habitation sites with domestic use areas, then these human burials show the necessity to keep the dead close to the living (Robb and Harris 2015, 38). It is also notable that all three burials from NE01 might have been easily located in reference to a rock outcrop emerging from the sea some 30 m from the shore – the only outcrop in the bay that could readily be used as a reference point for the site and its burials. A quick survey of the area containing the entire site did not reveal the existence of other possible funerary or habitation contexts. However, given the generally heavy anthropic alteration of said area, the hastiness of the survey and the rapid destruction of the site, these conclusions cannot confirm a local burial-habitation pattern, although one might in fact have existed there.

Concluding remarks and future research

Patchy archaeological signatures from the islands of Venezuela show a series of material and contextual commonalities when compared to other Early, Middle and even Late Holocene sites across the insular Caribbean and the northern rim of the South American continent. The largely unoccupied spaces enabled the rapid spread of Archaic Age lifeways along the coasts and through the islands. Apparently, early indigenous communities lived well apart from one another but existed within historically and culturally interconnected networks of traditions in terms of subsistence, ritual and mortuary practice. To illustrate this statement, let us compare the Archaic Age insular burial grounds at the NE01 site on Margarita to the Malmok site on Aruba (see Kelly and Hofman, this volume, while other parallels would emerge by comparing the data presented by Boomert, Valcárcel Rojas *et al.* and Ulloa and Valcárcel Rojas, this volume). Moving among the spatial and temporal scales of this analysis leads to the realization that even within the same region of the Southeastern Caribbean – i.e., present-day Venezuela – the Archaic Age was a layered palimpsest of processes unfolding at different tempos and exhibiting a variety of local flavors (Harris and Robb 2015, 27).

In Malmok, anywhere from 60 to 70 deceased individuals were buried between ca. 1650–1300 cal BP (see also Kelly and Hofman, this volume, Versteeg *et al.* 1990, 50). These interments chronologically succeed the SK2 and SK3 burials on Margarita. Nevertheless, Aruba also yielded older dates, suggesting a wider, all-embracing temporal range (for the most recent data on the Aruban Archaic Age, see Kelly and Hofman, this volume). The crouched posture and the placement of the SK2 body on its side closely resemble the Malmok burials, as the bodies of the latter site might have been wrapped and tied into this posture. The hands facing the front of the head, or perhaps grasping it – visible in the SK2 burial – have also been associated with the burials of adult individuals in Malmok. The use of red ocher, which characterized the SK2 burial, was also noted in about half of the individual interments in Malmok. Moreover, half of the grave pits in Malmok featured marine shells used as burial offerings, a detail also discovered in the SK2 burial. Last, the SK2 remains were covered with small stones, while at Malmok, all the male bodies were covered by stones, but not every female.

Data obtained at NE01 suggest that subsistence was oriented toward marine resources throughout the entire stratigraphic sequence of this site. However, its privileged location in one of the island's most fertile areas, with advantageous rainfall rates besides (Vila 1958, 65), would not only have favored a sedentary lifestyle but facilitated plant management. Only in this place, among all the Venezuelan Caribbean islands, could plants have been easily intertwined with marine resources to form Archaic Age mixed foodways. In fact, NE01 seems to relate to the last phase of occupation at the Las Varas site on the nearby continental Araya Peninsula, where Sanoja and Vargas (1999a, 155; Sanoja 1989, 529) observed purported signatures of transition toward sedentarization and tribalization ca. 4600 BP. Marine-terrestrial and animal-plant mixed economies could well have been underway at both sites by that time (see Greaves and Kramer 2014; Rodríguez Ramos *et al.* 2013).

It has been suggested that Aruba, Curaçao and Bonaire might have functioned as refugia for early indigenous populations far into the Ceramic Age (Versteeg *et al.* 1990, 33). Pottery was intermingled with Archaic Age shell deposits and tool kits on these islands from 3000 to 1480 BP (Du Ry 1960, 94; Haviser 1987; Haviser 1991, 40–41, 60; Haviser *et al.* 2011; Hoogland and Hofman 2011, 2015; Hoogland *et al.* 2015; Kelly and Hofman this volume; Oliver 1997; Rouse and Cruxent 1963, 110; van Heekeren 1960, 115). Interestingly, a similar hypothesis has been proposed with respect to northeastern Venezuela. According to Rouse and Cruxent (1963, 58–59), mountains and steep coasts cut this region off from the rest of the country, halting the advance of the Ceramic Age riverine-oriented Saladoid peoples from the south. This pause could have permitted the Archaic Age peoples to live in relative isolation from the somewhat distant rest of the country, where horticulture and pottery-making technologies were already widespread. Arguably, horticulturists could have found the natural separateness of Margarita Island with its arid environment highly unattractive (see Chaves 1964). Therefore, Margarita and its associated islands of Coche and Cubagua could have served as refugia of Archaic Age peoples until the first centuries AD, when the increasing influx of new peoples and technologies markedly changed strategies for making a living.

Intriguingly, bioanthropological analyses showed that the shovel-shaped incisors and strong masticatory apparatus of SK2 also characterized early skeletons found on Aruba (Kelly and Hofman, this volume; Versteeg *et al.* 1990, 37). Differences between SK2 from NE01 and the later northern Venezuelan population tend to support the claim of marked anthropophysical differences between the Archaic Age and the succeeding Ceramic Age peoples. Examples include the narrow, long and high skulls (dolichocran, hypsicran, acrocran) of the earlier and the wide (brachycran) skulls of the later arrivals (Kelly and Hofman, this volume; Lemoine Buffet *et al.* 2015; Tacoma 1991; Versteeg *et al.* 1990, 12). Beyond Margarita, these differences were repeatedly encountered in Aruba, Cuba, Trinidad, Suriname and Colombia (Boomert 2000; Correal Urrego and van der Hammen 1977; Herrera Fritot 1965; Tacoma 1989, 1991; Versteeg 1991; see also, Valcárcel Rojas *et al.* Ulloa Hung and Valcárcel Rojas, this volume).

However, recent investigations aimed at characterizing the differences between Archaic and Ceramic Age populations make a rather puzzling impression. The isotopic composition of human bone collagen from Malmok (an Archaic Age site), as well as from Santa Cruz and Tanki Flip (both Ceramic Age) on Aruba, did not change despite the expected marked contrast between the results of the earlier marine versus the later terrestrial plant diet (Versteeg *et al.* 1991). Furthermore, Mickleburgh and Pagán-Jiménez (2012, 2472; Kelly and Hofman, this volume; Pagán-Jiménez *et al.* 2015) reported that an individual from the Archaic Age site of Canashito on Aruba (ca. 2300–1800 BP) exhibited maize starch grains with evidence of grinding and baking. Recent archaeogenetic investigations on Aruba support historical continuity rather than a replacement of the invaded by the invading (Carrero-González *et al.* 2010; Toro-Labrador *et al.* 2003; see also Moreno-Estrada *et al.* 2013 and Castro de Guerra *et al.* 2009).

Though fragmentary, the data from NE01 can shed some light on the conundrum of continuity versus discontinuity with respect to Archaic and Ceramic Age populations. One test pit excavated close to the burials, crossing through all cultural layers of the shell midden, showed a tiny – less than 10 cm thick – lens of sand dividing a lower non-ceramic layer (associated with the SK2 and SK3 burials) from an upper ceramic layer (the SK1 burial). Remarkably, from the very beginning, the upper layer produced well-fired and plain potsherds, showing no observable differences in vessel morphology or manufacture moving upwards, that is, forward through time. It should be noted that a thin layer of sterile sand also separated shell-bearing strata without pottery (below) from those containing pottery (above), found during ongoing research at the El Manglillo site (NE17) on Margarita's southern coast (Figure 10.3. left). These lenses could indicate the "interruption" of occupational sequences. But such a fragmentary indication should not be over-interpreted. On the other hand, while the upper-layer SK1 individual features a craniometrical index similar to its SK2 counterpart from the lower layer, it did not share the shovel-shaped incisors.

Drawing from these fragile threads of data, we may hypothesize that Archaic Age peoples brought ceramics to Margarita from their mainland ceramic-bearing neighbors, probably the early Saladoid Arawakan-speakers. Initially, the former neither manufactured pottery themselves nor shared Margarita Island with the newcomers. With the passing of time, Archaic Age peoples did not become extinct but slowly mixed with incoming pottery makers. If these predictions are correct, comparing the genetic and isotopic signatures of SK1 and SK2 will confirm them. SK1 should turn out to demonstrate the genetic merging of Archaic and non-Archaic Age peoples, a process resulting from intermarriage accompanied by mobility and exchange. Similarly, the Late Archaic and Early Ceramic Age peoples who lived at NE01 would have blended their food supplies. They would have made use of plant resources resulting from the site's optimal soil and rainfall conditions. But at the same time, because they were also situated so fortuitously with respect to bountiful sea resources, their staple diet would have continued to be based on marine food. In fact, both SK1 and SK2 show a very low incidence of dental caries. In our view, to reiterate, the ceramic strata do not signify the replacement of Archaic Age peoples by pottery-making newcomers. Instead, they may suggest adoption of ceramics by the early dwellers and their intermarriage with the newcomers while maintaining a diet more or less like that of their past.

These results pose some challenges to the archaeological reconstructions currently in vogue. For example, insular refugia might not have been 'sanctuaries' where a static and homogeneous Archaic Age way of life was perpetuated until drastic submersion by newcomers. It is true that the early peoples survived longer on the islands than on the continent, but the significance of this is that they might have been exposed to gradual rather than sudden catastrophic relations with their mainland (and insular) neighbors. These manageable relations reshaped them and their daily routines. Paraphrasing Siri Hustvedt (2012, 70), the Late Archaic Age peoples (and, for that matter, the Early Ceramic Age peoples) became themselves through interactions with their neighbors. We argue in this chapter that the Archaic Age worlds were not palimpsests disconnected from before and after their temporal durations. Instead, they were historically sinuous processes of sociomaterial flows operationalized in complex and "thick" realms of everyday life.

The accelerating sophistication of archaeological methods, techniques and theoretical approaches applied to the investigation of the early human presence in the Caribbean – palpable in this volume – is encouraging. Cutting-edge analyses of already existing materials are revealing astonishing new information. However, none of these efforts can replace fieldwork, which is still our primary conveyance to the realms of past lives. We urge swiftness. No laboratory, however brilliantly equipped and operated, can resuscitate archaeological sites such as NE01 at El Tirano. These locations succumb daily to "modern" development.

Acknowledgements

We acknowledge the valuable comments received from Corinne Hofman, Arie Boomert, Sarah Inskip, Jaime Pagán-Jiménez, Dan Bailey, Konrad A. Antczak and Angus Martin. We also recognize the invaluable professional assistance of Lilia Vierma (†) of the Instituto del Patrimonio Cultural in the rescue archaeology project Margarita 2008. Fundación ARCA sponsored the ^{14}C dating and the rescue archaeology at the NE01 site. This research has received funding from the European Research Council under the European Union's Seventh Framework Programme (FP7/2007–2013), ERC Grant Agreement No. 319209, under the direction of Prof. dr. Corinne L. Hofman.

11

The Archaic Age of Aruba: New evidence on the first migrations to the island

Harold Kelly and Corinne L. Hofman

Introduction

The close proximity of Aruba to mainland South America made it an ideal location for the initial settlers. The first wave of migration occurred ca. 1450 BC, when Amerindians from coastal Venezuela and/or Colombia settled on the island. These Amerindians encountered an ecosystem similar to their place of origin, which aided in their adaptation to the new environment and made the successful exploitation of the available resources possible. The initial arrivals to Aruba have traditionally been characterized as nomadic "fisher-hunter-gatherers", with a predominantly marine, coastal orientation, occupying different areas of the island (Versteeg and Ruiz 1995). Their diet consisted of marine food and, to a lesser extent, small game and fruits and nuts (Dijkhoff and Linville 2004, 5). In the vein of these traditional characterizations, the classification of sites on Aruba as "pre-Ceramic," although proposed with caution, was based on the combination of three aspects, namely the lack of pottery, a high percentage of bivalves and a limestone surface or limestone association. In contrast, "Ceramic Period" sites were classified as having pottery in fair amounts and lacking in bivalve/oysters in any significant quantities (Versteeg and Ruiz 1995, 20–21). Recent archaeological investigations, starch grain analysis and ^{14}C dating show that the traditional classification schemes must be revised. In this chapter, we present new evidence on the first migrations to the island, offering novel insights into the lifeways of the Early Archaic Age dwellers of Aruba.

Aruba's island setting

Aruba is located in the Southern Caribbean and situated 30 km north of the Paraguaná Peninsula of Venezuela (Figure 11.1). The island is 31 km long and roughly 10 km wide. Precipitation is very low and the vegetation has a xerophytic character. The

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 147-162.

Figure 11.1. Map showing location of Aruba, situated 30 km north of the Paraguaná Peninsula of Venezuela (Map by Menno L.P. Hoogland).

coastal regions are influenced by runoff from the gullies during the rainy season and hurricane activity in the region (Dijkhoff and Linville 2004). Aruba has three different landscapes: first, the Aruba lava formation, a hilly landscape in the central part of the island; secondly, the composite batholith[1] landscape situated northwest and southwest of the hilly central part. Both are surrounded by the third landscape type, the limestone formation, consisting of a flat terrace, with sandy beaches in combination with lower limestone terraces along the west coast (Versteeg and Ruiz 1995, 35). The oldest formation on the island is the Aruba lava formation, composed of volcanic rocks that form the landscape of undulating hills. Within the valleys of the hills, metamorphic rocks are found, which have been eroded into gullies. The largest part of the island is covered with batholith boulders eroded into distinct shapes due to spheroidal weathering. The batholith landscape is cut through by the gullies that flow to the sea during heavy rains transporting debris. The coastline is composed almost entirely of lime, which is much younger than the abovementioned geological formation. Limestone deposition occurred on top of the older formation, and together with the sea-level changes during the Pleistocene and tectonic uplift of the island, created the terrace-like formation observed nowadays (Dijkhoff and Linville 2004, 14).

Archaic Age sites

A total of 33 Archaic Age sites (Figure 11.2) have been recorded on the island, located in various environments and representing different contexts. The majority are coastal shell middens that are primarily composed of bivalves and oysters. One example is the Arashi 2 shell midden, with a radiocarbon date of 380–204 cal BC. Then there are the

1 Black and white speckled rock unit consisting mainly of quartz diorite (Versteeg and Ruiz 1995, 38).

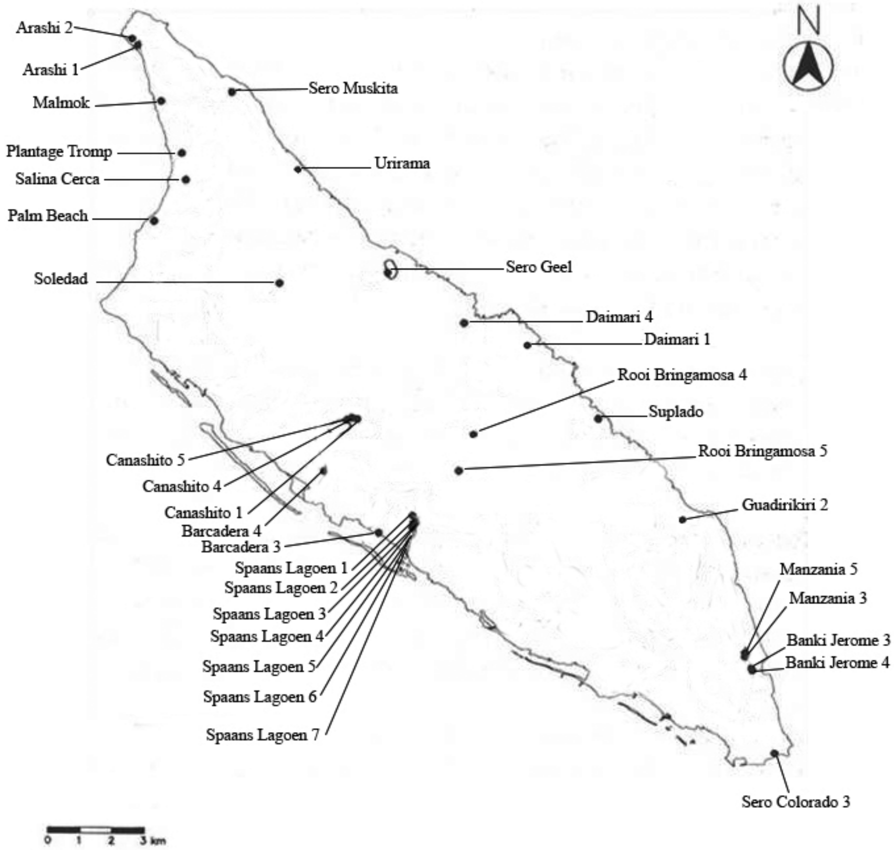

Figure 11.2. Map of Aruba showing the 33 Archaic Age sites (Adapted from Versteeg and Ruiz 1995).

inland shell middens, such as the Spaans Lagoen sites and Bringamosa 4 and 5, the latter situated along the banks of Rooi Bringamosa. There are stone extraction sites and special activity sites for stoneworking, such as Coashiati and Dos Playa, which were previously categorized as either belonging to the Archaic or Ceramic Age because of the occurrence of rock types and stoneworking techniques found in both Archaic and Ceramic Age contexts (Versteeg and Ruiz 1995, 14).

Furthermore, there are sites such as Sero Muskita, where a single tool was found, which has been categorized as being older than all the other Archaic Age sites on the island. The finishing techniques and shape of this tool are similar to that of a tool found at Arikok and suggest a date prior to ca. 2000 BC. Their occurrence on the island might be the result of incidental visits from Venezuela (Versteeg and Ruiz 1995, 16–17). Guadirikiri is located in front of the Guadirikiri rock art site, one of the most extensively painted caves on the island, which was previously classified as Ceramic Age, i.e., after AD 900, because of the occurrence of ceramics. A recent radiocarbon date on a shell, however, produced a date of cal AD 670–565, placing it in the late phase of the Archaic Age.

There are three primarily burial sites, namely Canashito, Malmok and Sero Colorado 3. Apart from "formal" burial sites such as Malmok and Canashito, there are several other sites where one or more burials were found. The site of Urirama, which is dated to cal AD 600, contained the remains of a female and an infant. These individuals where buried in a *boca* in close proximity to the sea (i.e., less than 100 meters), under an overhanging rock along the east – west running limestone cliff. A burial at Daimari 1 was dated to cal AD 620 and consisted of one individual buried in the sand dune right next to a shell midden. The grave of this individual was marked by four limestone rocks placed in a semicircle on top. The shell midden associated with the burial contained a great variety of shell material as well as ceramic fragments, and was categorized as multicomponent, belonging to both the Archaic and Ceramic Age. In the following section, we present new data on 15 of the Archaic Age sites at Malmok, Canashito, Sero Colorado 3, Spaans Lagoen and Bringamosa.

Malmok

Malmok, in the northwest, is located ca. 200 to 300 m from the sea. The site is bordered by a salt marsh to the east and the coast to the west, and is located on a lower terrace limestone formation covered with sandy soil. Malmok consists of a burial ground with a small shell midden situated to its north. The midden, of 20 m in length, has an oval shape and consists of a shallow deposit of shell materials. It reflects short-term activities and temporary camping. Collagen samples from four skeletons yielded ages between 1740 ± 110 and 1420 ± 150 BP (Versteeg *et al.* 1990, 32–34). These have been corrected for 310 years of marine reservoir effect due to large component of marine food in the diet (Klinken 1991, 110) resulting in calibrated ages of cal AD 330–1435. Van Klinken assumed that there was no maize in the diet, but recent research revealed that maize contributed to the diet (see below). Consequently, the calibrated dates of the collagen samples will be about 100 years older. Four shell samples collected in burial contexts yielded dates between 2430 ± 150 BP and 2070 ± 80 BP and four shells from the midden are in the same time range (2345 ± 140–2120 ± 50 BP, resulting in calibrated ages of 360 cal BC – cal AD 370 (Klinken 1991; Versteeg 1991). In conclusion it seems to be plausible that the midden and the cemetery are not contemporaneous (Versteeg *et al.* 1990), and that the shells in the burial context has been collected from the older shell midden (Louwe Kooijmans, personal communication, 1991). The burial site is 200 m in length in a north – south orientation and 50 m wide; at least 70 burials where identified, of which 60 were excavated (Versteeg *et al.* 1990). Some burials were located closer to each other than others, and several burial clusters were distinguished (Figure 11.3). The majority of the clusters were composed of a central male individual, with females placed around him. The burials were thought to represent successive generations of one band. The deceased were buried in three different postures, namely: 1) crouched position on the right side (the majority of the individuals); 2) crouched position on the left side (N=16); and 3) supine position with the legs flexed (N=2, one infant and one adult). Most graves were covered with either a large or small limestone block that functioned as a grave marker. The use of a red dye on the top or back of the skull was a common practice and occurred with at least 19 individuals. The skulls of these individuals were relatively narrow and high compared to the human skulls that were found in the Ceramic Age sites, which were low and wide. In both male and female individuals, the incisors were shovel-shaped (Versteeg *et al.* 1990).

Figure 11.3. Malmok burial cluster (After Versteeg et al. 1990, 9).

A recent dental anthropological study and starch grain analysis on the dental calculus of four individuals provided new insights into the diet of the Malmok population with respect to plant food consumption (Mickleburgh and Pagán-Jiménez 2012). The individuals had no caries, but a high rate of dental wear; most of the adults showed horizontal and flat wear of the molar, which indicated the consumption of tough, fibrous plant food and relatively unrefined protein foods. The high frequency of dental chipping suggests that grit and other contaminants were present in the food. Starch grain analysis indicates that the individuals consumed unrefined starchy plant foods such as manioc, maize and cocoyam, which were treated with pressure and heat without water. These unrefined starchy plant foods were categorized as a small carbohydrate component of their diet (Mickleburgh and Pagán-Jiménez 2012). The identified starchy plant foods demonstrate that the Malmok people did not only rely on gathering what was available in their environment for their plant food consumption, but also introduced and successfully cultivated plants in their (new) environment.

Canashito

Canashito is located inland on a limestone outcrop. Remains are scattered over three sites: a burial site and two sites with large shell content. Furthermore, there are two rock art sites, of which one has been destroyed (Versteeg and Ruiz 1995, 83). Radiocarbon dating of a molar of a female individual located within a burial cluster provided a date of 2210±95 BP or around 215 cal BC (Versteeg *et al.* 1990, 35), while one shell sample dated 1300 BP (Versteeg *et al.* 1990, 66). The burial site consists of five burials, of which four formed a cluster, while the fifth one was located 6 m to the east in a limestone rock-shelter (Figure 11.4). Both the cluster and single burials had large limestone rocks in their direct vicinity. The individuals were buried in a flexed position, and in three burials a hand was placed near the individual's head. The cluster burials were interpreted as an individual family group in which three individuals, one of which was identified as a female, were buried around a central male (Versteeg *et al.* 1990). The Canashito burials share many similarities with the ones from Malmok in terms of the posture of the deceased, association with limestone, high skull shape and occurrence of shovel-shaped incisors. Similarities between Archaic Age burial sites on Aruba are not merely an expression of local development, but have a more widespread occurrence within the Southern Caribbean region, e.g., in sites on Curaçao and Cuba, Ecuador, Peru and Colombia. Recent dental anthropological research and starch grain analysis on dental calculus show results similar to those of Malmok, and point to a diverse consumption of plant foods (Mickleburgh and Pagán-Jiménez 2012). The Canashito individuals also lacked caries and had a high mean degree of wear on the dentition, with horizontally and flatly worn molars as a result of consuming tough and fibrous foods. On the other hand, they had a low frequency of dental chipping, which was attributed to the lack of grit and stone particles from grinding implements present in their food. Nonetheless, the observed high degree of wear might be masking the rate of chipping damage to the teeth due to the substantial removal of enamel and tooth crown height. Starch grain analysis has indicated the consumption of unrefined starchy plant foods, such as maranguey, sweet potatoes and maize, that were probably grilled or baked (Mickleburgh and Pagán-Jiménez 2012). As in the case of Malmok, the starchy plants were categorized as constituting a small carbohydrate component of the overall diet. It was also pointed out that treating starchy crops with heat and pressure would produce foods that are less cariogenic, and in turn would inhibit the formation of caries on the teeth. The people of Canashito do not seem to have been as heavily reliant on gathering as previously thought but, similarly to the occupants of Malmok, successfully introduced and cultivated (semi)domesticated plant foods. However, recent isotope analysis, together with starch grain analysis of the Canashito (B3) and Malmok individuals (B6 and B10), shows different patterns in the origin and diet of the two sites. Strontium isotope analysis revealed that the Canashito individual (B3) was nonlocal, with a likely origin in the north-central coast of Venezuela, while the Malmok individuals were identified as locals (Laffoon *et al.* 2012; Mickleburgh and Laffoon 2018). Isotope analysis of dental enamel and the comparison of calculus starch grain occurence between the Malmok (B10) and Canashito (B3) individuals also revealed differences in maize consumption. The results indicate that the nonlocal Canashito individual had a much lower value compared to the Malmok individual, which suggests a lower consumption of maize compared to the local Malmok individual. Nevertheless, the elevated isotope levels of the Archaic Age individuals of Aruba further corroborate the results of the starch grain study, which indicates a much earlier consumption of maize than was previously identified (Mickleburgh and Laffoon 2018).

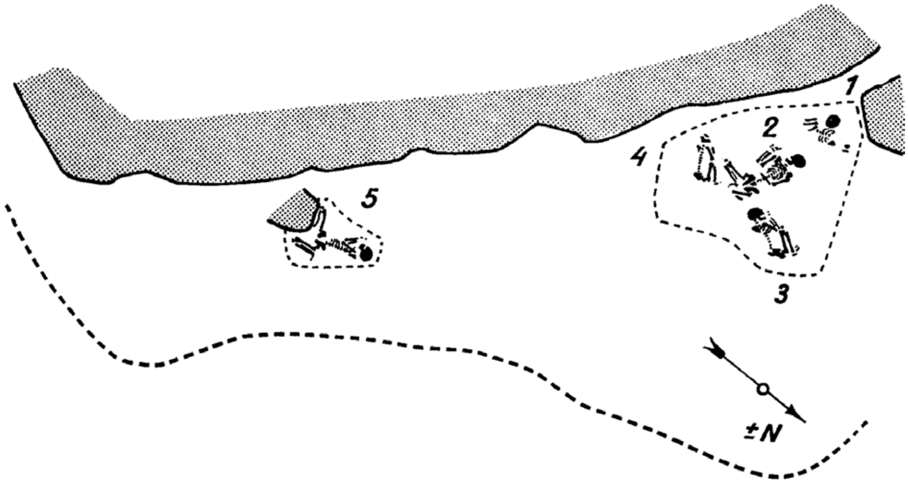

Figure 11.4. Canashito burials (After A.D. Ringma's field sketches in Hummelinck 1959, 89).

Sero Colorado 3

Only five of the Archaic Age sites are located at the southern point of the island, while the remainder are located between Spaans Lagoen (central part of the island) and Malmok (northern point of the island). There is a lack of sites along the coastal area between Spaans Lagoen and these five sites. This "empty" area lies within the present-day densely populated areas of Savaneta and San Nicolas, which have undergone intensive construction since the 1920s (i.e., the Lago refinery and subsequent urbanization). It is therefore very likely that sites located in this area were destroyed during this period of intense construction. Prior to the discovery of Sero Colorado 3, there were four sites, categorized as shell middens (Banki Jerome 3 and 4) and artifact scatters (Manzanilla 3 and 5). These sites represented a very scarce exploitation and use of the area, contrasting greatly with the remainder of the island. The discovery of Sero Colorado 3 brought forth concrete evidence of a more extensive use of the southern part of the island during the Archaic Age. Sero Colorado 3 dates to cal AD 20–130, and is located within a low-lying rock-shelter along an east – west running limestone ridge, situated on the lower limestone terrace 370 m from the shoreline on the most southerly tip of the island. The site yielded three burials, two male adults (F1 and F2) and one child (F3), of which F1 was illegally excavated with a machine. The undisturbed burials (F2-F3) had limestone rocks as grave markings, and it is very likely that this was also the case for F1. The burials were thought to be part of a cluster because of their close proximity to one another. The individuals in F2 and F3 were both found in a flexed position, lying on their right side in a north – south orientation. The individual in F2 was interred in front of a limestone slab, with the top of the cranium in close proximity to the slab. The right knee of this individual was located near the cranium of F3, suggesting that these two individuals were interred together. Burial F3 was buried in a flexed position on its right side, with its left arm touching the lower jaw. Bones related to a turtle carapace were found on top of both burials (F2-F3), suggesting that the two individuals were purposely buried under the carapace. Similar turtle bones were found in the remains of the destroyed burial (F1), which suggests that this individual was also covered with a turtle carapace on which a limestone rock was placed. Both F2 and F3 contained shells as grave goods. Apart from shell, F2 contained crab and bird remains near the cranium, which seem to have been intentionally placed in the burial. *Cittarium pica* shells were found within the residue of burial F1, suggesting a context similar to burials F2 and F3. Furthermore, within the residue of burial F1, a biconic perforated *Lobatus gigas* pendant was found. Its context (i.e., grave good or personal adornment) remains undetermined. Burials at Malmok contained a diversity of shell species as grave goods, but none were worked into ornaments.

Like Malmok and Canashito, Sero Colorado 3 also shares characteristics that typify Archaic Age burial sites on the island. Similarities include the strong relation to limestone; the covering of burials with limestone rocks and/or turtle carapaces; the crouched position of the buried individuals; the position of their hands near the cranium; the relation between individuals within the burial layout; and the presence of grave goods. Beyond this, Sero Colorado 3 has additional characteristics that are very striking. The covering of individuals with a turtle carapace and a limestone rock, as at Malmok, occurs together with the burying of an individual near a limestone slab, as at Canashito. The three burials were each covered with both a turtle carapace and a limestone rock, and the individual F2 seems to have been purposefully interred with its cranium near a limestone slab. The covering of all three individuals with a turtle carapace was striking (only 10% of the individuals buried at Malmok were covered with a turtle carapace), as was the usage of a turtle carapace to cover a child (only adults were covered with turtle carapaces at Malmok). Another noteworthy feature is the burial arrangement at Sero Colorado 3, which does not consist of a central male surrounded by other individuals, as is the case at both Canashito and Malmok. The three excavated burials include two adult males (F1 and F2) and one infant (F3), of which the adult male (F2) was buried around the child (F3), with the right knee of the adult placed near the cranium of the child. The latter is in contrast with other known composite burials, where it is an adult female who is associated with an infant. Furthermore, the hand of the child in burial F3 was placed near its lower jaw, which is a posture predominantly associated with adult burials at Canashito and Malmok. These factors may suggest that the Archaic Age peoples at Sero Colorado had a different social structure than those at Malmok and Canashito, possibly indicating a different origin for this group. In sum, the burials at Sero Colorado 3 demonstrate that Archaic Age activities on the southern point of the island do not simply represent incidental visits or short-term resource exploitation excursions, but instead suggest "prolonged" habitation of the area.

Spaans Lagoen

Spaans Lagoen, located on the leeward side, is the largest inland bay on the island. It extends 1.5 km inwards and is between 100 and 150 m wide. The Spaans Lagoen is filled with sea water and traverses the well bedded, fossil-rich conglomeratic limestone of the Middle Seroe Domi Formation, and ends in a salt marsh (*salinja*) with a diameter of ca. 500 m. The salt marsh is fed with fresh water from the drainage of several gullies (i.e., *rooien*) that cut through the isolated hills of the Middle Seroe Domi Formation in the hinterland. The Rooi Francés, Rooi Bonheur and Rooi Taki gullies, which separate the isolated hills and drain into the salt marsh, have all been incised to a very low level, resulting in the accumulation of recent or subrecent detritus in their lower courses (Buisonjé 1974). The banks along the Spaans Lagoen are densely vegetated with *Rhizopora mangle*, while the intertidal zone is densely vegetated with the *Laguncularia racemosa* and *Avicennia nitida* mangrove species. The dryer zones, located in more elevated areas within the intertidal zone, are vegetated with *Batis maritime*, *Seusuvium portulacastrum, Bontia daphoides* and *Sporobuls virginicus* (Boekhoudt 2007). The Spaans Lagoen, with its diverse flora and fauna, connecting the sea to the hinterland by means of its 1.5 km-long channel and interconnected gullies, provides an ideal entry point for the exploration of new territories and subsequent exploitation of available natural resources. Artifacts and radiocarbon dates obtained from along the banks of the Spaans Lagoen and gullies in the hinterland demonstrate that the area not only served as a gateway for inland exploration for the first arriving groups, but also for continued exploitation of its natural resources through time. All Archaic Age remains are concentrated exclusively along the western bank, with a total of seven shell middens, of which four are located along the banks close to the water's edge and three are located along a north – south running middle limestone terrace located within the intertidal zone further upstream.

Spaans Lagoen 7, located closest to the sea near the entrance of Spaans Lagoen on the elevated western bank (i.e., 3 m amsl), is a shell midden. The material remains are "evenly" spread along the bank's edge. The shells consist chiefly of *Lobatus gigas* (95%), and further *Melongena melongena, Codakia orbicularis* and *Vasum muricatum.* Some ceramic fragments were also found.

Spaans Lagoen 6, located 700 m upstream from Spaans Lagoen 7, is a shell midden 30 m in diameter with human remains. Directly behind the site, there is an exposed natural outcrop of basalt, which contains readily available raw material for stone tools. The site consists mainly of shell material and to a lesser extent stone material. Similar to Spaans Lagoen 7, ceramic fragments are scattered throughout the site. Shells include *Codakia orbicularis*, *Arca zebra* and *Murex* sp., and to a lesser extent *Lobatus gigas*, *Melongena melongena* and *Vasum muricatum*. Fragments of tonalite[2], basalt flakes and a hammerstone were probably procured from the basalt outcrop behind the site. Two sets of dates were obtained from shell samples and human remains. The shell provided a date between 1465–1280 cal BC, while the human burial gave a date of cal AD 570–655, suggesting that the area was not only revisited several times during the Archaic Age but was also used for different types of activities. The shell midden was the result of marine food exploitation during the initial phase of the Archaic Age, while the burial likely represents the revisiting of the area for the exploitation of a whole range of natural resources.

Spaans Lagoen 5, located ca. 300 m upstream from Spaans Lagoen 6, is another shell midden located on the western bank of the lagoon. The site measures 25 m in diameter and mainly consists of shells, and to a lesser extent lithics. Similar to Spaans Lagoen 6 and 7, this site also contains some ceramic fragments. The shell material includes *Melongena corona* and *Arca zebra*, and to a lesser extent *Lobatus gigas, Codakia orbicularis* and *Vasum muricatum*. A few basalt flakes and cores were found, but with no clear tools or tool preforms. A shell provided a date of cal AD 270–425, indicating a different period of visitation and exploitation of natural resources in the area compared to that of Spaans Lagoen 6. Nonetheless, these dates evidence the continuous visitation of Archaic Age

2 Coarse-grained rock consisting of plagioclase, hornblende or biotite and a quartz content greater than 20% (MacKenzie *et al.* 1982, 104).

peoples to this area, which in the case of Spaans Lagoen 5 seems to be related to a second wave of exploration. Spaans Lagoen 4 is located behind a westerly oriented bend of the lagoon, 200 m upstream of Spaans Lagoen 5. It is a shell midden 30 m in diameter. The site consists mainly of shell and some lithics. Similar to all the other Spaans Lagoen sites, this site also contains a few pottery fragments. Shells include *Codakia orbicularis* and *Arca zebra*, and to a lesser extent *Vasum muricatum*, *Columella corona* and *Murex* sp. Tonalite fragments and basalt flakes and some cores were recovered. A shell date of cal AD 675–780 was obtained, which concurs with the dating of the Spaans Lagoen 6 burial and seems to be related to a third period of exploitation of the natural resources in the area. Spaans Lagoen 1, 2, and 3 are located adjacent to one another along the rock face of an elevated north – south running limestone terrace. All three sites are small shell middens of 20 m in diameter that contain shell and stone material, except for Spaans Lagoen 1 which, similarly to the previous sites, also contains some pottery fragments. The shell material mainly includes such bivalves as *Codakia orbicularis* and *Arca zebra*, and to a lesser extent *Melongena corona* and *Vasum muricatum*. A shell sample from Spaans Lagoen 3 produced a date of cal BC 1448–1266. This date, together with the date range of Spaans Lagoen 6, represents the oldest Archaic Age activities on the island, and corroborates the hypothesis of Spaans Lagoen being the region of initial arrival and exploration.

The initial arrival of Archaic Age populations on the island was previously associated with very early incidental visits, which were thought to have occurred around 2000 BC near the northern tip of the island (Versteeg and Ruiz 1995). The seven sites at Spaans Lagoen, together with their respective radiocarbon dates, provide a different picture of the first activities on the island, which are older than previously thought. Not only does Spaans Lagoen contain the highest density of Archaic Age sites, it is also the region with the most continuous Archaic Age activity that stretches the furthest back in time. The natural characteristics of Spaans Lagoen, both in terms of diversity in flora and fauna and of connection between the sea and hinterland, provided the Archaic Age peoples with a unique combination of natural resources and inland access, which aided the exploration of their new territory. A noticeable aspect of the Spaans Lagoen Archaic Age sites is the presence of ceramics in almost all of them. The Archaic Age on Aruba was previously referred to as the pre-Ceramic period, and the assignment of sites as belonging to the Archaic Age was directly related to the absence of ceramics. Even in the cases where ceramics were recovered from dated Archaic Age sites like Malmok and Canashito, these were always regarded as "contaminated" by Ceramic Age occupations. The implications of the presence of ceramics in the majority of Archaic Age sites at Spaans Lagoen are very profound. Not only does it confirm the production and use of ceramics by Archaic Age peoples as in other areas of the Caribbean (e.g., Hoogland and Hofman 2015; Rodríguez Ramos *et al.* 2008a; Ulloa Hung and Valcárcel Rojas 2002), influencing their lifestyles, but it also elucidates the biased categorization of archaeological sites as belonging to a specific time period (i.e., the Ceramic Age) based on one aspect (i.e., ceramics) that is not exclusively correlated with the particular period. This ultimately resulted in the underrepresentation of Archaic Age activity on the island and the further distortion of the archaeological record, which is already inaccurate as a result of post-depositional processes and subrecent development activities on the island.

Figure 11.5. Protruding materials on the west bank at the Rooi Bringamosa 5 site (National Archaeological Museum Aruba 2010).

Bringamosa 4 and 5

Bringamosa 4 and 5 are situated along the banks of Rooi Bringamosa, which cuts through the isolated hills of the Middle Seroe Domi Formation in the hinterland and connects with the Rooi Bonhuer, where it finally drains into the Spaans Lagoen salt marsh. The Rooi Bringamosa, with its tributaries reaching the Sero Arikok and its connection with Rooi Bonheur, provides a link between the sea and the hinterland spanning 6 km in length. These '*rooien,*' connecting the sea with the hinterland, provided the Archaic Age dwellers with a viable route for the exploration of new territories and exploitation of natural resources, which was relatively easily accessible upon arrival at the Spaans Lagoen Bay

Bringamosa 5 is situated ca. 3 km upstream from the seaward entrance of the Spaans Lagoen Bay and 2 km upstream of Spaans Lagoen 6. It is located on the bank of a westerly bend of Rooi Bringamosa. The site consists of a thin lens of exposed materials, 30 cm in width and 6 m in length, which protrudes from the eroded bank wall (Figure 11.5). The exposed materials consist mainly of *Codakia orbicularis* and *Arca zebra*, and to a lesser extent *Vasum muricatum* and *Melongena corona*, together with tonalite and basalt fragments. The site is located on the slope of a hill and covered with a sediment layer 50 cm thick, which is currently eroding due to rainwater drainage along the hill slope. Radiocarbon dating on a shell sample provided a date of 1495–1315 cal BC, which falls within the date range of the Spaans Lagoen 6 site. This site forms part of the first wave of Archaic Age arrivals and exploration of the hinterland through the Spaans Lagoen Bay area connection. The site, situated at the junction of the Rooi Bringamosa/Rooi Bonhuer and connecting tributaries to the east, provided these early dwellers with a suitable location for exploring the wide hinterland region while providing access to marine food resources located in nearby Spaans Lagoen.

Bringamosa 4 is located ca. 1 km upstream of Bringamosa 5, and is a partially exposed shell midden on the eastern bank of the *rooi*. The exposed area of the shell midden measures 1 m in length and 30 cm in width. Artifacts include *Codakia orbicularis* and *Arca zebra*, and to a lesser extent tonalite and basalt fragments. Charcoal fragments from a palynological core yielded a date of 1700 BP (van Nooren 2009). The radiocarbon date of Bringamosa 4 falls within the range of Spaans Lagoen 5 (cal AD 280–470), which is related to the second wave of Archaic Age activity in the area. The Bringamosa 4 site, which is situated 3 km upstream from Spaans Lagoen 5, seems to have played a similar role as the Bringamosa 5 site during this phase. An inland exploration either by Archaic Age groups already settled on the island at Malmok or by newly arrived peoples from the mainland of Venezuela might possibly have stretched all the way to Arikok, located 2 km further inland at the origin of Rooi Bringamosa.

Discussion and conclusion

New archaeological investigations of Archaic Age sites, recent radiocarbon dating and starch grain analysis on dental calculus, together with a reappraisal of past data, provide the most complete picture of Archaic Age migration, activity and subsistence to date for Aruba, and profoundly changes the Archaic Age narrative of the island. A total of 15 dated sites illustrate patterns of migration, exploration, exploitation and settlement and resettlement, which are far more dynamic and widespread than previously assumed. The first migration to and arrival on the island had previously been associated with incidental visits from the mainland, but did not provide any concrete evidence of time span, location or activities carried out. Radiocarbon samples from Spaans Lagoen and Rooi Bringamosa, as well as from Ser'i Noka 1 and Arashi 2, pinpoint not only these initial visits, but also subsequent waves of migration from possible multiple mainland locations. The geographic orientation of the Spaans Lagoen, Rooi Bringamosa and Ser'i Noka 11 sites, in relation to the Venezuelan mainland in the south, makes this part of the mainland a very plausible place of origin for Archaic Age groups migrating to the island and arriving at Spaans Lagoen. The Arashi 2 site, located on the northwestern tip of the island with a southwesterly orientation, was probably reached from Venezuela as well, but could also have been reached from the Colombian coast, located within the Gulf of Venezuela. The sites of Spaans Lagoen 6 (1465–1280 cal BC) and 3 (1450–1265 cal BC) and Bringamosa 5 (1495–1315 cal BC), located in the hinterland, represent the region where the initial wave of Archaic Age arrival and subsequent exploration occurred. It is within this area that the first peoples set foot on the island and utilized the connection of Spaans Lagoen to the hinterland as a means to explore their new territory while exploiting the natural resources available for subsistence. Another very important aspect of Spaans Lagoen 6 and 3 is that these sites demonstrate that the Archaic Age peoples not only used pottery, but that it eventually formed an integral part of their material possessions and the knowledge that they brought with them from the mainland. Ser'i Noka 1, located in Santa Cruz and supposedly related to the Ceramic Age, provided a date that was originally regarded as being erroneous (Versteeg *et al.* 1990, 65), but the current date of ca. 1300–1060 cal BC illustrates the continued Archaic Age exploration of the hinterland, which might have been the result of either a second wave of migration from the mainland or subsequent exploration activities of the first Archaic Age groups. Either way, it demonstrates the vested interest of Archaic Age peoples in exploring new territories on the island. The Arashi 2 site, dated between 380–205 cal BC, seems to be related to a third migration wave, which might have originated either in Venezuela or Colombia. In this case, the exploration was concentrated along the northern part of the island. The Sero Muskita site, located 3 km southeast of Arashi 2 and previously associated with the oldest Archaic Age activities on the island, could very well have been related to this much younger exploration phase of the island. A very striking aspect of this third exploration wave is the time difference of almost 1000 years with the Ser'i Noka 1 site. Nonetheless, this gap is not thought to represent a lack of interest or activity on the island, but seems rather to be related to a lack of data. Aruba, which is located within the interaction sphere of Archaic Age migration and expansion from the mainland, must probably have been visited regularly by Archaic Age communities from the mainland, and even from adjacent islands such as Curaçao.

The sites of Sero Colorado 3 (cal AD 5–130), located near the coast, and Canashito (430–0 cal BC), in the hinterland, not only fall within a similar time frame, but are also the oldest dated burial sites on the island. Sero Colorado 3 lies directly in front of the Venezuelan mainland, which is even visible from the site. Canashito, although located 2 km inland, lies within the *rooi* system that drains in the sea near Parkietenbos, and can thus be relatively easily accessed by new arrivals. A noticeable fact about the Canashito site, besides having a rock art site in the vicinity, is its connection with the same *rooi* system that reaches Ser'i Noka 1, where the second oldest set of dates has been obtained. These two burial sites seem to indicate that both the southernmost tip of the island as well as the central part were simultaneously inhabited by different Archaic Age groups, which migrated from Venezuela to the island. Recent isotope analysis on a buried individual at Canashito (B3), identified as nonlocal, corroborates the hypothesis of Archaic Age migration waves toward Aruba with a possible origin in the north-central coast of Venezuela. Furthermore, the isotope analyses together with the starch grain study indicate that the inhabitant(s) of Canashito not only possibly originated from the north-central coast of Venezuela, but that they had a different diet compared to the locals at Malmok (Mickleburgh and Laffoon 2018). Both the Canashito and Sero Colorado 3 sites reflect what is considered to be the first period of permanent Archaic Age habitation on the island. The shell midden site of Malmok yielded a radiocarbon dates between approximately 360 cal BC – cal AD 370, which falls within the time frame of these burial sites. Similarly to the burial sites, it does not reflect permanent habitation, though it nonetheless indicates a contemporaneous Archaic Age presence and activity on the northern tip of the island. It is very well possible that this is related to the occupation of Canashito, when new territories where explored and exploited. In the period after, there seems to have been a second wave of exploration from the Spaans Lagoen Bay into the hinterland. Radiocarbon dates of cal AD 270–425 for Spaans Lagoen and ca. cal AD 200 for Bringamosa 4 (Nooren to Kelly, personal communication, 2004) indicate similar efforts at exploring the hinterland, as had been done by Archaic Age peoples around 1000 years before. This second exploration wave is concomitant with the activities at Malmok.

Radiocarbon dates of shells from the Malmok burial site (500 cal BC – cal AD 100) predate those obtained from the burials by 200 years. This is the same time period as the second wave of the Spaans Lagoen and hinterland explorations. It is very well possible that this might have been the result of a coastal exploration by people from Malmok downwards along the coast, accessing the hinterland through the Spaans Lagoen. Nonetheless, it remains a possibility that the second wave of the Spaans Lagoen explorations is related to the migration of different peoples from the mainland who were present on the island contemporaneously with those from Malmok. The subsequent period at Malmok represents the second period of habitation, which is dated between ca. cal AD 200–1300. This represents the longest span of permanent Archaic Age habitation on the island, and the burial site contains the largest number of buried individuals (i.e., 70) encountered on the island. During this period, habitation seemed to be concentrated within the Malmok area, and to a lesser extent in other parts of the island. Interestingly, radiocarbon dates obtained at sites such as Urirama (cal AD 650), Daimari 1 (cal AD 620) and Spaans Lagoen 6 (cal AD 570–655) indicate a widespread occurrence of Late Archaic Age burials throughout the island. Although this might seem to reflect a widespread occupation of the island, this is not necessarily the case. Nonetheless, the Urirama site, where a female and two adolescents were buried, could very well be related to the habitation of that area. Both the Spaans Lagoen 6 and the Daimari 1 sites include individuals that were interred either directly within an existing shell midden or within the direct perimeter of a midden. These burials therefore do not seem to reflect habitation of the area, but rather the interment of deceased individuals coinciding with the exploitation of natural resources. Spaans Lagoen 4, a shell midden located adjacent to Spaans Lagoen 6, yielded a radiocarbon date of cal AD 680–835. This site falls within the same time frame as the burial located within the Spaans Lagoen 6 shell midden. There seems to be a plausible relation between these two sites, whereby an individual from Spaans Lagoen 4 may have been buried in the shell midden of Spaans Lagoen 6. The Daimari 1 site, which contained a circular marking of limestone rocks placed on top of the interred individual, similarly as in Malmok, seems to have been the result of a similar phenomenon. Even though the period of ca. cal AD 600 does not seem to be suggest island-wide Archaic Age habitation, the abovementioned sites, together with Guadirikiri 2 (cal AD 575–700), seem to indicate a possible expansion of the exploitation territories on the part of people inhabiting the Malmok area. In either case, it is evident that the Archaic Age of Aruba includes many phases of migration and exploration, in which groups originating from the mainland not only visited the island regularly, but also explored and settled in different locations throughout the island and through time. The evidence also indicates that the Archaic Age peoples were not solely reliant on available food resources for their subsistence. They introduced and successfully cultivated new foodstuffs, which formed an integral part of their diet alongside marine food and gathering plant material for consumption. Furthermore, the fact that these peoples used ceramics from their first arrival on the island highlights the fundamental misinterpretation of Archaic Age activity on the island as being related to the Ceramic Age. No longer can the Archaic Age be referred to as the pre-Ceramic period.

Acknowledgements

The new archaeological investigations at Spaans Lagoen, Bringamosa and Sero Colorado 3 have been carried out by a team from the National Archaeological Museum Aruba (NAMA). Radiocarbon sampling was made possible through the support of the ERC-Synergy project NEXUS1492, funded by the European Research Council under the European Union's Seventh Framework Programme (FP7/2007–2013)/ERC Grant Agreement no. 319209.

12

Construction and deconstruction of the "Archaic" in Cuba and Hispaniola

Jorge Ulloa Hung and Roberto Valcárcel Rojas

The diversity, transformation and complexity of the so-called "Archaic" (*arcaico*) or pre-Arawak communities are some of the most controversial topics in current Caribbean archaeology. Despite this, almost a century of research in Cuba and more than 50 years in Hispaniola have generated classifications and models based predominantly on four basic approaches: colonization, diffusion, evolution, and transculturation. The different ways this topic has been handled in the archaeological traditions of both islands has affected the visibility of Archaic Age communities and their perception.

Existing approaches have used archaeological data from both islands to create and perpetuate the historical dichotomy of Archaic vs. agriculturalists, which is remarkably similar to another such dichotomy, precolonial vs. colonial (Mitchell and Scheiber 2010; Silliman 2010). Similarities between these perspectives include: a) the segregation or marginalization of indigenous groups based on supposed technological, cultural or social inferiority; (b) the direct correlation between sociocultural development, technological practices, and modes of subsistence; (c) understandings of cultural differences in terms of spatial, temporal, and structural divisions; d) promoting a vision of acculturation directly linked to migration, colonization, and cultural integration; (e) the establishment of a dichotomy between developed and socially complex societies, on the one hand, and the Archaic, primitive or less developed societies on the other; and (f) the conceptualization of cultural and social changes as unilineal phenomena.

This chapter is an attempt to deconstruct and contextualize the Archaic vs. agriculturalist dichotomy on both islands. Moreover, we illustrate how the approaches to the use of the data mentioned above have contributed to the historical marginalization of "Archaic communities" which, at the same time, have fostered the creation of "stereotypes" about their transformation**.** In that sense, rather than concentrating on a traditional approach emphasizing typological, chronological, or taxonomic aspects, we will focus on the theoretical and conceptual aspects of this topic on both islands.

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 163-176.

The "Archaic" universe in the Cuban context

The analysis of ideas about homogeneity or diversity of indigenous communities in the Greater Antilles is related to interpretations of the European historical sources. Written sources influenced the creation of archaeologists' taxonomic and cultural schemes, in which details of linguistic differences, ways of decorating the body, descriptions of places or regions, and reactions to Europeans were linked to patterns of material culture (Curet 2006; Hulme 1993; Petersen *et al.* 2004).

One of the categories created during the first half of twentieth century to designate the Archaic communities of Cuba was that of the Ciboney (Harrington 1935 T. I, 270–273). The Ciboney were divided into two cultural variants, Cayo Redondo and Guayabo Blanco (Cosculluela 1947; Fewkes 1904; Ortiz 1935; Osgood 1942; Pichardo Moya 1956, 1990; Rouse 1941, 1942; Tabío and Rey 1966, 15–90), the latter evolving from the former.

Another "Archaic" cultural group was called Guanahatabey, defined on the basis of historical descriptions of the inhabitants of western Cuba at the time of European arrival. The supposed links with "primitive" people prompted their characterization as Archaic. Indeed, some archaeologists considered this group to be the oldest in the archipelago (Fewkes 1904; Cosculluela 1946; Morales Patiño 1952; Ortiz 1935; Pichardo Moya 1956, 1990).

The culture-history models of Ciboney and Guanahatabey were essential to the archaeological definition of the "Archaic" universe in Cuba at the beginning of the twentieth century. From this perspective, a direct correspondence between a body of archaeological data and a particular colonial history was imposed, which has been rightly criticized by William Keegan (1992) and other researchers (González Herrera 2008; Rodríguez Ramos 2008).

The definition of the "Archaic" universe in Cuba also supported the Taíno–Ciboney dichotomy (Harrington 1935; Lovén 1935, 79–84), which later on assumed various forms (Agriceramicists vs. Archaics; Agroceramicists vs. pre-Agroceramicists; farmers vs. fishermen; producers vs. appropiators; Neolithic vs. Mesolithic communities; tribal vs pretribal societies, etc.). This dichotomy was also a way of conceiving the diversity and transformation of these communities based on the presence or absence of certain archaeological indicators (such as ceramics, agriculture, gouges, features of lithic industries, cranial modification, and so on) (Dacal and Rivero de La Calle 1986; Kozłowski 1975b; Morales Patiño 1952; Rouse 1942, 131–134; Tabío and Rey 1966). At the same time, this dichotomy was directly associated with physical, ethnic, and social aspects, and more recently with genetic traits, in order to determine the population of origin and migratory routes to the island (Coppa *et al.* 2008; Lalueza-Fox *et al.* 2003). This shaped and defined an "Archaic" phenomenon whose chronological, spatial, economic, and technological standardization became a kind of Antillean model, formalized through a system of series, subseries, ages, and periods (Rouse 1992, 49–71).

In Cuba, the problems in the use and organization of archaeological data according to this model can be summarized in two basic antinomies: homogeneity vs. diversity and rupture vs. continuity. The former is expressed in a proliferation of cultural labels to try to describe the heterogeneity or plurality in so-called "Archaic pattern," and the latter in the attempts to explain the ceramics associated with some settlements traditionally classified as Archaic. In both cases, the solution to those problems or antinomies has been the inclusion of the archaeological data within an evolutionary model, with emphasis on economic stages as segments of a continuous historical sequence which, at the same time, define the types or models of social existence in Archaic communities.

In this sequence, concepts such as period, phase, and/or tradition directly link chronology with socioeconomic aspects. Therefore, diversity within the "Archaic" begins to emerge by considering the chronological differences at the beginning or end of that sequence in different places, or the coexistence of Archaic communities at different developmental phases (Domínguez *et al.* 1994; Jiménez Santander and Jiménez Ortega 2008; González Herrera *et al.* 2006; Guarch Delmonte 1990; Tabío 1984).

These evolutionary approaches, combined with perspectives on migration and transculturation, have been the basis for explaining the transformation and diversity within the "Cuban Archaic model." The variety of migrations proposed, originating from the southwest of the United States (especially Florida and Lousiana), Central America, Colombia, Venezuela or Hispaniola, as well as the intraisland migration of those communities, has been used to justify the presence of different lithic or shell traditions as well as ceramics in Archaic contexts (Febles 1991; Kozłowski 1975b; Morales Santos 2010).

Within this scenario, the (transcultural) relations between communities with different social, ritual, and symbolic features have been subsumed under the patterns established by the evolutionary model. The social interactions and transculturation are essentially conceived as the interplay between two basic factors: cultural tradition and migration. In this model, the direct connection between economic, social, and cultural diversity with migratory processes has minimized the potential of observational methods, and the richness of the particularities observable in these communities (Keegan and Rodríguez Ramos 2004; Torres Etayo 2004). In essence, the obsession with classifying cultures has limited the understanding of their diversity, which explains why concepts such as transculturation and interaction have not been used to challenge the traditional categories of sociocultural evolution and the current taxonomic dogmas.

A new approach to understanding Archaic societies in Cuba began in the sixties (Kozłowski 1975b; Tabío and Rey 1966) and gained a new impetus in the eighties with the reevaluation of "Archaic contexts with ceramics," (e.g., Arroyo del Palo, Mejías, Aguas Verdes, Canímar and Playitas; see Figure 12.1, top map); these were initially classified as a "new culture" and later baptized as "*protoagricola*"/ proto-agricultural (Tabío 1984). From the study of such contexts, the processes of Neolithization in Cuba were immersed in a kind of duality, in which *protoagricola* was used to refer to an independent phenomenon with possible foreign origins and, at the same time, as a transitional stage of the Archaic. This produced a confusing situation in which the same archaeological record could be interpreted in different ways according to the importance placed on the analysis of specific components such as economy, stone tools, or ceramics (Godo 1997; Ulloa Hung 2005; Ulloa Hung and Valcárcel Rojas 2002).

New lines of thought about this phenomenon (Godo 2001; Ulloa Hung and Valcárcel Rojas 2013) have begun to emphasize the complexity and continuity of the so-called "Archaics." Investigations in eastern Cuba (Ulloa Hung and Valcárcel Rojas 2002), and more recently in the west-central part of the island (Pérez Carratalá 2013),

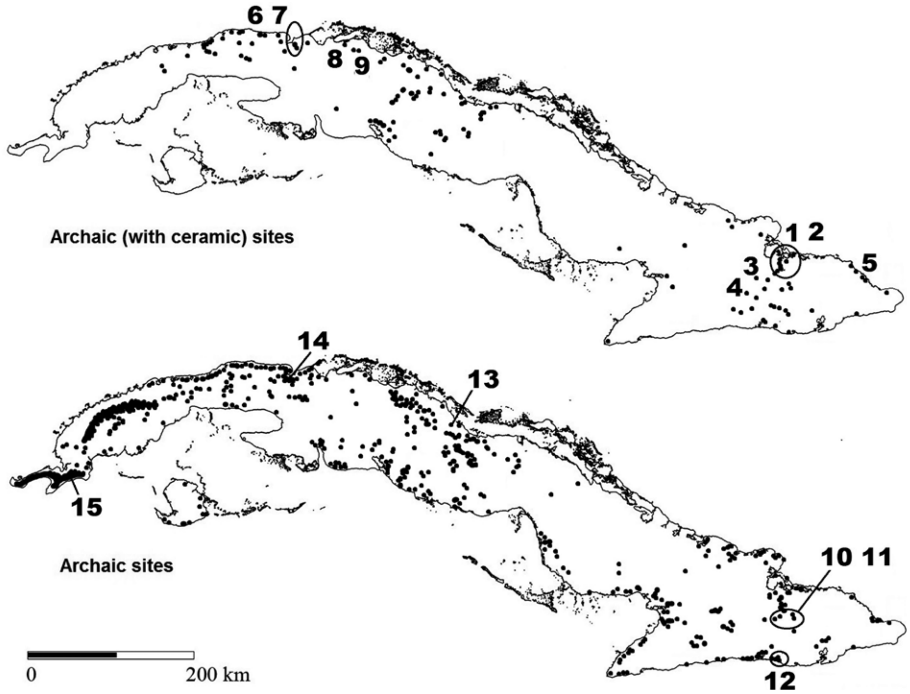

Figure 12.1. Top map: Distribution of "Archaic with ceramic" sites in Cuba. Bottom map: Distribution of "Archaic" sites in Cuba. Maps created using information from Jiménez Santander (2013). 1. Corinthia III; 2. Arroyo del Palo; 3. Mejías; 4. Catunda; 5. Aguas Verdes; 6. Canímar; 7. Playitas; 8. Cayo Jorajuría; 9. Elguea I; 10. Seboruco I; 11. Levisa I; 12. Damajayabo; 13. Sierrezuela; 14. Canímar Abajo; 15. Cueva Funche.

have demonstrated that the diversity of "Archaic groups" (Smith 2016b) is fundamental to assessing the "Cuban *protoagrícola* process."

The discovery, in stone tools and human coprolites, of remains of starch grains from domesticated plants such as maize (*Zea mays*), sweet potato (*Ipomoea batatas*), yautia (*Xanthosoma* sp.), beans (*Phaseolus* sp.), and peanut (*Arachis hypogaea*) at five archaeological sites in the central region of Cuba (Figure 12.1, top map, numbers 8 and 9) is an unmistakable indicator of possible horticulturalist or farming practices in the contexts of these communities (Pérez Carratalá 2013, 9).

In the case of the eastern part of the island, the early presence of pottery, which dates from around the second century BC (Corinthia III site, 135 cal BC – cal AD 185) (Cooper 2007b; Appendix, this volume) and is linked to multiple "Archaic" archaeological contexts, lasted until around the eighth century AD (Belleza site, cal AD 770–1020; Catunda site, 35 cal BC – cal AD 310) (Cooper 2007b; Appendix, this volume), when it overlapped with the early Arawak presence on the island (Ulloa Hung and Valcárcel Rojas 2002).

The concentration of Archaic sites with ceramics in eastern Cuba is characterized by long-term, broad-spectrum ecological exploitation (coasts, inland forests and intermountain valleys), which included settlements of different sizes and functions, whose

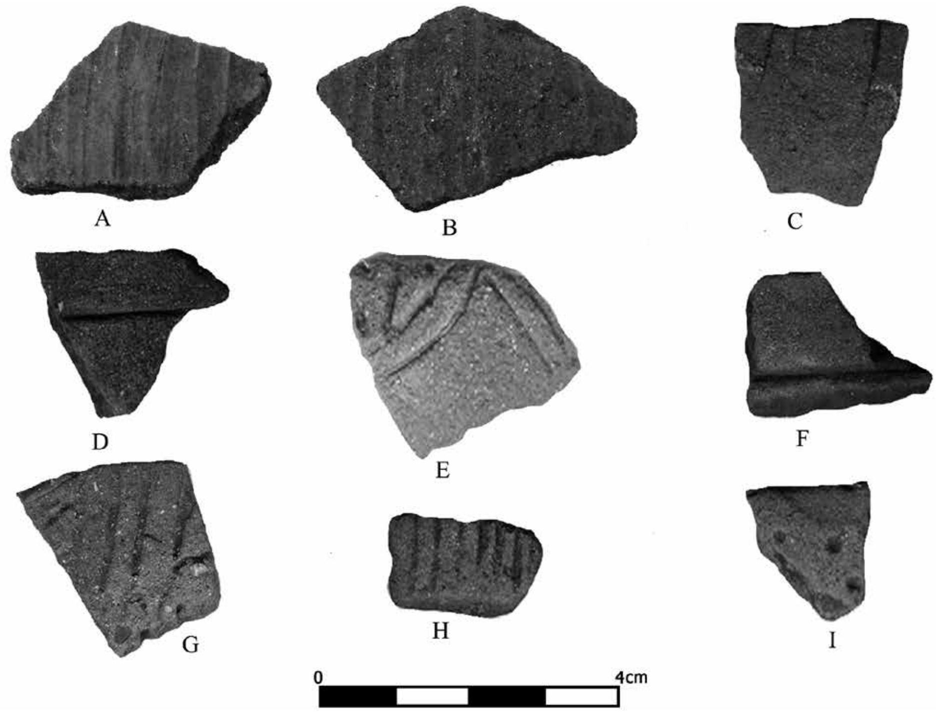

Figure 12.2. Ceramics in the "Archaic" context of eastern Cuba: (A–B), Corinthia III site; (C–I), Catunda site.

modes of subsistence and tools suggest the development of societies that can be classified as incipient Neolithic (see Figure 12.1, top map).

In some sites, pottery is abundant and functional/utilitarian; it ceases to be exceptional (Figure 12.2). The sites also include macroremains of charred palm (*Roystonea regia*) and corozo seeds (*Acrocomia* sp.), suggesting an intense management of botanical species. In addition, the stone tool types do not fit into existing typochronological frameworks (Ulloa Hung and Valcárcel Rojas 2002, 149–175).

Recent studies dealing with the complexity of the "Archaic" in Cuba highlight other aspects that are worth summarizing:

"Archaic" contexts with macro-lithic tools are not only found in the east of Cuba but throughout the island, and paleo-landscape studies indicate that their age may be older. Macro-lithic tools have been found as surface finds and in four multicomponent sites, and therefore they cannot be directly associated with a specific economic model (for example, hunting) or with specific groups or periods (Izquierdo Díaz *et al.* 2015; Izquierdo Díaz and González Herrera 2007; see also Valcárcel Rojas *et al.*, this volume).

Settlement systems associated with 2348 recorded "Archaic" sites and distributed throughout the Cuban territory (Jiménez Santander 2013) (see Figure 12.1, bottom map) contradict traditional ideas derived from historical records about the "Archaic" concentration in a specific region of the archipelago, and the traditional cultural taxonomy of Cuban archaeology. The relationship between these communities and different landscapes suggest mobility and dynamism, and cannot always be explained by only one model of evolution.

Multiple lines of evidence (starch grains and isotopes) (Buhay *et al.* 2013; Chinique de Armas *et al.* 2015); Chinique de Armas *et al.*, this volume; Roksandic 2016) from the Canímar Abajo site indicate that, as early as the second millennium BC, its population used similar food sources to those of later agricultural groups in the Caribbean. This suggests the coexistence of a range of diverse subsistence practices within the category of "Archaic" rather than a single pattern for the whole island. It also shows the rigidity in the use of archaeological data regarding these communities, as well as how the traditional taxonomic schema has acted as a constraint on interpretation.

Different cultural "Archaic assemblages" in Cuba, with or without ceramics, show clear indications of management of botanical species (Chinique de Armas *et al.* 2015; Pajón *et al.* 2007; Pérez Catarratalá 2013), suggesting that early forms of agriculture and ceramics (1) did not develop at the same time and (2) were not introduced only by the Arawaks from South America. In Cuba, such phenomena are diverse and cannot be explained only by migration or colonization.

The complexities of the "Archaic" in Cuba, associated with the production of ceramics at different times and contexts (Figure 12.1, top map), together with diverse shell and stone industries, is present throughout almost the entire island (Jiménez Santander 2013). Their distribution covers almost the whole island, overlapping with the wide diversity of cultural landscapes of the "Archaic," and reinforces the idea of the possible existence of an pre-Arawak Antillean ceramic horizon (Rodríguez Ramos *et al.* 2008a).

The existence of numerous and important "Archaic" funerary spaces with obvious symbolic connotations, including the act of burying the dead, is related to organized rituals with offerings of food remains and other items (like stone spheres) (Garcell Domínguez 2009; La Rosa Corzo and Robaina Jaramillo 1994; Martínez-López *et al.* 2009). Diverse rock art, widely represented in areas with highest concentration of "Archaic" sites (Gutiérrez Calvache *et al.* 2009), suggests a management of the landscapes that includes the creation of social memories and a complex system of beliefs, which undermines the view of a supposed primitivism. Moreover, the diversity of settlement patterns (Izquierdo Díaz *et al.* 2015) and the exploitation of marine resources, evidenced in large shell middens, indicate that the impact of these groups on the natural resources of the archipelago–including the transfer and import of animals and plants–should not be underestimated.

In summary, the new studies on the "Archaic" in Cuba support the claim that these societies did not disappear, and were vital to the processes of biological and cultural interweaving that generated the multicultural mosaic of the Greater Antilles. The understanding of their complexity cannot be based solely on evolutionary or migratory models. It is also necessary to consider the dynamics of other factors, such as adaptation, interaction, and transformation, in order to be able to transcend the historical divide imposed by our own ideas.

The "Archaic" universe in the Hispaniolan context

In Hispaniola, archaeological practice has also generated models to explain the diversity and transformation of the "Archaic." Early on, the Hispaniolan Archaic was defined in comparison with the so-called "Ciboney" from Cuba. In fact, this practice extended the Ciboney model to Hispaniola (Krieger 1929, 24–27; Rainey 1941, 22–28; Rouse 1941, 24–53). This pioneering archaeological work was characterized by descriptions of artifacts and the use of analogies with so-called diagnostic objects and sites of the "Ciboney," in addition to considering all Archaic Age sites as temporary camps of small size or sites in caves.

As in the case of Cuban archaeology, another practice in Hispaniola was the use of historical narratives to confirm the existence of "Archaic" populations in certain regions of the island at the time of the European colonization, especially in the Guacayarima Peninsula (Fernández de Oviedo 1851, 90–91). These documents were also one of the main sources used to support cultural and economic differences and the presence of communities considered "Archaic."

In Caribbean archaeology, especially in the Greater Antilles, the "Archaic" pattern was reinforced in chronological and spatial terms by a model developed from archaeological studies conducted in northern Hispaniola. This was later extended to the entire Caribbean based on a cultural sequence developed using "universal evolution" criteria, establishing concepts such as Paleo-Indian, Meso-Indian, and Neo-Indian (Cruxent and Rouse 1969; 1982, 82–84), which later became a system based on ages (Lithic, Archaic, Ceramic and Historical) (Rouse 1992).

In the system of ages, the Ciboney/Guanahatabey pattern of Cuba and Hispaniola was equivalent to the Lithic and Archaic Ages, with chronological ranges determined by the presence or absence of typological features or certain tools, and each with its own sociocultural implications. For example, the Lithic Age was defined by the presence of chipped stone that produced blade tools, while the Archaic Age was characterized by ground-stone as well as shell instruments. Both were subdivided into series, Ortoiroid and Casimiroid, and the last one was directly related to Cuba and Hispaniola through the subseries Casimiran, Courian, and Redondan. Sites of both islands, such as Seboruco, Mordán, Barrera, Levisa 1, Guayabo Blanco, and Cayo Redondo, marked the features and traits that defined them (Rouse 1992, 45–70).

Despite these pioneering studies, it was during the 1970s that a genuine archaeological interest in these communities developed in the archaeology of Hispaniola, which had been overshadowed by the paramount research on the "Taínos." Such interest included the publication and characterization of collections (Vega 1973), and above all, it fostered excavations and research that generated new data and alternative ideas for the comprehension of the Archaic Age based on the discovery and study of new archaeological contexts (Koski-Karell 2002; Moore 2008; Moore and Tremmel 1997; Ortega *et al.* 1973; Ortega and Guerrero 1981; Veloz Maggiolo 1972, 278–300, 1976, 1980; Veloz Maggiolo and Ortega 1973).

Since then, the interpretation of the archaeological data has concentrated on defining variations and transformations within the "Archaic" pattern based on a combination of the cultural-historical approach, with cultural ecology, analysis of settlement patterns (Koski-Karell 2002), and Marxist ideas (Veloz Maggiolo 1976, 1980, 1991). An overview of those alternative proposals emphasized aspects such as:

A. Changes in artifact typology, mobility and in "Archaic populations" are conceived as ecologically-dependent.
B. "Archaic" cultures with ground-stone tools are as old as, or even older than others that emphasized shell or chipped stone tools. This raised questions about the chronological sequence established by the traditional ages system.
C. The concept of the "Archaic" people is explained by combining typological traditions with cultural ecology and admitting different origins. In other words, there is no standard "Ciboney" settler. This goes well beyond the idea of migrations solely from South American regions.
D. Cultural hybridizations are a factor of change in tools and a strategy to modify the ecology. Therefore, an adaptive strategy changes by hybridizing with others, and can lead to a evolutionary process.
E. Exploitation of mangroves are considered key to explaining the transformations and hybridizations of "Archaic" cultural traditions.
F. Some cultural elements present in agricultural communities of the Greater Antilles come from the "Archaic" cultures.
G. Demographic growth is considered a factor that generates cultural exchange, which caused some artifact assemblages to be more popular and enduring.

The analysis of these factors shows that the relationships between society and the environment have become an essential pillar in explaining the diversity of the "Archaic," and for reviewing the traditional concepts and taxonomy. Such a vision was archaeologically formalized through different cultural and technological traditions, initially defined for Hispaniola, and later extrapolated to the Antilles under the categories of modes of production or modes of life (*modos de vida*) (Veloz Maggiolo and Vega 1987; Veloz Maggiolo and Pantel 1989). In this approach, one can see the influence of Latin American Social Archaeology (LASA), as well as the neo-evolutionist ecological approach present in Vere Gordon Childe (1972), Julian Steward (1978), and Betty J. Meggers (1998, 1999), where the emphasis is on using human ecology to explain natural, cultural, and social phenomena.

Another important emphasis of their argument is human adaptation, considered as the economic and technological strategies that characterized the daily life of "Archaic" communities (Veloz Maggiolo 1976, 1985). The model proposes adaptation patterns represented by technological traditions that are spatially and temporarily recurrent. From this perspective, the "Archaic" peoples transformed their ecosystems (environments), and the environments determined their types of culture (i.e., their patterns of adaptation) and social organization. This aspect, which is in agreement with the Marxist conceptualization, is relevant to the definition of a social economic formation (SEF), whose variables or modes of production are based on the different technological schemes that define the different ways of transforming the ecology.

Cultural diversity is, therefore, conceived as an expression of the mechanisms of environmental adaptation and of a system of relations between human groups and the different typological and technological schemes. From this view, environmental adaptation and cultural hybridizations are the key to explaining transformations and diversity within the "Archaic" of Hispaniola. Other concepts, such as traditions, modes of life, phases, period, and daily life, are homogenizing categories of cultural and social aspects. It is a line of deductive interpretation in which a type of environment conditions types of artifacts and certain social and economic structures.

Another idea popular among Hispaniolan archaeologists in characterizing the society-ecology relationship is productive symbiosis, which is defined as the way in which people change or transform specific ecosystems in order to survive. Two important ecosystems, mangrove and *guáyiga (Zamia* sp.), are considered to have determined the sociocultural dynamics of the "Archaic" in Hispaniola (Veloz Maggiolo 1992). From this point of view, complexity and change in these societies are perceived as an evolutionary process that took place within a particular context (i.e., the mangrove). That process is materialized through a technological sequence that always goes from simple to complex, from single to diverse, from "pure" with few possibilities of ecological confrontation to hybridized with greater options. Adaptation and evolution thus comes to account for differences and diversity within the "Archaic". One example is the studies on the Archaic site Cueva de Berna (Veloz Maggiolo *et al.* 1977), located in the east of the Dominican Republic. Its state of cultural hybridization is fundamental to explaining the long occupation, high capacity for exploitation of natural resources, and demographic increase.

In general, the model substantiates the attempts to concatenate three essential approaches: migration, adaptation, and evolution. This attempt conceives migration as being linked to the diffusion of "pure" technological and adaptation schemes, whose entry into "ecological spaces," such as mangroves, favors evolution through hybridization and ecological adaptation.

A challenge to those ideas emerged in recent studies on the subsistence of "Archaic" groups (Rivera-Collazo 2010), which report that all available environmental niches were managed in an active way, through a diversity of technologies and economic activities, including the intense use of botanical species, some of them acquired through different vectors of interaction (Hofman *et al.* 2011a; Pagán-Jiménez *et al.* 2005; Pagán-Jiménez and Rodríguez Ramos 2007).

Crucial aspects of the study of the "Archaic" in Hispaniola include the models and discussions of the presence of ceramics at the El Caimito site (Veloz Maggiolo *et al.* 1974). It is possible to isolate three basic lines of thought on this. The first is centered on the migration and colonization of the Arawaks and the acculturation of the "Archaic" people (Rouse 1992, 90–92); the second, on the diffusion of ceramics from Colombia or other regions of Venezuela, independently of the Saladoid tradition (Veloz Maggiolo 1998; Zucchi 1984); and the third, on the recognition of the complexity and continuity of "Archaic" communities by establishing the existence of a pre-Arawak ceramic horizon, under the assumption that this phenomenon is more complex and diverse (Keegan 2006; Rodríguez Ramos *et al.* 2008a).

The ceramics analysis of El Caimito, which included X-ray diffraction (Veloz Maggiolo *et al.* 1974), shows a tradition of the use of same kind of clays and a consistency in manufacturing throughout time that confirms local production rather than acquisition by exchange. The diversity of ceramic types throughout the full span of occupation reveals an emphasis on finishing the surfaces of small vessels with small, incised decorations, features that are also found on other sites with early ceramics in Hispaniola.

The presence of ceramics in "Archaic" contexts also reveals interesting nuances in sites such as El Caimito, Musiepedro, Honduras del Oeste, and Punta Bayahibe,

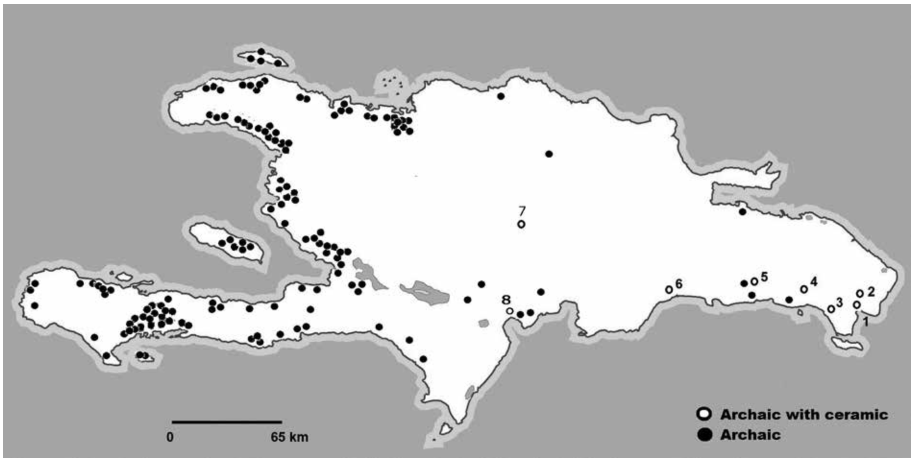

Figure 12.3. Distribution of "Archaic" and "Archaic with ceramic" sites in Hispaniola. Map created using information from Rímoli and Nadal (1984) and Moore and Tremmel (1997). 1. Cueva de Berna; 2. Musiepedro; 3. Punta Bayahibe; 4. La Piedra; 5. El Caimito; 6. Honduras del Oeste; 7. Los Limones; 8. El Curro.

where pottery is diverse and was present throughout their whole occupation. Moreover, ceramics are an important component of the archaeological assemblages of these sites. In other sites, such as Cueva de Berna, Cueva de Los Limones, La Piedra, Cañada de Palma, and El Curro (Figure 12.3), pottery is present only in the upper part of stratigraphic sequences and does not constitute an important component within their archaeological record (Atiles Bidó and López Belando 2006; Ortega and Guerrero 1981; Rímoli and Nadal 1983; Veloz Maggiolo *et al.* 1977; Veloz Maggiolo 1980). In four of these sites, a few fragments of griddles have been recovered (Rímoli and Nadal 1983); their quantity does not necessarily indicate that ceramics were an important part of the material repertoire. On the other hand, the chronology available for some of these sites (Table 12.1), as well as the technological and economic assemblages, are somewhat different.

This information confirms that El Caimito was not an isolated phenomenon. It is part of a complex panorama of "Archaic" sites with ceramics (only eight to date because of scarce archaeological research) located in different areas (Figure 12.3), between the coast and the forest, near water sources and in littorals and inland places. Some of them are associated with concentrations of *guáyiga* (*Zamia* sp.), or species such as corozo (*Acrocomia* sp.), palm tree (*Roystonea* sp.), and even corn (*Zea mays*) (Fortuna 1981), based on pollen and macrobotanical analysis (Nadal 2008; Rímoli and Nadal 1983; Veloz Maggiolo *et al.* 1977). That panorama also indicates that the phenomenon involves "Archaic" groups with different economic and technological orientations, as well as different periods, and therefore they cannot be studied using the traditional forms of organization and interpretation of the data, centered on homogeneous categories.

The Hispaniola panorama also makes it evident that the presence of ceramics and the management of vegetable species was linked to several subsistence strategies of the "Archaic" people, as well as to different sociocultural and environmental condi-

Site	Botanical species	Sample number	Material dated	Radiocarbon	Calibration 2 sigma ranges
Musiepedro		I-8646	Marine Shell (*Citarium pica*; *Lobatus gigas*)	2255±80 BP	130 cal BC – cal AD 285
La Piedra		I-8740 I-8741	Marine Shell (*Crassostrea rhizophorae*)	3585±85 BP 3625±85 BP	1745–1320 cal BC 2205–1750 cal BC
El Caimito	*Zamia* sp. *Roystonea* sp. *Acrocomia* sp.	I-6924 I-7821 I-7822 I-7823	Land Snails (*Pleurodonte* sp.; *Polydontes* sp.; *Caracolus excellens)*	1965±90 BP 1830±85 BP 1865±85BP 2130±85BP	195 cal BC – cal AD 245 cal AD 15–390 40 cal BC – cal AD 350 380 cal BC – cal AD 20
Honduras del Oeste	*Roystonea hispaniolana* *Acrocomia quisqueyana*	unknown	Marine Shell	2310±95 BP	672 cal BC – cal AD 165
Cueva de Berna	*Zamia* sp. *Clusia rosea jacq*	I-5939 I-9540 I-9541	Charcoal Charcoal Marine Shell	3205±90 BP 3840±130BP 3575±90 BP	1690–1260 cal BC 2635–1915 cal BC 1745–1295 cal BC
Punta Bayahibe	*Zamia debilis Coccoloba* sp. *Ziziphus rignoni* *Guaiacum sanctum* *Anona glabra* *Sabal* sp. *Conocarpus erectus* *Cyperus rotundus* *Chrysobalanus icaco* *Ipomeas* sp. *Erythroxylum* sp. *Chamaesyce* sp. *Rachicallis americana* *Opuntia dillenii* *Pereskia quisqueyana*	Beta 199781	Marine Shell	3380±60 BP	1435–1120 cal BC
Punta Bayahibe		Beta 199782	Marine Shell	3530 ±70 BP	1640–1290 cal BC
Punta Bayahibe		Beta 222903	Marine Shell	3550±50 BP	1620–1380 cal BC
Punta Bayahibe		Beta 222904	Marine Shell	3600±80 BP	1755–1365 cal BC
Punta Bayahibe		Beta 222905	Marine Shell	3460±50 BP	1510–1250 cal BC
Punta Bayahibe		Beta 222906	Marine Shell	3150±50 BP	1130–835 cal BC
El Curro	*Zea mays* *Conocarpus erectus* *Rhizopora mangle* *Acrocomia quisqueyana* *Bursera simaruba*	unknown	Charcoal	3400±95 BP	1940–1495 cal BC

Table 12.1. Compilation of botanical species identified and radiocarbon dates from "Archaic with Ceramic Age" sites from Hispaniola. For calibrated dates see Appendix, this volume.

tions. An interesting detail in this regard is supported by recent studies at the Punta Bayahibe site (Atiles Bidó and López Belando 2006) (Figure 12.4). It indicates that pottery in "Archaic" contexts has a wide chronological distribution (Table 12.1), not necessarily linked to the arrival of the Saladoid or limited to a particular region or site, with a traditionally imposed denomination of "Caimitoid". This also indicates that the production of ceramics and the management of botanical resources by the "Archaic" people is not related to a particular settlement pattern or specific technological scheme, but that it is a more diverse, multi-causal phenomenon.

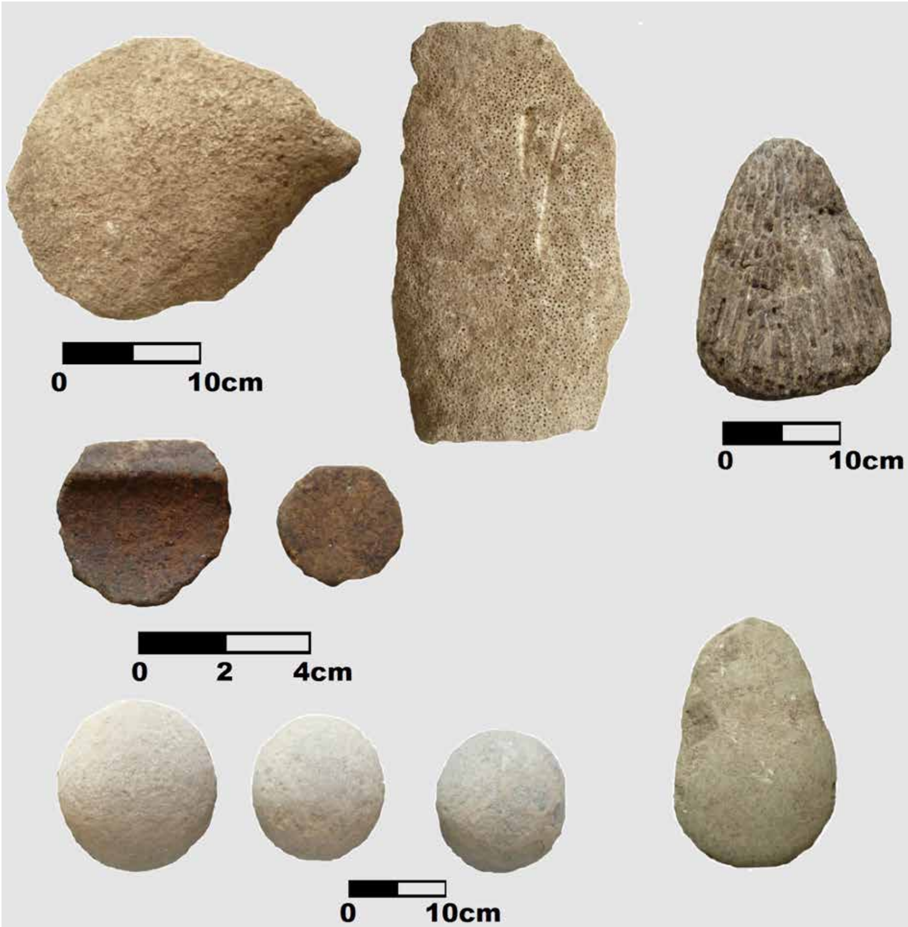

Figure 12.4. Some items from the Punta Bayahibe site.

Conclusion

The traditional tendency in studies of "Archaic" communities in Cuba and Hispaniola has been the use of general criteria to organize, compare, and understand the archaeological record. Initially, the combination of archaeological and ethnohistorical descriptions was used to create and define Ciboney culture, which served as a framework for the study of these communities.

In Cuba, the topic of the "Archaic" has been discussed more than on other Caribbean islands, and therefore the visibility of these groups is not detached from the island's archaeological practice. This visibility has also helped to generate the impression that the high number of reported "Archaic" sites was due to "push" factors produced by the agriculturalist expansion into western Cuba, making that region a repository of marginal groups isolated by a frontier (Rouse 1992, 90–92).

Systematic research in Cuba and Hispaniola in the 1970s began to refute the traditional criteria of the Ciboney and reveal diversity in terms of artifact typology, settlement patterns, relations with ecology and chronology. The new research not only questioned traditional criteria, it also began to reveal, in a consistent manner, the presence of ceramics and intensive management of botanical resources in some of these complexes, bringing up new questions and advancing new ideas about the complexity and subsequent frequency of communities traditionally considered "Archaic", "primitive", or "pre-Agroceramicist".

One of the essential features of this new period of research has been the development of chronologies that question the unilineal evolutionary logic that proceeds from the simple to the complex, and which has an impact on the cultural taxonomy and criteria of social organization of these communities. The advancement of the archaeology of Hispaniola and Cuba has been of special importance in changing the traditional ideas. This includes new forms of cultural relations and temporal and spatial distribution of "Archaic" societies based not only on typological issues, but also on models for the transformation of the environment, the processes of cultural hybridization and transculturation, and the consideration of new migratory routes.

Marxist concepts and categories, such as mode of production, socioeconomic formation, and mode of life, have been adopted to develop a multi-evolutionist conception that considers the close relationship between typology, cultural ecology and historicism and that counters the unilineal evolutionism of traditional models of the Ciboney. Since its incorporation into the archaeologies of Cuba and Hispaniola, the trend has been to create new patterns in which attempts at homogenization persist by using a sociocultural taxonomy.

One manifestation of this homogenization is how new evidence is being used (e.g., the ceramics of El Caimito and Arroyo del Palo, the lithic industry of Canímar and Playitas, Seboruco and Levisa or Barrera-Mordán, etc.) from a normative perspective, which has created new taxonomic schemes (e.g., the Caimitoid series, *protoagricola* stage, Mayarí cultural variant, Canímar cultural variant, Seboruco-Mordán lithic industry, etc.) in which traditional criteria for using and organizing data still prevail.

In other words, it is important to note that comparisons of the "Archaic" communities from an interinsular perspective have received much less attention than later Arawak communities. The result is that the Archaics have been studied more than local phenomena generated by direct migrations and defined based on the presence or absence of typological and ecological aspects. This has produced less focused analysis on social aspects from an archaeological viewpoint, and even its archaeobiological characterization has been insufficient in comparison with the Arawak communities.

Finally, the central topics of this new research trend are the recognition of a pre-Arawak ceramic horizon and the intensive management of botanical resources. Research has shown a wide diversity in both respects; this is not necessarily associated with a specific chronological period, the location of the sites or their artifact typology, as has usually been the practice in Cuban and Hispaniolan archaeology. The diversity in the quantity and characteristics of the ceramics, and the management of botanical resources in different contexts and chronological periods of the "Archaic," indicate that it is not possible to explain those phenomena in Cuba or Hispaniola based on preconceived approaches. The "Archaic" contexts of both islands reflect a dynamic existence related to multiple situations and cultural processes. Nevertheless, better data is still needed in order to understand the post-Saladoid multifocal developments and in what way the "Archaic" societies were involved. But more than anything, we need more refined research that can allow us to leave our comfort zone in an attempt to understand these communities, and to go beyond the historical divisions that exist only in our limited perception of the past.

Acknowledgements

We would like to acknowledge Arlene Alvarez, Antonio Curet, and Alice Samson, whose help made the translation and corrections of the text possible. The research leading to the results presented in this chapter was funded by the European Research Council under the European Union's Seventh Framework Programme (FP7/2007–2013)/ERC Grant Agreement no. 319209. This research is part of the ERC-Synergy project NEXUS1492 in collaboration with the Instituto Tecnológico de Santo Domingo (INTEC).

13

Levisa 1. Studying the earliest indigenous peoples of Cuba in multicomponent archaeological sites

Roberto Valcárcel Rojas, Jorge Ulloa Hung,

and Osmani Feria García

Between the '60s and the '80s of the last century, a phenomenon we could call "Seboruco-Levisa" shocked Cuban archaeology. The Taíno and ceramics began to fall behind, and the study of lithic assemblages and the earliest humans in Cuba and the Caribbean became paramount. It was a revolution in Cuban and Caribbean archaeology in a time of social revolution[1]. Perhaps it would not be an exaggeration to say that, somehow, a revolutionary lithic paradigm was introduced in response to the dominance of the pottery studies promoted by Irving Rouse and "capitalist America". Even so, Rouse's classificatory schemas remained in place, and the normative vision is still present.

Beyond the historic and social background, this phenomenon was a transcendent force that enlivened archaeology in Cuba and the region. It posed new goals in terms of themes, techniques and research methods, the organization of patterns of cultural classification, and the design of archaeological practice itself. Undoubtedly, there were positive gains from this cognitive adventure, which left several by-products in terms of data. One of them was the presence of materials from peoples of the Archaic

1 The Cuban Revolution began in 1959, after the toppling of Fulgencio Batista's regime. In 1961, the Cuban government declared its socialist character. In 1962, archaeological research on the island was institutionalized and soon, together with ample efforts in training and investigation, it revealed its Marxist profile and its alignment with dialectic and historical materialism (Tabío and Rey 1985).

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 177-190.

Age in archaeological contexts of the so-called Lithic Age[2], and the redundant presence of ceramics in some of these spaces, a fact that was never refuted but totally left out of the analysis.

The site that has provided the main data for mapping the chronology of the earliest human presence in Cuba is Levisa 1, with a date that places this period at around 4000 BC. With this information combined with lithic techno-typology referents, even earlier chronological proposals for the island would be reached (Guarch Delmonte 1990; Izquierdo Díaz *et al.* 2015). Fifty years later, the dating of Levisa 1 is still significant, although perspectives on this topic have changed much.

This chapter reviews the archaeological data for the Levisa 1 site. We argue that factors concerning the cultural and chronological organization of pre-Columbian societies, beyond a detailed and deep analysis of the site, have determined the manner in which this location is understood. Although we cannot advance the understanding of the proto-Archaic Age occupation of Levisa 1 and its chronology, we intend to present more detailed information about the Archaic Age component of this space, a subject that has been poorly treated but is nonetheless crucial to achieving a more balanced view of the real nature of the site. Likewise, we discuss these matters with respect to other sites, where communities of different cultural origins and levels of socioeconomic development settled down over time – named multicomponent spaces (Izquierdo Díaz *et al.* 2015, 56) – in the Mayarí-Levisa area.

The pre-Arawak universe in Cuba

At the time when Levisa 1 started acquiring relevance, the view of pre-Columbian Cuba was divided between the so-called Ciboney culture, represented by the Cayo Redondo and Guayabo Blanco cultures, and the Arawak ethnolinguistic groups known as Taínos and Subtaínos. The existence of another cultural group, the Mayarí, was also taken into consideration; this group belonged to an apparently Ciboney context, but with ceramics (Tabío and Rey 1985). At the time, the Guayabo Blanco and Cayo Redondo peoples were estimated to be the first to populate the island. According to some researchers, the Cayo Redondo still existed at the time of European arrival and would correspond to the historical Guanahatabey. This relation is questioned by other authors, as there are no chronological data on the Archaic Age presence at that time (González 2008).

The Guayabo Blanco culture was characterized by the use of artifacts produced from seashells (vessels, spoons, gouges, points, hammers, etc.), similar to those of the Manicuaroid tradition of northern South America. The Cayo Redondo people used many of these seashell artifacts as well as others made of stone (percussors, vessels, mortars, pestles, stone balls, ground-stone daggers, etc.), apparently linked with the

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2 The terms Archaic Age and Lithic Age are defined first of all by the predominance of a chipped stone industry and food gathering and, secondly, by the rise of stone grinding (Rouse 1992, 33). Rodríguez Ramos *et al.* (2013, 133–134) has questioned the notion of a period in which "only flaked-stone tools were being made" and points out the critical implications for such a classificatory system, due to the increasing evidence of plant management and the use of ceramics in contexts recognized as Archaic. Those authors use terms like "pre-Arawak societies" or "pre-Arawak times".

Banwaroid tradition of Trinidad. Although it was recognized that both Ciboney groups evince a chipped stone industry, not much attention was paid to this issue.

The Ciboney of Cuba corresponded to what was later recognized as communities of the Archaic Age (Rouse 1992). Other views held in Cuban archaeology tend to see its various expressions as phases, variants, stages or moments of a so-called *pre-agroalfarera* (pre-Agroceramic) stage (Tabío 1984), an appropriation-economy stage (Guarch Delmonte 1990) or a pretribal economic social formation (Izquierdo Díaz *et al.* 2014). These general stages would include contexts with a prominent chipped stone industry as Levisa 1 and locations like Seboruco 1. It should be noted that some authors assume the artifactual diversity of the Archaic Age is not a matter of cultural differentiation but of environmental adjustment and regional development (Guarch Delmonte 1990; Godo 2001).

The communities of the Archaic Age are located throughout the archipelago, with their earliest expressions dated around ca. 2500 BC (Cueva Funche, 2900–2135 cal BC; Cooper 2007b, and see Appendix, this volume). The archaeological sites are found both on the coast and inland, in present-day riparian areas, mangroves and plains and even in mountain areas, with cave camps and settlements in open spaces. Some of its most representative contexts are in the Cauto River valley and in the south of the present-day province of Camagüey, both in the eastern part of Cuba, as well as in the far western areas of the island (Izquierdo Díaz *et al.* 2014). It is believed that these communities could have arrived from Central America, South America and even Florida, and there are genetic linkages with these populations and those of Hispaniola (Chinique de Armas *et al.* 2016, 126; Coppa *et al.* 2008).

The exploitation of terrestrial and marine resources through fishing, hunting, and gathering was key to their subsistence. They used personal ornaments of bone, shell, and stone, as well as various objects of ceremonial character, some of them as burial offerings, particularly polished stone balls and ground-stone daggers. The management of identity indicators of an apparently ethnic character, such as dental modifications reported in human remains from the Canímar Abajo site, in the western part of Cuba (Alarie and Roksandic 2016; Smith 2016b, 43), is significant. The rock art is also relevant, consisting of paintings and engravings on the walls and ceilings of caves (Izquierdo Díaz and Rives Pantoja 2010). Their main funeral areas, which could have tens or even hundreds of burials, are reported in caves and rock-shelters, although many are reported in mounds in open spaces (Chinique de Armas *et al.* 2016; Guarch Delmonte 1990).

For some sites, the intensity of plant food exploitation can be inferred by the abundance of milling instruments. Thus, the cultivation of plants is dated to around 1200 cal BC by the identification of starches (*Phaseolus* sp., *Manihot esculenta*, Fabaceae family, *Zamia* sp., *Zea mays*, *Ipomoea batatas* and Marantaceae family) in stone instruments and dental calculus or by paleodiet analysis (Smith 2016b). The growing productive capacity of some communities in terms of plant cultivation, efficiency in hunting, fishing, and gathering activities, the persistence in the use of certain sites, spaces and cemeteries, and the management of ecologically rich environments suggest the existence of high-stability groups, either sedentary or in the process of achieving this condition. At the same time, there were also high-mobility groups, with a less complex social and settlement organization, focused on appropriation activities and other dietary patterns; the same diversity occurs in cultural terms (Alarie and Roksandic 2016, 124; Chinique de Armas *et al.* 2016, this volume; Godo 2001).

Ceramics recovered in many of these sites (Jiménez *et al.* 2012), verified throughout the island, is a complex phenomenon, with multiple causes and temporalities. This situation has been archaeologically named the proto-agricultural phase (or stage) (Guarch Delmonte 1990; Tabío 1984). This denomination creates a false image of homogeneity in contexts whose nature can be very diverse and suggests a path to agriculture that does not necessarily have to be related to the production of ceramics. However, the remains of plant foods and evidence of their cultivation have been found in several Archaic Age contexts with ceramics. This information, as well as indications of settlement stability, cultural complexity, and links with Arawakan-speaking groups, point to the circumstance of these communities undergoing a neolithization process (Godo 2001; Pérez Carratalá 2014; Valcárcel Rojas 2008, 10).

It is plausible that by 2000 BC, there were Archaic Age sites with ceramics (Cayo Jorajuria, 2875–2500 cal BC; Cooper 2007b; Jouravleva 2002, 36, and see Appendix this volume). However, more reliable dates have been obtained for the Playitas site (west part of the island), which is dated to around 26 BC (Godo 2001, 66) and around 350 BC in the eastern part of the island (Corinthia 3 site, 135 cal BC – cal AD 185; Cooper 2007b; Valcárcel Rojas *et al.* 2001 and see Appendix, this volume).

Pottery is generally simple and poorly decorated; it is scarce in some places and more abundant in others. There is evidence that, in some locations, it is a local invention, although in others it could have come from external regions such as Hispaniola, North America, and even Colombia or, as in the case of the Arroyo del Palo site, from Arawak agricultural communities present on the island since the seventh century AD. The last case could evince a transcultural process that, at the level of artifacts, could also have contributed griddles and petaloid axes (Godo 1997, 2001; Jouravleva 2002; Pérez Carratalá 2014; Ulloa Hung and Valcárcel Rojas 2002, 174; Valcárcel Rojas *et al.* 2001). Although some authors have stated that the ceramics from Arroyo del Palo are influenced by Arawak communities (Tabío and Guarch Delmonte 1966), crude ceramics different from those of Arawak societies are also reported (Ulloa Hung and Valcárcel Rojas 2002).

The discovery of Levisa 1 and the determination of its chronology have helped to clarify the complex panorama previously seen. However, as discussed in the following sections of this chapter, its link to the so-called Archaic Age, which impacted the site itself, is still an issue to be elucidated.

Levisa 1 and the first inhabitants of the West Indies

The Levisa 1 site is located in northeastern Cuba, in the Mayarí municipality, part of the present-day province of Holguín (Figure 13.1). It is situated in a rock-shelter set at the base of a limestone cliff about 30 meters high. About 50 meters east of the site runs the river of the same name. The site is about 2 km from the sea. The archaeological materials appear in the shelter and in the immediately surrounding area, occupying about 600 square meters.

It was first investigated in 1964 by archaeologists from the Academia de Ciencias de Cuba (Academy of Sciences of Cuba) under the direction of Ernesto Tabío. At that

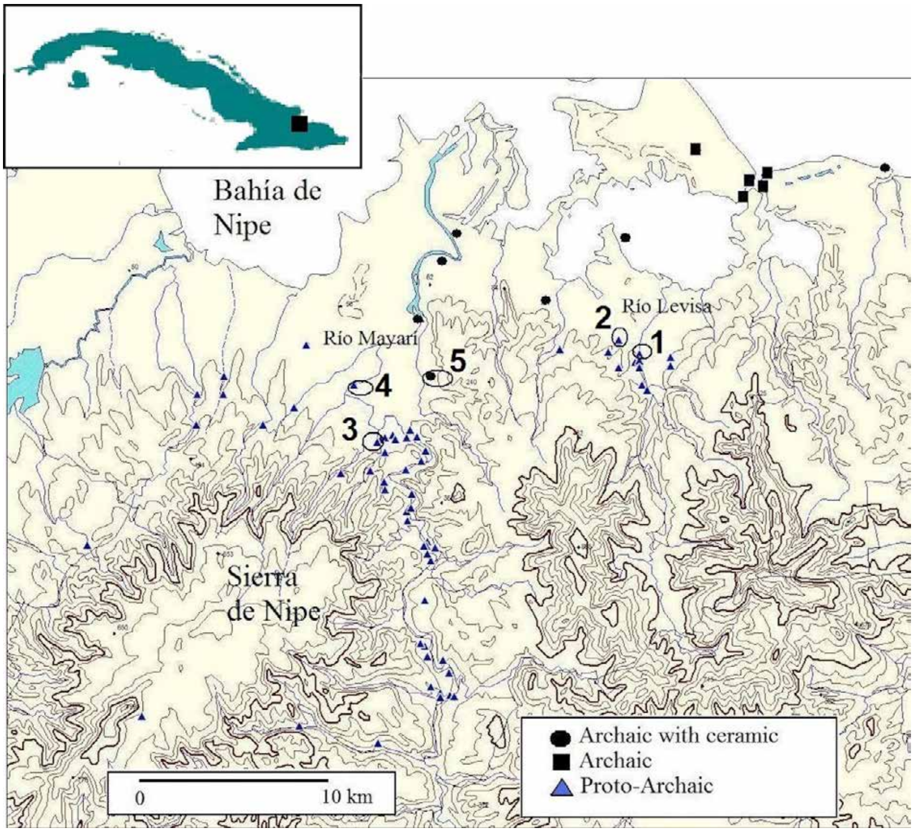

Figure 13.1. Map of the Levisa and Mayarí regions showing the archaeological sites mentioned in the text: (1) Levisa 1; (2) Levisa 8; (3) Seboruco 1; (4) La Línea; (5) Arroyo del Palo.

time, small exploratory pits were excavated in different places, as well as three test units covering an area of 7 square meters, with a maximum depth of 1 m, without reaching base rock. In 1973, the same area of the rock-shelter was studied through a formal excavation unit of 4 square meters, divided into squares of 1 square meter, excavated in arbitrary levels 5 cm thick, reaching a maximum depth of 1.60 m in section I–1 (Pino 1974). Excavation notes indicate that 12 levels or layers were defined; the samples for dating were collected from section or square I–1. The point of maximum depth was level 2.20 m in the H–1 section (Archivo del Instituto Cubano de Antropología, La Habana [AICAN], Levisa 1 Site Record). Archaeologist Janusz Kozłowski (1975a, 195) recognizes the existence of seven anthropogenic layers. Until now, it has been impossible to find information about the true depth of these layers.

From the areas excavated on both occasions, a layer of soil that could have been up to 1 m thick in some parts had been removed, apparently for agricultural purposes. All sediments were drawn from a small cave connected to the rock-shelter, which, according to archaeologist Milton Pino, must have been occupied by indigenous people. Because section I–1 is very close to the wall of the shelter, it is believed that this area should have been little affected, thus being more representative of human occupation at the site (Pino 1976).

In exploratory studies, abundant lithic material was found, mostly blades, which bore some similarity to the one found previously at the Seboruco 1 site, located 15 km southwest and relatively close to the Mayarí River (Guarch Delmonte 1964; Tabío 1964) (Figure 13.1). The site Seboruco 1 – a big rock-shelter of about 2000 square meters, associated with caves containing pictographs – quickly sparked interest in this type of evidence. Large blades of siliceous material were attributed to an intermediate culture between the Taíno and Guanahatabey or the Ciboney Cayo Redondo (Izquierdo Díaz *et al.* 2015, 98; Núñez Jiménez 1948, 1963). A few shell artifacts (gouges, dishes), pecked and ground materials and even ceramics were collected at both Seboruco 1 and Levisa 1.

In the excavation carried out in 1973 by O. Teurbe Tolón, M. Pino, and the Polish archaeologist J. Kozłowski, it was confirmed that chipped flint appeared in all layers. The study by Kozłowski determined the presence of a well-developed blade industry, which decreased from the earliest to the most recent layers. Blade tools such as end scrapers, burins, retouched blades, truncated bladelets, shouldered points, and fragments of specimens with surface retouch technique were very common in the initial layers, particularly layer VII. Tools with surface retouch technique are not present in the intermediate levels (V, IV). In the recent levels (III–I), there are blades, but very few in number; they are replaced by flake tools and denticulate and notched implements, particularly sidescrapers (Kozłowski 1975 a/b, 11; 1980, 67). Two samples from layer VII and layer V were dated to 4335 to 3640 cal BC and 2205 to 1410 cal BC (Cooper 2007b; Kozłowski 1975a, 194; and see Appendix, this volume).

Before these dates were available, Kozłowski had already recognized similarities between the evidence from Levisa 1 and Seboruco 1, on the one hand, and Mordán site materials, in the Dominican Republic, on the other. The latter was considered the earliest site at that time, which, together with the Rancho Casimira site in Venezuela, formed the basis of the so-called "Paleo-Indian" presence in the region, and thus underpinned the discussion of the initial entry of human into the West Indies (Cruxent and Rouse 1969). Based on these similarities, Kozłowski (1975b, 6–12) proposed the existence of an industrial cycle called Seboruco-Mordán.

With these dates and a more detailed analysis of the archaeological material from Levisa 1, Kozłowski inititated a review of the issue. In his opinion, from a typological perspective, the materials from the Mordán site suggested a less ancient industry than that of level VII of Levisa 1, and they proved to be comparable to those of level VI of the same site. The dates and lithic typology of layer VII supported this view, which made Levisa 1 the earliest known site in the West Indies. They also indicated that this industry came to the region in a pretty advanced form (Kozłowski 1975a, 195–196).

The antiquity of Levisa 1 and the characterization of archaeological materials strengthened the legitimacy of previous lithic-type findings from Seboruco. It allowed archaeologists to definitively establish a new and specific cultural complex on the island, completely independent of the traditionally held early cultural groups: Ciboney Guayabo Blanco and Ciboney Cayo Redondo. This situation opened up a new field of study. Thus, the conceptual and methodological point of reference would not be the scientific production of North American researchers, as in previous decades, but that of East European socialist bloc archaeologists, as Kozłowski, who had been involved in these studies and in the training of Cuban personnel. Lithic studies attracted special attention that contributed to singling out Cuba in the West Indian setting, which was the focus of ceramic research at the time and for many years after, in accordance with Irving Rouse's methodology and cultural interpretation of the pre-Columbian world.

In the '80s, the investigation of these communities, which began to be called *proto-arcaicas* (proto-Archaic Age) or early *preagroalfareros* (pre-Agroceramicists) (Tabío 1984, 40; Trzeciakowski and Febles 1981, cited by Izquierdo Díaz *et al.* 2015, 83), strived for systematization and comparative samples, which led to a remarkable level of identification and characterization of chipped stone industries (Febles 1988). Fieldwork extended to the Mayarí River basin, where more than 30 sites were located, while more than a dozen were located in the Levisa River basin. During the 1990s, studies covered different areas of the central and western part of Cuba. The number of sites rose to the hundreds, and according to Gerardo Izquierdo Díaz *et al.* (2015, 19), five complexes were ultimately distinguished: Levisa, Seboruco, El Purio, and Melones – all in Mayarí municipality – and the so-called Western-Central Geoarchaeological Region, which includes sites in the provinces of Villa Clara, Cienfuegos, Matanzas, and Mayabeque.

The intensive research carried out from the 1980s to the present – based not only on techno-typology studies, but also on statistical and archaeometric analysis with a strong national perspective that was greatly influenced by the Cuban archaeologist Jorge Febles – identifies the Levisa complex today as the latest expression of the proto-Archaic Age. Its blade industry is considered smaller in size and diversity than the ones reported for other complexes. Melones is recognized as the oldest complex, with a relative dating of ca. 8000 BC (Izquierdo Díaz *et al.* 2015, 91–94).

Commenting on the Levisa 1 dates

The date of Levisa 1 is a solitary figure because of the lack of absolute dates in other proto-Archaic Age contexts. Apart from Seboruco 1, Levisa 8 (also in Mayarí; see Figure 13.1) and Sierrezuela, in Villa Clara province, there are only workshops or camps where exclusively lithic material is present, or where faunal remains or food waste do not constitute clear anthropic layers (Izquierdo Díaz *et al.* 2015, 117, 162–164). A certain chronological order has been ascertained only for Seboruco 1, but relies on collagen-method dating. Only one out of ten available collagen dates could be associated with the proto-Archaic Age occupation, yielding a reported age of 5800±200 BP. Sediment analysis suggests that the area where Seboruco 1 is located, as well as the nearby sites of Seboruco 2, 3, 4, 5 and 6, could have been occupied by proto-Archaic Age communities between ca. 9000 and 5000 BC (Guarch Delmonte 1981, 100–103, 128). The typology of chipped stone artifacts prompted some researchers to consider Seboruco 1 older than 6000–7000 years (Tabío 1984, 42). Adopting a similar perspective, Melones 10, also in Mayarí municipality, has been proposed as the oldest site on the island, with a chronology that ranges from ca. 8000 to 6000 BC (Izquierdo Díaz *et al.* 2015, 56.).

Kozłowski believes that the stratigraphy of Levisa 1 and the nature of its lithic material traits is consistent with the absolute and relative chronology of the site. His analysis is as follows: in layer I, the most recent and superficial, a fragment of pottery decorated with incised lines can be associated with the Arroyo del Palo site, a location with dates ranging between cal AD 1155–1390 and cal AD 895–1225 (Pino

1995; and see Appendix, this volume). Laminar tools from layers IV and V (dated 2205–1410 cal BC) bear similarities to pieces from the deeper layers (of Archaic Age affiliation) of the Damajayabo site, located in southeastern Cuba and dated 1760–1275 cal BC. Archaeological evidence from level VI in Levisa 1 shows some similarities with that of the Mordán site, which has a maximum date that must be later than that of layer VII in Levisa 1, as was finally confirmed once it was dated to 4335–3640 cal BC (Kozłowski 1975a, 194–196; and see Appendix, this volume).

Although the techno-typological evolution proposed by Kozłowski for Levisa 1 may be debatable – diverging from studies conducted in the last 30 years at other sites, as well as the typological connections he refers to with respect to pieces of Damajayabo and Mordán sites – one must admit some consistency in the Levisa 1 dates. This is reinforced by the dating obtained from shell samples in layer VI (section I–1 level from 0.55 to 0.60 m): 3365–2890 cal BC and 3100–2495 cal BC (Pino 1995; and see Appendix, this volume). Finally, it is true that the earliest date of Levisa 1 corresponds to the West Indian proto-Archaic Age chronologies and the initial occupation of the region: Angostura in Puerto Rico at 5380–4345 cal BC and Vignier 3 in Haiti at 4605–4260 cal BC (Rodríguez Ramos *et al.* 2013, 127; and see Appendix, this volume). However, the Levisa 1 dates have their troublesome side. In a letter to Guarch Delmonte (AICAN, Levisa 1 Site Record, June 27, 1973), Kozłowski says that there were difficulties because the charcoal obtained was too pulverized and should receive special treatment in the laboratory.

Kozłowski discussed the link between faunal remains, studied by Pino (1974), and proto-Archaic Age materials from Levisa 1. He notes a relationship between changes in the lithic industry and modifications in economic behavior. The oldest layers are characterized by the presence of remains related to the hunting of mammals and the collection of terrestrial mollusks. These activities were gradually replaced by the collection of marine mollusks and fishery (Kozłowski 1975a, 1980). However, the complex scenario of over 300 sites related to the proto-Archaic Age lithic industry has raised questions about the dates of Levisa 1. There is no evidence of faunal remains, hearths or any other domestic activity at these sites. There is also the fact that at almost all of the few sites with faunal remains and hearths, the archaeological contexts show a strong alteration plus the presence of different cultural components, as in Levisa 1, Levisa 8 and Seboruco 1. Under these circumstances, the dating of Levisa 1 was seen as a weak. As Izquierdo Díaz *et al.* (2015, 57) believe, "There is a broad consensus among the community of Cuban archaeologists that the datings from Levisa 1 and Seboruco 1 are increasingly inconsistent for the society to which they apply. It is demonstrated every day that the samples obtained from multicomponent sites cast doubt on their authenticity and chronological range. Actually, it is not known for certain what cultural component was dated in Levisa 1" [translation by authors].

Levisa 1 and the multicomponent sites in Mayarí

According to the fieldwork notes from the surveys in Levisa 1 in 1964, no less than three gouges, one at a depth of 0.45 m, and a mortar were recovered. Several pottery fragments were found on the surface and in the top stratigraphic layer. Next to the river, decorated ceramic fragments were obtained, including one with perpendicular

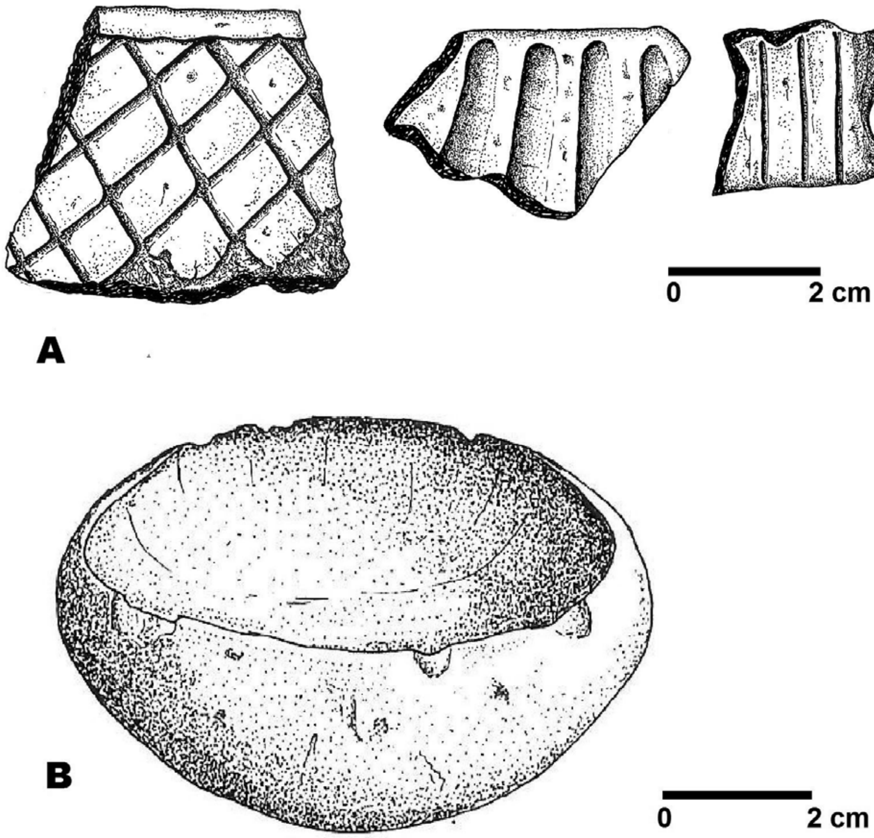

Figure 13.2. Materials from Levisa1. (A) decorated ceramic; (B) stone vessel (Modified from Valcárcel Rojas et al. 2000).

linear incisions, another with incisions and a band of paint or red slip and a third with crosshatched line incisions (Guarch Delmonte 1964; Tabío 1964). During the excavations of 1973, a decorated fragment with incised oblique lines similar to materials from the Arroyo del Palo site was obtained at a depth between 0 and 5 cm. In layers II, III, and IV, several shell pieces were found: a gouge, a highly polished point, two vessels, a pendant and several microbeads (Kozłowski 1975a, 184–187; Pino 1976).

In 1997, Valcárcel Rojas analyzed a collection of materials from Levisa 1 deposited in the municipal museum of Mayarí and obtained by amateur archaeologist Yanet Sánchez in uncontrolled excavations he carried out at the site in the 1990s. The collection involved abundant lithic material, particularly blades; it also included 124 stone artifacts, shells and ornamental and utilitarian ceramics. Among the stone pieces, 39 discoid beads were identified, a disc-shaped object, a hammer in pebble, a polished stone vessel, and an elongated pendant. Regarding bones, the collection contains one tubular-shaped bead and 21 fish vertebra beads, 13 shell gouges and eight disc-shaped beads. There is also a disc-shaped coral pendant, as well as a tabular pendant and five disc-shaped beads made of a material that is still unidentified. Pottery includes 23 non-decorated sherds and three decorated ones, with incised crosshatch lines in one case and lines perpendicular to the rim in two others (Valcárcel Rojas *et al.* 2000) (Figure 13.2).

For some researchers, the ceramic decorations from Levisa 1 recall the materials from Arroyo del Palo. However, the report of gouges and other shell artifacts in intermediate layers – without presence of ceramics – suggests that there might have been a non-ceramic Archaic Age occupation, independent of the proto-Agriculturalist and proto-Archaic Age occupation. In any case, it is obvious that the abundance of these materials clearly associated with pre-Arawak communities indicates that they are not intrusive components, and that different peoples occupied the place.

A similar situation was found at Seboruco 1. Pino (1991) summarizes the data for the site: regarding shells, he reports the finding of 12 gouges, a point, a vessel, a microbead, and a pendant. Stone artifacts include an oval pendant and a disc-shaped piece, several pestles, and mortars. A bead of fish vertebra was also located. The discovery of different types of coloring material (limonite and red ocher) is also significant.

Pino says that these objects appear on the surface or in the initial layers, at 40 cm depth maximum, as frequently in the caves as in the rock-shelter. In his opinion, they could be a late acquisition of the proto-Archaic Age or belong to the Archaic Age people who occupied the site. Tabío (1964) mentions the discovery of a few fragments of pottery, but he does not describe its features. Guarch Delmonte (1981, 137) refers to two beads from seal teeth (*Monachus tropicalis*). The information about several burials is important; one of the skeletons is dyed in red, similarly as in the Archaic Age burials in Cuba (Izquierdo Díaz *et al.* 2014). The features of one of the skulls are also similar to those found at Archaic Age sites (Rivero de la Calle and Díaz 1980).

The Levisa 8 site was discovered in 1984, at a distance of 1.4 km northwest of Levisa 1. It consists of a large workshop with a large amount of macroliths on the surface (large cores, points, knives, and blades up to 33 cm in length). It is set at the entrance to a cave named Santa Rita, where several anthropic layers with faunal remains were detected. Archaeologists who excavated the cave reported crude ceramics in the upper strata, in their opinion similar to that of the so-called proto-Agriculturalist communities, together with some fragments of cassava griddles. Typical proto-Archaic Age chipped stone is found in all the strata, but it becomes more noticeable in the middle and lower layers. On the wall of the cave, 16 meters from the entrance, a petroglyph depicting a human head was located. Some researchers considered it similar to a *guaysa* or *caratona*, a typical Arawak "Taíno/Subtaíno" item (Febles and García 1984; Febles Dueñas and Guarch Rodríguez 1985).

Archaeologist Jorge Febles directed a controlled excavation in the cave. Ceramics were located in at least nine squares (1 m square each); these consisted of 56 sherds and two vessel rims. Stratigraphic data of 43 pieces are available. This material is concentrated on the surface and at a level of 0.00–0.10 m, although a few sherds appear at a level of 0.30–0.40 m. We have no data on the stratigraphy or conservation status of the excavated archaeological contexts. There are only two fragments with decoration: double incised lines, shallow and parallel to the rims. The two rims are straight with interior beveling. Pottery fragments are thin, generally between 4 and 5 mm-thick, brown in color, with incomplete baking and grainy paste. A 25 mm-thick fragment of a possible cassava griddle was analyzed, and is distinguished from the potsherds by its fine, compact paste and complete oxidation.

Figure 13.3. Shell gouge from Levisa 8 (Photograph by Roberto Valcárcel Rojas).

Among the material at the site, there is also part of a gouge (Figure 13.3), a pestle, and several hammers in pebbles.

It is difficult to assign these ceramics to a specific cultural group, although the technology of the fragment believed to be part of a cassava griddle fits with the pieces known to belong to Arawak communities in Cuba. In iconographic and stylistic terms, we can say the same about the anthropomorphic petroglyph.

Another little-known multicomponent site is La Línea, located 3.2 km north of Seboruco 1, at a high point close to the Mayarí River. So far, only Guarch Delmonte (1981, 159–162, 185–187) has assessed the place. Although it was only cursorily explored, Guarch Delmonte considers it an indigenous settlement of around 30,000 square meters. Faunal remains and ash concentrations were found, as well as an industry of chipped stone similar to that of the later stages of Seboruco 1. Ceramics similar to those of Arroyo del Palo, which include some decorated fragments with incisions perpendicular to the rims and three shell gouges, were also collected. Unlike other multicomponent sites, Guarch Delmonte believes that the proto-Archaic Age presence is apparently later than the proto-Agricultural or Archaic Age component.

Summary and conclusions

After the 1973 studies and the papers in which Kozłowski (1975a, 1980) presented a summary of his work on the site and its data, Levisa 1 was neither excavated again in detail, nor has emphasis been placed on the evaluation of the radiocarbon dates. In fact, there is a lack of interest in the issue due to the appearance of new materials and proto-Archaic Age sites. These show not only the diversity of the proto-Archaic Age society and its lithic industry, but also the possibility of much earlier expressions. Either way, as no new absolute dates have been obtained, Levisa 1 has remained the principal benchmark for ascertaining the period of the proto-Archaic Age archaeological setting in Cuba.

In the long term, this location has become trapped in the narrative of the search for origins, so common in archaeology, as discussed by Lucas (2005), and characterized by the interest in defining the essence of something – in this case, the beginning of human presence in Cuba and the Antilles. The discourse around the site gradually put aside any given detail out of its primordial profile, particularly the report of objects that were considered outside the proto-Archaic Age pattern.

The multicomponent character of this and other proto-Archaic Age sites is not common, but is sufficiently clear from the data we have referred to. Except for La Línea, at which the lack of controlled excavations has made consistent evaluation a difficult task, none of the other sites mentioned (Seboruco 1, Levisa 1 and Levisa 8) represent an accidental phenomenon. They show archaeological contexts that perhaps involve more than one type of cultural component apart from the proto-Archaic Age itself. This has been recognized by various researchers, particularly Izquierdo Díaz and associates (2015), but few authors have examined the nature of this matter. To Guarch Delmonte (1981, 110) the presence of Archaic Age-related materials in Levisa 1, Seboruco 1, and La Línea is due to a process of transculturation in which Archaic Age and proto-Archaic Age groups interacted. In his opinion, this occurs at Levisa 1 around 1000 BC. This author also believes that people carrying ceramics similar to that of Arroyo del Palo were at the site and interacted with the proto-Archaic Age people.

Kozłowski viewed the presence of blades, typical of the proto-Archaic Age, at Archaic Age sites (Damajayabo, Cueva Funche; likewise, in such proto-Agricultural sites as Arroyo del Palo and Mejías) as an indication of exchange. This would thus be a feature of the first stage of interaction between the two cultures, which arose during the second millennium BC. During the second stage, toward the end of the first millennium BC, as in the case of Levisa 1, the appearance of Archaic Age artifacts in proto-Archaic Age sites and the transformation of its tools is witnessed. Kozłowski considers this evidence of acculturation of the proto-Archaic Age society (Kozłowski 1980, 73–74).

In Guarch Delmonte and Kozłowski's analyses, the idea that the proto-Archaic Age and Archaic Age societies are very similar, existing in parallel, is latent. Kozłowski (1975b, 12) even suggests a proto-Archaic evolution process in connection with Archaic Age groups, which leads to the incorporation of ceramics. However, such valuation is only at the level of artifacts and cultures, and there is always a large margin of doubt, since the analysis is based on contexts that have been too altered (Seboruco 1) or on small excavation areas (Levisa 1). On the other hand, specific interaction mechanisms receive little attention, and there is a tendency toward thinking of the proto-Archaic

Age presence as lasting for millennia, at least in Kozłowski's perspective, in view of typological features whose chronological evolution is based on information obtained from a small space of a single site (Levisa 1).

The early proposals of these authors regarding the processes of interaction and cultural mix is valuable, particularly at a time when diffusionist and evolutionist considerations were so popular. While the contemporaneity of and interactions between proto-Archaic Age and Archaic Age groups is possible, the exchange processes that transported proto-Archaic Age artifacts into Archaic Age contexts with or without ceramics should be proved as well. In any case, it is clear that some of the places frequented by the proto-Archaics were of interest to many posterior indigenous populations. Different cultures found a connecting point there in terms of environmental and spatial references, although these societies did not necessarily have a parallel existence.

The Levisa 1, Levisa 8, Seboruco 1, and La Línea sites are very close to each other and share a transitional landscape, at some distance from the sea where the coastal plain ends and the mountains begin. The first three sites are associated with cave formations, and all of them are close or relatively close to the most important river basins in the region. Those locations are of great environmental interest, as natural shelters from which access to several settings is possible.

They are very special locations in terms of converging societies. While it is noticeable that the Archaic Age and proto-Agriculturalist sites are located on the coastal plain, the proto-Archaic Age societies tended to move away from the sea; they grouped or dwelled near the mountains, but always close to the rivers. In this setting, the studied sites are located in a contact zone where the Archaic Age presence ends, and the proto-Archaic Age presence begins. There are no reports of Agriceramicist or Arawak sites in the area, although materials from these communities have appeared in isolation.

As there are so many doubts concerning the chronology, availability and accuracy of the data, a more obvious facet of a possible connection should be assessed, although not excluding the possibility of multiple links and interactions. This would entail the processes of reuse of proto-Archaic Age artifacts and spaces by Archaic Age, proto-Agriculturalist and Agriceramicist groups. The attractiveness of these locations, given their centrality and potential for shelter and access to multiple environmental resources, should also include their character as repositories of valuable artifacts, perhaps seen as old and associated with ancestors. With these objects and others, the memory of the societies that frequented such places at other times might have been maintained. The new occupants could recognize and promote this memory and create new ones. Beyond simple reoccupation, a possible synergy in which the abandoned materiality and special essence of the place as space for prior life was captured. Under these circumstances, the key points would pertain to the cultural and natural landscape of the region, fully identified in the constructions and narratives of the environmental surroundings by different people over the centuries. This idea of important places in indigenous memory finds another example in the Canímar Abajo site, a location with a cemetery that, after an apparent abandonment of this function, again served as the establishment of a funerary area for Archaic Age communities 1200 years later (Roksandic 2016, 82). In Levisa 1 – and probably in other multicomponent sites of Mayarí – we could have a space where the objects were read through their use, as *traces* of memory, treated in the sense by Jones (2007, 21). At the same time, we would be faced with a vehicle of memories activated in different ways, and a key site for multiple cognitive maps and wayfindings (Ingold 2000b) generated over centuries.

In essence, the multicomponent nature of these locations preserves multiple possibilities of existence and link the capacities of the people who inhabited them; it is very important to understand the complex nature of such spaces. The issue of antiquity is only one more aspect in a set of connections, meanings, and memories, which makes these places unique symbols of the enormous wealth and diversity of the precolonial universe of Cuba.

Acknowledgements

The research leading to the results presented in this chapter was funded by the European Research Council under the European Union's Seventh Framework Programme (FP7/2007–2013)/ERC Grant Agreement No. 319209. This research is part of the ERC-Synergy project NEXUS1492. The text was prepared during the first author's postdoctoral stay at the Instituto Tecnológico de Santo Domingo (INTEC), Dominican Republic. We want to thank the Instituto Cubano de Antropología and the Departamento Centro Oriental de Arqueología for granting us access to their scientific archives. We would also like to acknowledge Gerardo Izquierdo, Ulises González, and Elena Guarch Rodríguez, whose support in providing information from their institutions has been a great asset.

14

Situating Jamaica

William F. Keegan

Jamaica is an enigma, or at least, a lacuna. There are currently no archaeological sites known on Jamaica that conform to the material expressions identified for the Lithic and Archaic Ages in the rest of the Caribbean (Rouse 1992). The island is comparable in climate, vegetation, topography, lithic sources, indigenous fauna and most other measures to the other large islands in the Greater Antilles (i.e., Cuba, Hispaniola, and Puerto Rico). There is no apparent reason why people reaching Jamaica would not find it an equally logical place to settle (Allsworth-Jones 2008; Atkinson 2006).

There seem to be two explanations. The first holds that definitive evidence for the Lithic and Archaic Ages will be found in Jamaica if we just look for it more carefully. Although it is virtually impossible to prove that something did not happen, archaeological surveys by avocational archaeologists James Lee[1] and George Lechler[2], the Jamaica National Heritage Trust (JNHT) archaeologists and others have not revealed any sites from this time period (ca. 5000 BC to 500 AD). Substantial construction projects, especially in coastal areas, are equally null (Richards 2006).

It is possible that sites from this time period are now submerged due to sea-level rise or tectonic activity. Recently, Ivor Conolley identified three possible "pre-Ceramic" sites in eastern Portland Parish, close to Long Bay and Manchioneal (Conolley 2016). Ross Craig 1 (North Booby Point site) was discovered by Dianne Frankson, Serestse Crooks, and Claire Woods in 1997. Ross Craig 2 is a submerged site identified in 2010, along with Ross Craig 4, about 1 km inland, and the historic Ross Craig 3 site. The sites yielded unmodified "hammerstones and metates" and water-worn

1 The late James W. Lee was a geologist and the founder and former president of the Archaeological Society of Jamaica. An avid avocational archaeologist, he actively searched for and recorded archaeological sites, produced important field notes, published accounts of his work and assembled an important collection of artifacts. His papers and collections were donated to the University of the West Indies, Mona. An outstanding description of the collection was published by Dr. Philip Allsworth-Jones (2008).

2 The late George Lechler was Technical Director of Explosive Sales and Services in Jamaica. An avid avocational archaeologist, his field technicians worked on most of the major construction projects in Jamaica over the past 50 years. He accumulated an important collection by encouraging his employees to watch for archaeological materials.

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 191-200.

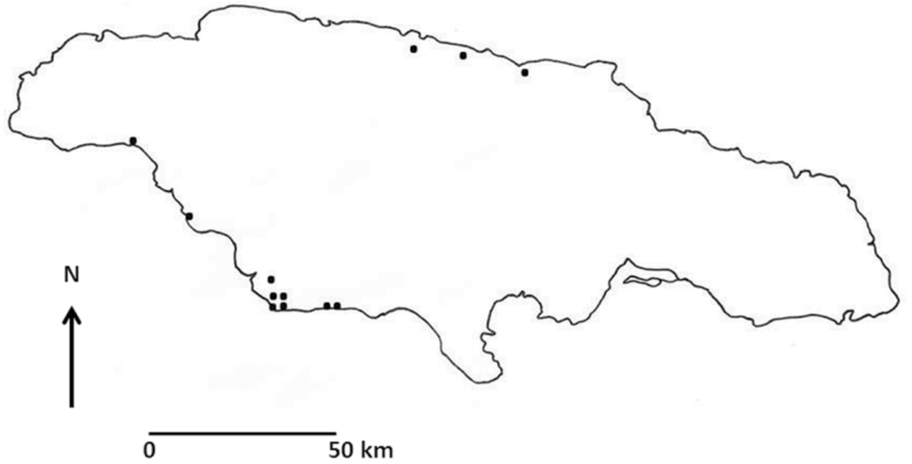

Figure 14.1. Approximate location of known redware sites in Jamaica (After Lee 1980; in Atkinson 2006).

Lobatus gigas columellas and other parts of the shell. There was no pottery or fauna. Radiocarbon dates on shell "tools" returned modern dates (Ivor Conolley, personal communication, 2017). In my opinion, the photographs of artifacts that Conolley generously provided are not sufficiently diagnostic to warrant their identification as Archaic Age artifacts.

The lack of evidence, despite decades-long observation by amateur and professional investigators, is used to support the alternate conclusion that no one reached Jamaica until after the beginning of the Ceramic Age (Atkinson 2006).

Yet this is a false dichotomy. It assumes that the criteria used to define technological ages are accurate (i.e., stone tools versus pottery, foraging versus farming), and it ignores the potential for a transitional phase between ages. This presents a third option: "Archaic Age" colonists reached Jamaica at a late date (ca. AD 600), after they had already adopted redware pottery and horticultural techniques (Figure 14.1). The timing of this transition coincides with the final phase of the Pre-Arawak Pottery Horizon (Rodríguez Ramos *et al.* 2008a), and recognizes that cultigens are present in Archaic Age contexts (Pagán-Jiménez 2013).

To appreciate this transformation, we need to redefine the conceptual framework. In addressing how the term "Archaic" is defined, R. Christopher Goodwin (1978) recognized three distinct and separate perspectives: first, the Archaic as an *age*, defined by the absence of pottery and the presence of ground-stone and/or formal shell tools (e.g., Rouse 1992); secondly, the Archaic as a developmental *stage*, characterized by a marine-oriented subsistence that followed a terrestrial hunting-based economy (e.g., Willey 1976; Willey and Philips 1958); third, the Archaic as an *economic pattern*, defined by an emphasis on marine mollusk collecting (e.g., Davis 1982). These three distinct perspectives will be examined in turn.

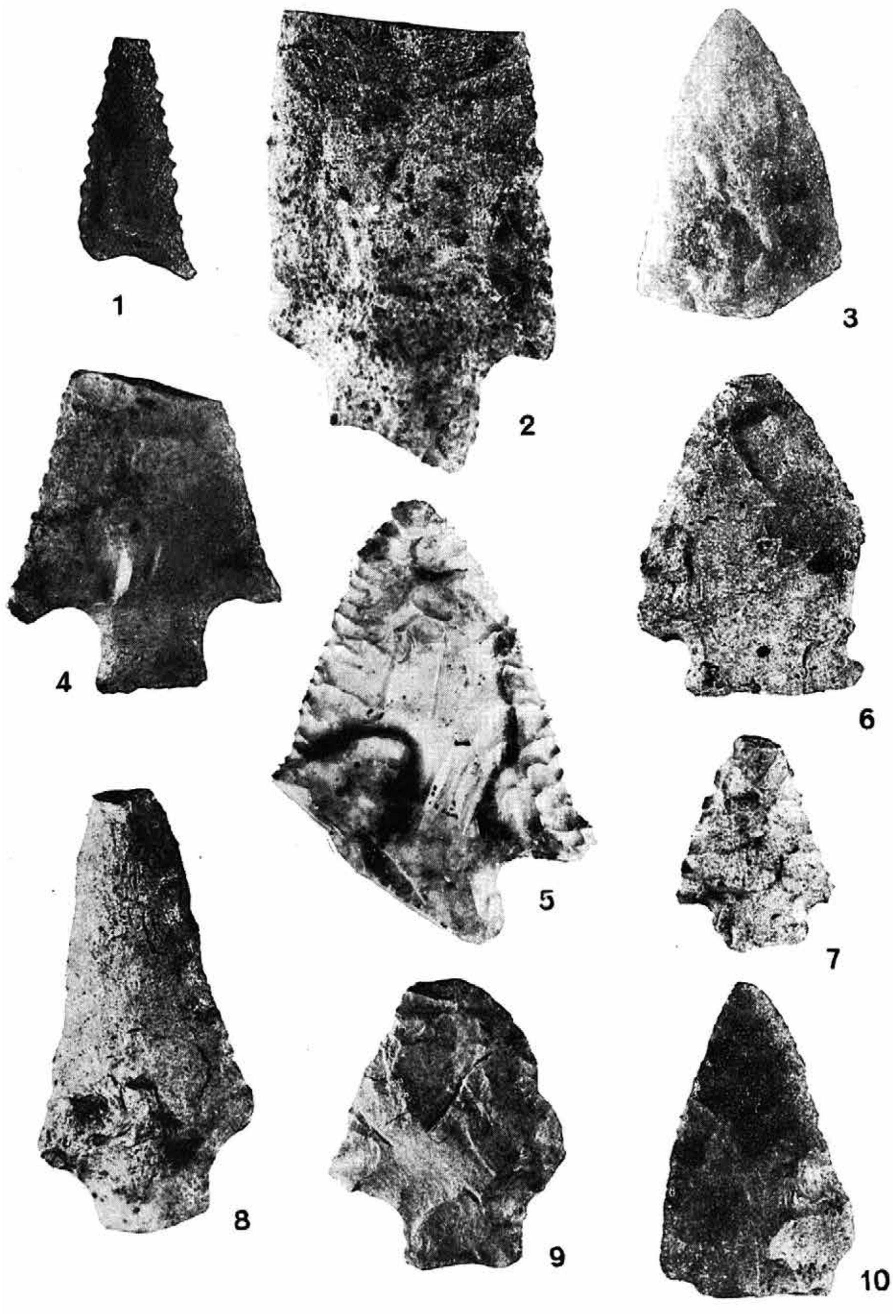

Plate XIII.

OLD HARBOUR, JAMAICA.

Stone points.

G. M. Coll. 1927.26. Figs. 1—10 (27.26.42, 8, 44, 20, 3, 21, 41, 6, 43 and 18).

Figure 14.2. Stone points from Old Harbour with Ripley Bullen's marginal note (bottom right): "All Florida types, prob[ably] planted" (Lovén 1935, Plate XIII). [This figure is included because some researchers have mentioned them, but are unfamiliar with the actual collection. It also includes Ripley Bullen's handwritten marginal note.]

Age

Irving Rouse introduced the concept of "age" as means for chronological control at a time before radiocarbon dating was available. For Rouse (1972, 260), age is "a section of a chronology that is demarcated by the first appearance of innovations such as bronze (at the beginning of the Bronze Age) and iron (at its end)." In the Caribbean, this translated to flaked stone (Lithic Age), ground stone (Archaic Age), and pottery and agriculture (Ceramic Age). If cultural development on Jamaica fits one or all these ages, then we would expect to find material correlates. So, what is the evidence?

Stone dart points from Old Harbour

Old Harbour is located on the south coast of Jamaica to the west of Kingston. It is the location most often cited as possible evidence for an Archaic Age assemblage. I could find no evidence that the "site" (if it exists) was ever excavated, and James Lee was unable to locate it (Allsworth-Jones 2008, 11). Lovén reports (1935, 219): "In 1920, when Captain A. F. Scholander of the Swedish R Navy was in Jamaica, he had the luck to obtain 75 arrowheads from a Swedish sailor who asserted that he had found them in a mound near Old Harbour." The points indisputably match projectile points from Florida (Figure 14.2). Ripley P. Bullen's marginal note (bottom right) reads, "All Florida types prob[ably] planted." Dr. Neill Wallis, Curator of Florida Archaeology at the Florida Museum of Natural History, confirmed that these are typical Middle Archaic points from Florida (Neill Wallis, personal communication, 2016). The Middle Archaic in the southeastern U.S. dates to between 5900 to 4350 cal BC (Anderson and Sassaman 2012, Table 1–1).

Allsworth-Jones mentions that bifacially worked stone points were found at the Green Castle site (11), but the site also contains pottery with crosshatch designs. With Trinidad as the sole exception (Harris 1991), there is no evidence for this type of projectile point anywhere else in the Caribbean. It is likely that the Old Harbour points were part of the sailor's personal collection, and were ascribed to Jamaica to increase their value. I had a similar experience in Haiti. Among a large private collection of "Taíno" artifacts, there were three projectile points. I could hardly contain my excitement until the collector informed me that they had been obtained in Florida.

Flaked- and ground-stone tools

J. A. Duerden's (1897) late-nineteenth-century review of Jamaican archaeology describes flaked-stone flints as follows: "In most shell-heaps flaked flints are found. They are generally small fragments, an inch or so across, broken off some large block, but now and then a core is met with, showing where flakes have been struck off. The flint is of the same character as that occurring abundantly in the White Limestone in most districts of the island. The significance of the flakes is somewhat doubtful, as shaped flint implements are not known in Jamaica. Most probably they were used as knives and scrapers" (available in Allsworth-Jones 2008, Appendix D, pp. 212–213). The flaked-stone flints that he describes are common expedient tools in the pottery-bearing deposits at both the Paradise (ca. AD 689–983) and Sweetwater (ca. AD 1301–1517) sites at Paradise Park, Westmorland Parish, southwestern Jamaica (Keegan *et al.* 2003). This technology is not restricted to the Archaic Age (Keegan and Hofman 2017).

Duerden describes three ground-stone "axes," which I believe were actually used as hoes. One is roughly shaped and possibly unfinished; one has T-shaped hafting surface; and one, measuring 9 by 5 inches, is highly polished, has a grooved neck and is made of diorite (Allsworth-Jones 2008, Appendix D, pp. 257–258). They are only superficially similar to grooved-stone axes from the Lesser Antilles (Harris 1983). A single, unprovenienced pestle is described and illustrated (Allsworth-Jones 2008, Plate IV, Figure 1, 259): "It is 5 inches in height, 2¾ inches across the base, and made of some heavy, basic, igneous rock. The head projects a little forward and carried two very prominent eye cavities with thick rims. No attempts are made to represent the ears, mouth or nose. Representations of arms extend from large, relief shoulder-blades, first down the sides of the body and then turn inwardly almost at right angles. The base is rounded and shows evidence of having been used for pounding." Finally, a "massive" spindle-shaped roller and an oval roller are described and illustrated, and a variety of smaller examples are noted (Allsworth-Jones 2008, 260). It is suggested that these were used with metates. There is a three-legged metate carved from a single block of dolerite (Allsworth-Jones 2008, 260), while a second one has a crude head resembling that of a turtle (Allsworth-Jones 2008, Plate IV, Figure 6). These artifacts are not typical of Archaic Age implements.

Allsworth-Jones (2008) does not describe any flaked- or ground-stone tools in the Lee Collection. It might be noted that there is a collector who has circulated photographs of what he purports to be stone blades, but these are undoubtedly modern creations. In sum, there are no archaeological sites, *at the present time*, at which only flaked- or flaked- and ground-stone tools occur. Using Rouse's definition of age, the earliest occupation of Jamaica occurred during the Ceramic Age (see also Keegan and Hofman 2017; Wesler 2013).

Stage

A stage is "the level of development achieved by ethnic groups in one or more traditions" (Rouse 1972, 295). The stage concept often is expressed in terms of band, tribe, chiefdom, and state. These have been somewhat arbitrarily applied in the Caribbean and are not particularly useful at this point in time (see reviews in Boomert 2000; Keegan 1994, 2000; Keegan and Hofman 2017; Torres 2013).

Economic pattern or *modo de vida*

Practitioners of this approach focus on cultural systems and emphasize *modo de vida* or "way of life" in developing their classifications (Keegan and Rodríguez Ramos 2004). This approach is characteristic of research conducted by archaeologists in Cuba, Dominican Republic, and Venezuela, where their scholarship has been influenced by Marxist theory through the Latin American Social Archaeology school of thought (Ensor 2000; Veloz Maggiolo *et al.* 1981). The product is socioeconomic stages of development that progress through a sequence of dialectical transformations. This orientation has recently come under internal criticism for being a classification scheme that focuses on economic development and history in which economic stages are fixed and static, and limited attention is given to transitions between stages (Torres Etayo

2010; Ulloa Hung and Valcáracel Rojas 2013). The human ecodynamics approach used by Isabel Rivera-Collazo is one method for improving the capacity to investigate transformations (2011b, this volume; Rivera-Collazo *et al.* 2015).

The *protoagrícola* economic pattern (incipient agriculture) that has been identified in Cuba merits consideration. This *modo de vida* is considered transitional between *modo de vida preagroalfarero* (Archaic Age) and *modo de agricultores ceramistas* (Ceramic Age). Incipient farming is observed throughout the Greater Antilles (Jamaica excepted), where it is recognized by the occurrence of pre-Arawak pottery in association with Archaic Age artifact assemblages (Rodríguez Ramos *et al.* 2008a). The sites of Arroyo del Palo and Mejías (Cuba), for example, contain simple pottery in association with fishing and gathering implements. These implements include a variety of expedient and formal tools made from marine shells, alongside various lithic artifacts. The assemblages found at different sites contain diverse combinations. While some archaeologists attribute this diversity to seasonal activities and adaptation to distinct environments (Ulloa Hung and Valcárcel Rojas 2013, 238; Veloz Maggiolo and Vega 1982), others have sought their origins outside the Caribbean islands. For example, lithic assemblages from Aguas Verdes, Caminar, and Playitas (Cuba) have been likened to those at Jaketown in the Mississippi Valley and Momil I in Colombia (Febles 1991).

Chronology presents a significant challenge for the interpretation of cultural developments. There are only two radiocarbon dates for redware sites in Jamaica (out of a total of 32 for the whole island), and few of these pass the tests of chronometric hygiene (Fitzpatrick 2006). The situation in Cuba is almost as challenging. The earliest Ceramic phase in Cuba has been dated to the ninth century AD based on uncalibrated radiocarbon dates from the El Paraíso and Damajayabo sites of AD 820 and AD 830. When these dates were calibrated, they shifted to AD 1084–1146 at 1 sigma (Persons 2013, 98). The importance of these cases is that the true Ceramic Age may not have begun in these islands until AD 900 at the earliest. This date is consistent with earliest dates for White Marl (Meillacoid) in Jamaica (Wesler 2013). [However, other calibrations suggest that Meillacoid pottery in this area could date to the seventh century AD (Cooper 2007a)]. If the available dates do provide a reasonable approximation, then the *protoagrícola* economic pattern lasted a millennium longer than in other parts of the Caribbean, which suggests that unique forms of transculturation must have occurred.

In the neighboring Bahama archipelago, current evidence suggests that these islands were first colonized by *protoagrícola* communities from Cuba who recently had adopted a somewhat greater dependence on pottery vessels (Keegan 2017). They arrived in the central Bahamas in the early eighth century AD and spread rapidly through the archipelago (Berman and Gnivecki 1995; Berman *et al.* 2013).

Why not Jamaica?

For the earliest time period, beginning around 4000 BC and extending to the mid-seventh century AD, there is no evidence that anyone visited or settled on Jamaica. The absence of material remains has been attributed to the failure of archaeologists and avocational collectors to find the earliest sites. The possible reasons range from geomorphic transformations to a lack of systematic archaeological surveys, but none of the justifications are particularly satisfying. Private collectors have engaged local laborers

Figure 14.3. Target plots from north and south Belize, the location from which Lithic Age colonists are thought to originate. These travel vectors enclose routes that would have encountered Jamaica or the Cayman Islands. Because there is no evidence for contact with either, the actual route(s) must be outside the target plots. This exercise suggests that the initial colonization of Cuba must have occurred no further east than Camagüey Province.

to find and procure objects of interest, and academic archaeologists have conducted research on the island for over 150 years (Keegan and Atkinson 2006; Wesler 2013). The most valued raw materials for the Archaic Age, including high-quality chert, are widely available on the island, and there are no obvious reasons why Jamaica would not have been settled if it had been discovered. Richard Callaghan (2008) has commented on the difficulty in reaching Jamaica during the earliest episodes of migrations in the islands, as well as similar difficulties in the Guadeloupe Passage during later times (Callaghan 2013). He suggests that direct movement from South and Central America across the Caribbean Sea was the optimal path to reaching the islands of the Greater Antilles (Callaghan 2001). In this regard, Jamaica's invisibility in terms of viewscapes from other shores (Torres and Rodríguez Ramos 2008), combined with wind and current patterns, made Jamaica a less accessible target. The crossing apparently was not made until a new phase of open-water crossings, known as the Ostionoid expansion, began around AD 600.

If Jamaica was not visited by humans until around AD 600 (Atkinson 2006; Wesler 2013), and the neighboring Cayman Islands were not visited until Columbus sighted them in 1503 (Scudder and Quitmeyer 1998; Stokes and Keegan 1996), then the area in which the first settlements on Cuba were located can be inferred. Belize has been suggested as the continental area with Lithic Age artifacts that most closely resemble those recovered in the Greater Antilles (Wilson *et al.* 1998), although not everyone agrees (Callaghan 2001). Jamaica and the Cayman Islands cast a giant voyaging shadow across Cuba and Haiti (Figure 14.3). This shadow restricts the possible voyaging corridors between the islands and mainland in the 5000 years before Jamaica was settled. In other words, none of the voyages from the mainland to the islands, or from the islands to the mainland, crossed the Jamaican or Cayman viewscapes before around AD 600. Voyages must have been restricted to western or eastern Cuba.

Conclusions

Research in the Caribbean has tended to emphasize the age concept, with each new technological age quickly replacing the previous. A more likely scenario begins with a Lithic Age represented by large chert (Pantel 1988). Some blades were used as tools, while others were intended for further reduction into flakes and microliths. Because many of the Lithic Age sites are blades quarries, they do not reflect the full range of economic activities. It is suggested that this is not an *age*, but rather one component of a broader economic system (see Veloz Maggiolo and Vega 1982). This system involved seasonal and logistic foraging expeditions. In addition to wild plants, a variety of cultigens were planted in low-intensity, horticultural gardens (Pagán-Jiménez 2013). Pottery was introduced in small quantities at an early date (Valcárcel Rojas *et al.* 2001, Valcárcel Rojas *et al.*, this volume). Ostionoid (redware) pottery did not evolve directly from the Saladoid pottery tradition, but instead developed among the pre-Arawak inhabitants of Cuba and Hispaniola (Keegan 2006; Keegan and Rodríguez Ramos 2007). In sum, the earliest inhabitants of Jamaica (and the Bahamas) practiced *protoagrícola* ways of life. They occupied primarily coastal settlements for relatively brief intervals, practiced seasonal mobility, fishing, and mollusk collecting with an emphasis on sea turtles, a limited use of predominantly redware pottery and the management and cultivation of a suite of cultigens. Specific economic patterns evolved along different trajectories throughout the islands west and north of Hispaniola, including more permanent settlements and the intensification of pottery use and farming. The bottom line is that the earliest inhabitants of Jamaica were *not* Ceramic Age Arawaks. They were communities of forager/farmers who fit the original meaning of Ciboney (Keegan and Hofman 2017, 11–12).

Modo de vida offers a promising approach to redefining native Caribbean communities. However, past uses of historical materialism have tended to emphasize static modes of production. Economic patterns need to be formulated as a diachronic research strategy. Human ecodynamics provides one method for investigating transformations (Rivera-Collazo 2011a).

The absence of typical Lithic and Archaic Age sites does not hamper efforts to understand cultural developments in Jamaica. The flaked-stone expedient tools that are significant components of the Paradise Park sites currently are under study by Reniel Rodríguez Ramos to determine how closely they approximate Archaic Age flaked-stone forms found in Cuba and elsewhere (cf. Rodríguez Ramos 2010). In addition, ceramic traditions have been assigned largely on the basis of decoration. A detailed study of redware pottery traditions in Jamaica, Cuba, and the Bahamas that is currently underway should help to clarify the relationships of these traditions with other pottery-making traditions in the northern Caribbean. The working hypothesis proposed here is that redware sites in this region reflect a *protoagrícola* way of life, and that this economic pattern is the final expression of pre-Arawak lifeways. In other words, it is a cultural complex that might best be called Ciboney.

Acknowledgements

I will be forever grateful to Tony and Eric "Busha" Clarke for their hospitality at Paradise Park and for getting me involved in Jamaica archaeology. My research was permitted, facilitated, and assisted by Roderick Ebanks, Dorrick Grey, and Leslie-Gail Atkinson of the JNHT, and Dr. Philip Allsworth-Jones then of the University of the West Indies, Mona. Dr. Ivor Conolley generously provided information about possible Archaic Age sites in eastern Jamaica and offered comments on an earlier draft. The late George Lechler was a font of knowledge and constant inspiration. Five seasons of fieldwork would not have been possible without the hard work and financial contributions of the Keeganites and Earthwatch volunteers.

15

Guácaras in early precolonial Puerto Rico: The case of Cueva Ventana

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In Puerto Rico, we colloquially use the phrase "*el tiempo de las guácaras*" to make reference to the times of old, when a mythical past unfolded. Although the definition of the word *guácara* has been debated, its most common use in the islands, particularly in the Spanish-speaking Greater Antilles, is to refer to caves; thus the phrase means the "time of the caves." The use of the term *guácara* is still noted in the names of important archaeological caves on Hispaniola, such as Guácara del Comedero and Guácaras de Sierra Prieta, among many others (Alberti y Bosch 1912; López Belando 2010).

According to the creation myth that was narrated by the inhabitants of the Lower Macorix region of Hispaniola to the Catalan friar Ramón Pané, who in 1493 accompanied Christopher Columbus on his second voyage to the Caribbean, their ancestors came from a *guácara* known as Cacibajagua, while the rest of the people originated in another, named Amayahuna, or "cave without importance" (Stevens-Arroyo 1988). The lexical form *guaca*, based on the term *guácara*, is also used in Guacayarima, meaning the region where the anal cavity of the earth was located, which was supposedly inhabited by cave-dwelling savages known as the Guanahatabey. Today, Guacayarima is a toponym for a peninsula located in the western quadrant of Hispaniola. It was also located to the mythical west where Coabey, or the house of the spirits of the deceased (*opías*), was located. Per the Spanish chronicles, the Guanahatabey also inhabited the Peninsula de Guanahacabibes, which was situated in the extreme west, or in the mythical rear, of Cuba, a region that is home to some of the most famous caves of that island, such as Cueva Funche, Cueva de los Pictogramas, and Cueva de Enrique, among many others, where early evidence of human occupation has been recorded.

The belief expressed to the Spaniards on Hispaniola – that life originated from one cave, regarded as a cosmic uterus, located where the sun is born, while either

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 201-214.

lesser beings or the spirits of the dead dwelled in what was regarded as a mythical anus or a receptacle of souls located where the sun dies – makes it evident that these spaces were envisioned, at least by some Caribbean indigenous groups, as cosmological bodies within which a liminal reality unfolded. These were, and for many still are, scapes that existed between and betwixt, pulsating entities that were impregnated with subjectivities, serving as metaphors of the intertwined cycles of life and the celestial (Carr *et al.* 2012).

Puerto Rico is one of the areas in the world that has the highest density of *guácaras*, containing more than 2000 of these negative physiographic features. Most archaeological cave contexts on the island are located within the *mogotes* or haystack hills developed by the natural sculpting of the karstic formations, mainly due to the solution of limestone (Lugo *et al.* 2001). In Puerto Rico, most of the attention that has been placed on these natural enclosures thus far has been relegated to the ancient use of the walls of dry caves as rock art canvases, where ideas, knowledge, and beliefs were portrayed in the form of petroglyphs, which tend to be prevalent in photic zones, and pictographs, which are mostly situated in the deeper or darker confines of the caves.

In addition to the focus on rock art, cave research in Puerto Rico has often been directed toward the documentation of the purported habitation contexts of the earliest occupants of the islands, commonly known as the "Archaic" Age. These were traditionally considered as iconic cave dwellers that lacked agricultural and ceramic-making traditions, while only having embryonic artistic capacities. The direct link of the discoverers of the Antilles with cave use led to the search for their residential locations in these sheltered contexts, as was the case at Cueva María de la Cruz in Puerto Rico, the site where the first corroborated evidence of the presence of "Archaic" Age people on the island was recorded (Alegría 1955; Rouse and Alegría 1990). Although the ritual use of caves has been deemed the "longest-lasting religious tradition in the history of the world" (Moyes 2012, 2), the use of these encapsulated spaces by pre-Arawak societies in Puerto Rico has often been relegated to the structural domain, even in cases where burials, sumptuary artifacts, and rock art have been documented. The downplay of the superstructural use of cave spaces during the earliest periods of Puerto Rican precolonial history has partially resulted from the assumption that the figural rock art present in some of these caves is related to the groups associated with what has been termed the Ostionoid series of the island, based on the notion that pre-Arawak societies did not have these sorts of symbolic behaviors, aside from the purported production of geometric and abstract pictographs (Hayward *et al.* 2009; Roe 2005).

However, recent evidence recovered from northern Puerto Rico at a site known as Cueva Ventana underlines the need for reevaluating some of the ideas we have had regarding the early use of caves on the island. In this work, we will argue that the engagement with cavescapes in pre-Arawak times was much more complex than traditionally assumed, and that their consideration as liminal spaces seems to have started much earlier than previously thought.

The body of the cave

Cueva Ventana is a solution cave located within the early Miocene-aged Montebello limestone of the Cibao formation, part of the karst belt of north-central Puerto Rico

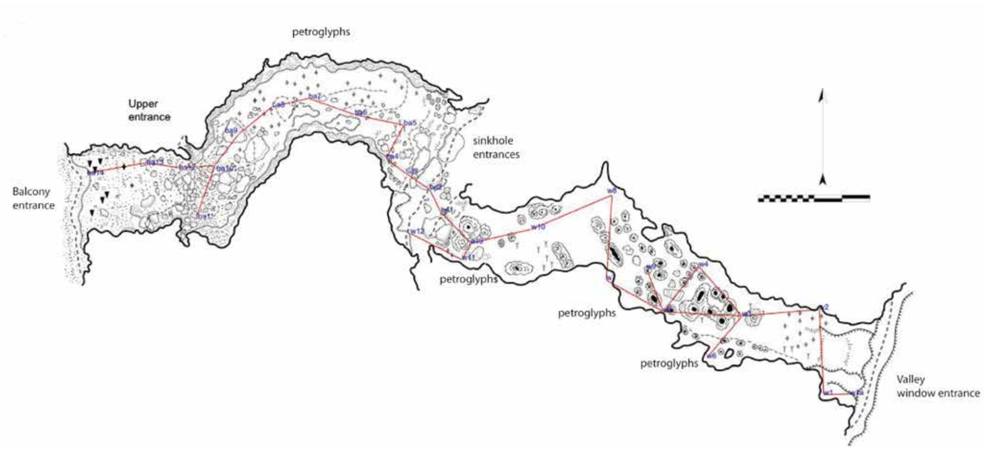


Figure 15.1. Map of Cueva Ventana (by Patricia Kambesis and Michael Lace).

(Monroe 1968, Renken *et al.* 2002). Given its location on a limestone cliff overlooking the valley of the Río Grande de Arecibo, at about 220 m above sea level, this cave has one of the most breathtaking views in the island, having been featured in several Hollywood movies and numerous TV commercials. This cave is composed of three morphologically distinct levels that span a total vertical extent of more than 69 meters. The uppermost level extends 177 meters in length with chambers 20 meters wide in some areas, having a ceiling that rises to 13 meters. It is oriented on an east – west axis, being bifurcated by a collapsed ceiling that divides it into two cave segments, called Cueva Oscura and Cueva Clara due to their differential light exposure (Figure 15.1). The entrances to both cave segments contain petroglyphs, thus indicating that the collapse of the roof took place prior to their human use.

We have conducted excavations in Cueva Clara as part of a larger community archaeology project that aims to make the people from the area active agents in the construction of the earliest chapter of their history. This work has made evident the importance of caves as three-dimensional contexts of engagement with our indigenous past, as these provide the public a unique opportunity to feel immersed within an ancestral space given the absence of sheltered precolonial architecture in the Caribbean.

The work in Cueva Clara included the excavation of three units (Figure 15.2), situated near the cave entrance, based on the results of previous testing conducted by Martínez Torres (1996). Although there was some variability in the stratigraphic make-up of the test units, fortunately in each case the archaeological layers containing precolonial materials were sealed under colluvial sediments derived from the slope wash of a mound located just to the east of the deposit (Figure 15.3). The detrital mound that produced such sediments seems to have formed after the precolonial use of the cave, given the lack of the clay-rich sediments associated with it within the artifact-bearing layers. Most archaeological materials were recovered from a stratum that consisted of an organic-rich silty loam, varying in thickness and artifact density in the different tested areas. In two of the units, this archaeological layer was intersected by ash lenses of varying thickness. Underlying the deposits was a layer of weathered bedrock mixed with allochthonous sediments, where the earliest traces of occupation were registered.

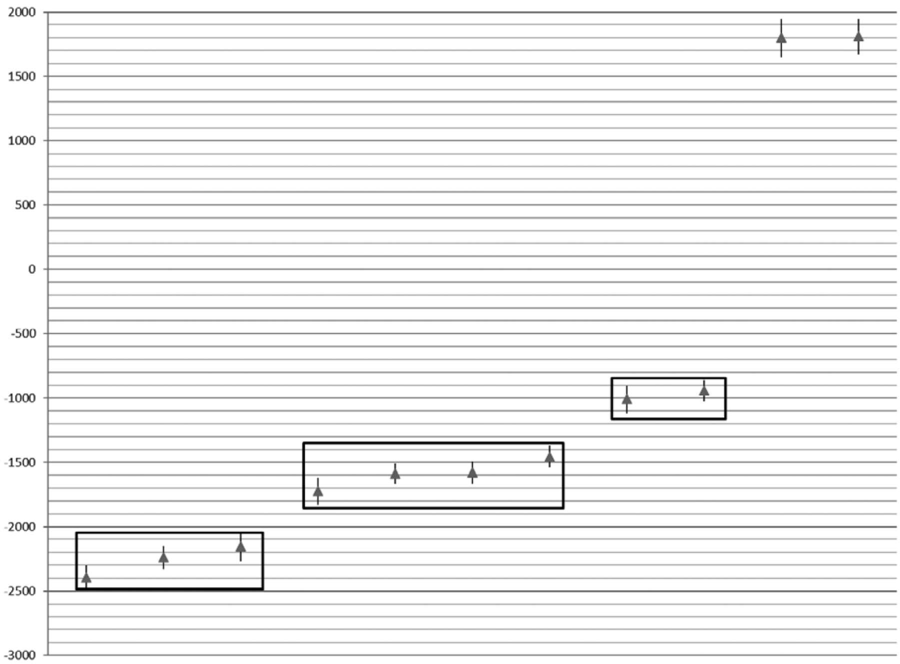


Figure 15.2. Spread of radiocarbon dates (years BC/AD) in Cueva Ventana.

Prior to our research, common wisdom in Puerto Rico was that the pre-Arawak inhabitants of the island tended to restrict their settlements to coastal locations, and that it was only after AD 600 that indigenous groups entered their mountainous interior (see discussion in Rodríguez Ramos 2014). However, the work at this cave clearly demonstrates that the island interior began to be humanized much earlier, as the dates from this site extend back to 2270 and 2040 cal BC, more than two and a half millennia prior to previous expectations. This, in tandem with the recent finding of inland pre-Arawak sites in open-air locations (e.g., Paso del Indio, el Cerro, and Jose Pilar Reyes, among others; see Martínez Torres 2013), has underlined the need to reconsider the strictly coastal nature of these groups and the evaluation of their potential adaptations to the mountainous interior, which clearly started much earlier than previously assumed.

The spread of radiocarbon dates at the site seems to indicate three main occupations, all of which fall in pre-Arawak times. To date each of these deposits, a combination of charcoal and shells (*Neritina* and *Phacoides* sp.), both of which are exogenous to the cave, was used (Table 15.1; Figure 15.4). Although *Neritina* shells are widely available on the coast, these also tend to migrate upriver, thus being obtainable in more inland locations (Pyron and Corvich 2003). However, in order to provide the most conservative date for those *Neritina* samples, the marine curve was used in their calibration (Reimer *et al.* 2009). The three ranges of dates fall (at a 2-sigma level) between: (I) 2490–2060 cal BC; (II) 1830–1370 cal BC; and (III) 1120–860 cal BC. The two most recent dates fall outside the range of pre-Columbian occupations, being related to more recent use of the cave, perhaps beginning in the nineteenth century, as indicated by the presence of blown glass and domesticated animals such as pigs and chickens.

Figure 15.3. Excavation units in Cueva Ventana (Cueva Clara portion).

Unit	Stratum	Age (BP)	1sigma low	1sigma high	2sigma low	2sigma high	Mean	Sample	δ13C	Process	Material
C	D-2	4250±25	-2460	-2370	-2490	-2300	-2395	UGM-17566	-4.1	AMS	Shell (Phacoides)
C	C-4	3810±25	-2290	-2210	-2330	-2150	-2240	UGM-17565	-12	AMS	Charcoal
C	C-6	3740±30	-2200	-2060	-2270	-2040	-2155	UGM-5106	-13.4	AMS	Charcoal
B	C-1	3740±30	-1770	-1660	-1830	-1620	-1725	UGM-5108	-8.3	AMS	Shell (Neritina)
A	B-3	3640±25	-1630	-1540	-1670	-1510	-1590	UGM-17561	-8.5	AMS	Shell (Neritina)
A	C-1	3630±25	-1620	-1530	-1670	-1490	-1580	UGM-17562	-7	AMS	Shell (Neritina)
B	C-3	3520±30	-1490	-1410	-1540	-1370	-1455	UGM-5107	-7.3	AMS	Shell (Neritina)
A	B-2	3170±30	-1070	-960	-1120	-900	-1010	UGM-5105	-8.1	AMS	Shell (Neritina)
C	C-1	3120±20	-990	-900	-1030	-860	-945	UGM-17564	-7.1	AMS	Shell (Neritina)
A	B-2	100±20	1700	1920	1650	1950	1800	UGM-5109	-28.3	AMS	Charcoal
A	C-3	140±20	1680	1950	1670	1950	1810	UGM-17563	-26.7	AMS	Charcoal

Table 15.1. Radiocarbon dates from Cueva Ventana.

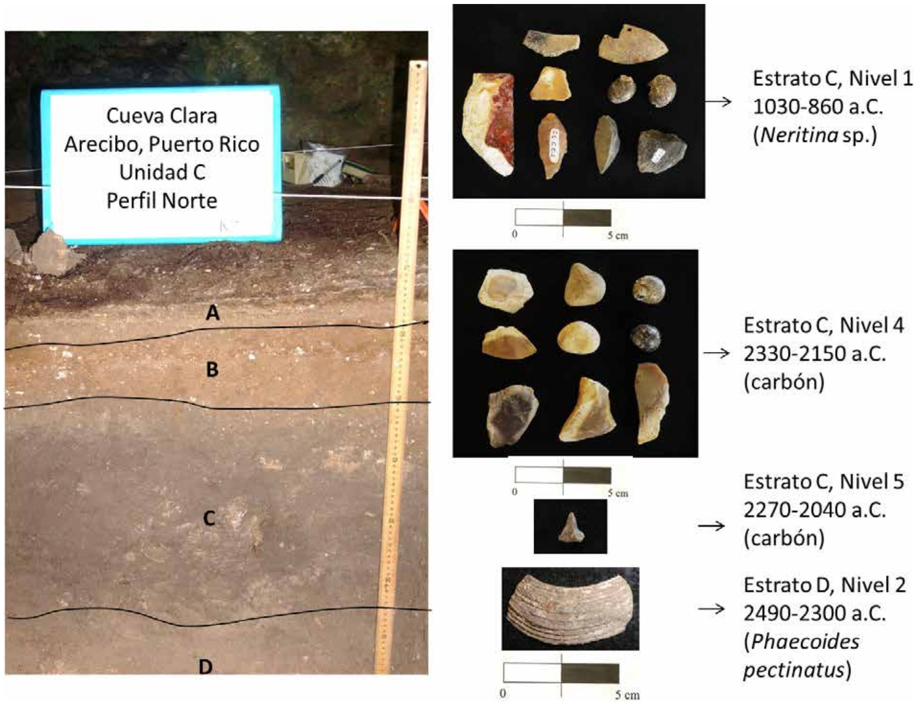


Figure 15.4. Profile, Unit C, north wall with associated materials and dates.

The things in the cave

Despite the limited nature of the testing conducted at the cave, a myriad of artifacts and ecofacts was unearthed, which provide a glimpse of the different sorts of activities that took place within this space over time.

Lithics

In the lithic realm, the use of chert since the initial use of the cave is evident. The lack of tested nodules and cores indicates that this raw material was imported in the form of flakes, most of which were manufactured using a parallel flaking format, often resulting in flakes of blade-like proportions, of up to 8 cm in length, brought to the site for consumption (Figure 15.5). Interestingly, this site also evidenced the presence of bipolar flakes, a technique not often associated to these early groups. In contrast to later periods, the bipolar technique seems to have also been aimed at producing elongated flakes, some of which were up to 5 cm in length, with flat profiles, to be used as handheld tools for tasks similar to those of freehand flakes. The nearest source of chert is located more than 50 km west of the site, between the municipalities of Moca and San Sebastián (Rodríguez Ramos *et al.* 2008b). The use of chert at this site adheres to the trends observed in other contemporaneous locations, signaling that exchange networks of this raw material placed emphasis on the movement of flakes and blades, which were detached at or near their procurement contexts, to the consumption locations (Rodríguez Ramos 2002). The extraction of flakes in the source areas has also been noted in the case of the locally available meta-volcanic stones that were obtained from the Abacoa River, which runs just south of the cave. The production of these

Figure 15.5. Artifacts recovered from Unit A, Stratum C, Level 1 (scale is in cm).

flakes also adhered to the parallel flaking format previously termed the "cobble-slicing technique," which involved their detachment from single or inverted platform cores, prepared for sequential flake extraction by trimming (see Rodríguez Ramos 2005a). This led to the production of rather large flakes, some of which measured up to 9.2 cm in length. The faunal assemblage does not seem to correspond with any emphasis on the production of these flakes for meat extraction, while the plants that are present mainly seem to have been processed by pounding or scraping (with coral files; see below). Thus, it is possible that some of the larger flakes were employed to carve wooden objects or to process fronds for basketry production, among other possible things. This site also evidenced the presence of use-modified artifacts. These consisted of meta-volcanic cobbles that served as irregular *manos* for the processing of vegetative products, as will be discussed below.

Pottery

Pottery has also been recovered at this location, though in limited quantities, starting at the intermediate level of occupation of the site. Thus, as has been documented in other contexts, this cave reflects the existence of a pre-pottery period, followed by layers in which ceramics increase in quantity. In contrast to other Early Ceramic contexts of the Greater Antilles, where some of this early pottery shows the presence of lineal and dotted incisions (e.g., Ulloa Hung and Valcárcel Rojas 2002; Veloz Maggiolo *et al.* 1974), the pottery found at this site is untreated, except for one piece that contains red slip and two fragments that are highly burnished. Interestingly, some pieces also contained traces of *espatulado*, a technique observed in the pre-Arawak pottery of Cuba (Ulloa Hung and Valcárcel Rojas 2002) and Puerto Rico (Rodríguez Ramos *et al.* 2008b). All of the recovered rim fragments seem to be from globular vessels. The fact that there are no documented "Ostionoid" contexts in the archaeological sequence of this site clearly shows that these clay objects are not the result of intrusion from later occupations, as is commonly assumed when pottery is found in pre-Arawak deposits (Ayes Suárez 1996) or in contexts radiocarbon dated to pre-Arawak times (e.g., Siegel and Joseph 1993). The presence of red-slipped and burnished pottery has also been documented in other early sites of northern Puerto Rico, such as Cueva Soto and Cueva Tembladera

(Martínez Torres 2013). In all contexts, however, the quantity of pottery is quite scarce, perhaps indicating its use in a restricted suite of activities.

Ideotechnic artifacts

Although the area that was sampled was quite limited, we documented the presence of several artifacts of an ideotechnic nature that mirror those documented in other early cave locations of northern Puerto Rico. These include two discoid adornments made of mother-of-pearl (*Pteria* sp.), which are quite similar to others documented in later Huecoid contexts. Similar artifacts have also been found in Cueva La Tembladera (Martínez Torres 2013) as well as in Maruca (Rodríguez López 2004). The presence of mother-of-pearl at these locations indicates the early use of shells for the production of personal adornments in Puerto Rico. In fact, the use of marine shells for producing these types of artifacts has also included *Lobatus gigas* as well as bivalves (Martínez Torres 2013; Rodríguez López 2004). The presence of gastropods that were also drilled for suspension was noted at the site, as has also been observed in Cueva Tembladera and Cueva Gemelos (Dávila Dávila 1981). The use of these *caracoles* as adornments, together with the production of lithic objects that seem to depict such gastropods, known as *bobito* pendants, seem to indicate the importance attributed to these Mollusca beyond their mere use as a source of food.

In addition to shell and gastropod adornments, this site also reflected the use of quartz (Figure 15.5, top left) and calcite. None of the fragments of these types of materials showed any type of intentional modification, so they were seemingly imported to the site in crystal form for their use, very likely in activities of a ritual nature, as has been argued for other contexts (Alegría 1955; Lundberg 1991). Another material that was brought to the cave was ocher. This iron-rich material was pulverized, as noted by its presence in use-modified lithic materials, probably for pigment production for body-painting or in other types of superstructural activities (Veloz Maggiolo 1972). The use of ocher is rather common in early sites in Puerto Rico (Martínez Torres 2013), even being found deposited over the bodies of certain individuals (Alegría 1955; Dávila Dávila 1981).

Plants

Until recently, it was though that these "Archaic" Age inhabitants of Puerto Rico were pre-agriculturalist, as the advent of cultivation was registered in association with the Saladoid migration to the island. However, important works by Pagán-Jiménez (2013; Pagán-Jiménez *et al.* 2005) on early sites such as Maruca and Puerto Ferro have clearly documented the cultivation and processing of important economic plants such as maize, manioc, and sweet potato in open-air locations during pre-Arawak times. Interestingly, Pagán-Jiménez's starch grain study at Cueva Ventana (Clara) documented early plant assemblage in a cave context for the first time (Table 15.2). This study indicated that between 1540 and 890 BC, plants such as maize, sweet potato, yams, elephant ear, beans, and zamia were all being processed in this cave (see also Pagán-Jiménez *et al.*, this volume).

The presence of these starches in irregular *manos* and a milling base show that many of these plants were pounded, with the aim of producing a paste that could later be transformed into food or another type of consumable. The absence of clay

Code	Unit	Stratum	Level	Type of Artifact	Identified Plants
CC-1	B	C	4	Coral file	*Zamia erosa, Zea mays, Dioscorea* sp.
CC-2	C	C	3	Milling base	*Ipomea batatas, Zea mays, Fabaceae*
CC-3	B	C	3	Irregular mano	*Zea mays*
CC-4	B	C	3	Irregular mano	*Zamia erosa, Manihot esculenta, Zea mays, Xanthosoma undipes*
CC-5	B	C	2	Irregular mano	*Ipomea batatas, Smilax coriacea, Zea mays, Xanthosoma undipes*
CC-6	B	C	1	Irregular mano	*Ipomea batata* (cf.), *Zea mays*

Table 15.2. Plants identified in the starch grain analysis conducted by Pagán-Jiménez.

griddles at this site (and in other early contexts in Puerto Rico) signals that these pastes were either wrapped in leaves and cooked directly on the fire or boiled, as noted in the modern production of *guanimes* in the island (Rodríguez Ramos 2005a). Interestingly, a coral file (*Acropora cervicornis*) was used to scrape or grate zamia, yams, and maize. Although this type of processing is to be expected with tubers, the type of products obtained by grating maize – as has also been documented in grater chips in later contexts (Berman and Pearsall 2008) – is still to be ascertained. One possibility is the production of a food similar to *mazamorra*, a type of porridge made of tender corn that is still consumed on the island, most notably in its mountainous interior. Interestingly, in addition to the aforementioned plants used as foodstuffs, the starch grain study also reflected the processing of *Smilax coriacea*. This plant has important medicinal properties, used for treating fever, venereal diseases, and rheumatism, among other illnesses (Pagán-Jiménez 2013). Thus, its presence within this context might signal the preparation of medicinal products, among other activities taking place within this cave.

The fact that these aforementioned cultivars were obviously planted in contexts outside of the cave, probably near the residential locations where the pottery was produced, is an aspect being addressed in an ongoing evaluation of the relationship of these enclosed spaces with the open-air locations with which they were associated in this early chapter of Puerto Rican history. Furthermore, the existence of these phytocultural traditions demands that we consider in greater detail aspects such as the development of fertility-driven rituals and their representations in pre-Arawak times, elements that have thus far been completely neglected in the study of these primeval societies.

Animals

The archaeological deposits in this cave also contained a wide array of animal remains (see Pagán-Jiménez *et al.*, this volume). Most of these were representative of fauna found in the immediate vicinity of the cave, including gastropods, frogs (*Anura* sp.), lizards (*Ameiva exsul*), iguanas (*Sauria* and *Iguanidae*), and Puerto Rican boa (*Epicrates inornatus*). In addition, some riverine resources were also collected, such as freshwater shrimp (*Atya* sp.), freshwater crab (*Epilobocera sinuatifrons*), and fish such as mountain mullet (*Agonostomus montícola*) and bigmouth sleeper (*Gobiomorus dormitor*).

Marine products were also imported to the site, including common snook (*Centropomus undecimalis*) and the previously mentioned *Phacoides* bivalve. An interesting occurrence, also noted in other inland cave sites of northern Puerto Rico such as Cueva Gemelos and Cueva Tembladera, is that of imported *Neritina* sp. shells. Their presence at this site, which began to be registered during its second period of occupation, is remarkable given the small amount of protein that these provide and the long distances that need to be transversed to procure them. This could indicate that it was a special-purpose or "luxury" food, likely linked to communalizing activities such as feasting, as has also been suggested for other food types found in this cave, such as freshwater crab, Puerto Rican boa, and lizards, among others (Curet and Pestle 2010; Oliver and Narganes Storde 2005).

Flying creatures were also represented in the analyzed sample. These include pigeons (*Zenaida aurita zenaida*), *guaraguao* (red-tailed hawks, *Buteo jamaicensis*), and short-eared owls (*Asio flammeus*), as well as a wide representation of bats, most notably the Antillean fruit-eating bat (*Brachyphylla cavernarum*). It is interesting to note that most of the remains of this bat were concentrated in several anthropogenic levels of two of the units (A and C), being virtually absent in the other (Unit B). The high quantity of bat remains together with their disparate concentrations could indicate their use as a special-purpose food by indigenous communities of the island, as was noted much later in the Spanish chronicles (Rodríguez Durán 2002).

Objectifying the cave

Another salient element documented in this cave is related to the presence of carved rock art. As previously noted, the most widely accepted notion in Caribbean archaeology is that the rock art manifestations of these early groups in the Caribbean were limited to geometric and abstract pictographs, while the production of petroglyphs were supposed to have started only after AD 600 (Hayward and Cinquino 2012; Roe 2005). However, the presence of petroglyphs at this location where no evidence of post-AD 600 occupations has been documented thus far, coupled with the location of at least some of them immediately overlying these early deposits, allows us to make the case for the production of this type of rock art on the island at this time (Figure 15.6). It should be noted that the closer proximity of these images to the archaeological deposit at this site – compared other sites such as Maisabel (Roe 1991) and Cueva Juan Miguel (Oliver and Narganes Storde 2005), where this spatial association has been used as evidence for a cultural correspondence between archaeological deposits and petroglyphs – underlines the higher resolution of such type of correlation in Cueva Ventana. Furthermore, some of the images that we have documented at this site, which we labeled the "segmented faces" (Figure 15.6, bottom right), have also been observed in other pre-Arawak contexts, particularly in northern Puerto Rico, such as Cueva Soto and Cueva Tembladera, which further underlines the likelihood of their production by these early groups. In addition, the petroglyphs on the wall adjacent to the excavation units include the *barbudos* (Figure 15.6, top right), an anthropomorphic element that has commonly been associated with later cultural components of the island.

As is observed in later contexts, some of these images are located in cave entrances. This might indicate that the ideas or narratives that were being objectified with their

Figure 15.6. Relations of petroglyphs to Unit A (Pictures to the right are from Martínez Torres 1996).

production, which in later contexts have commonly been linked to the mythical being known as Macocael, had already started to take shape much earlier than previously assumed. According to what was told to Pané on Hispaniola, Macocael, whose name means "he of the eyes that do not blink," was in charge of keeping watch over the entrance of Cacibajagua at night to make sure that its inhabitants returned before sunrise. One day, he arrived late, and the sun carried him off on account of his poor vigilance, and thus he was turned into stone near the door of the cave (Stevens-Arroyo 1988).

Cueva Ventana forms part of a stacked group of enclosures that were likely attached by more than just geography. We paid an initial visit to the intermediate cave, where we documented a wide array of pictographs, some of which overlie previous images, perhaps reflecting the differing but related set of narratives that were attached to these spaces through social memory and ritual performance. Some of the personages or ideas reflected by these images were not only produced and reproduced within this intermediate cave, but were also portrayed in the upper cave, even in different media, thus denoting continuity in the ritual grammar and the articulation of its attended meanings in both spaces. The presence of similar images in other areas of the island indicates that the symbolic reservoir that was carved and painted in these caves was horizontally negotiated, most likely during ritual engagements between the peoples that participated in its structuration during this early time.

Early *guácara* use in Puerto Rico: Some final thoughts

As has been shown in this work, Cueva Ventana contains an assortment of elements that provide insights into the types of activities that took place there, indicating that *guácaras* served varying purposes throughout time and space. This illustrates the problems with essentializing cave use during this early period of Puerto Rico's ancestral history, and underlines the need to look beyond the mere use of these spaces for domestic ***or*** ceremonial purposes as commonly assumed for these early societies, as it is likely that both types of activities (and perhaps others as well; e.g., *recreational* ones) took place in these spaces at any point in time. However, the noted changes in artifact and ecofact distribution in Cueva Ventana signal the shifting emphases in its use through time. The limited amount and low richness of lithic artifacts in the earliest phase of occupation of this site, together with the lack of evidence for plant use (neither cultivars nor wild, as evidenced by the analysis of a bivalve scraper and a use-modified cobble), pottery and ideotechnic artifacts, indicates the likelihood that this cave was initially used intermittently for short periods for a limited suite of logistical activities, although not precluding its potential concomitant ceremonial use.

Starting in the second phase of the cave's use, the marked increase in the quantity and richness of ecofacts and artifacts shows a shifting and more intensive use of this cave, while also corroborating recent lines of evidence that indicate the need to reconceptualize some previous notions of pre-Arawak groups of the island, including aspects such as: the presence of cultivation practices; pottery production; rock art; pigment production, likely for body ornamentation; and the manufacture of ideotechnic artifacts. Some of the artifacts produced could also have included wooden objects and basketry, as is indicated by the presence of flakes with blade proportions made of local and extraneous raw materials. If this was the case, perhaps the context of their production could have played a role in their biographies and, thus, in the attendant social value placed on those objects.

Interestingly, the presence of some of these elements clearly attests that activities beyond the domestic domain were taking place in this cave, most notably between periods II and III. These include the processing of ocher, the presence of calcite and quartz crystals, the presence of symbolically loaded fauna (e.g., lizards, frogs, boa, bats, river crabs), the production of figurative rock art and the use of ideotechnic artifacts. In tandem, the presence of these elements provides us the means to argue that activities related to the superstructural realm took place in this cave, most intensively since its second phase of use. Interestingly, testing conducted by Martínez Torres (1996) on the eastern end of the cave indicated a very different scenario because, although there is rock art, no similar archaeological deposits have been documented. Thus, it is quite possible that the orientation of the cave played into the different activities that took place at its eastern and western ends, perhaps signaling aspects analogous or homologous to the aforementioned cosmological narratives associated with these spaces much later in time. Although other features associated with superstructural activities were not documented within this cave, particularly the presence of burials (only two adult teeth were recovered), there is evidence for the use of a cave with a similar artifactual and rock art assemblage in the vicinity of Cueva Ventana, known as Cueva Matos, where human interments have indeed been recorded, as well as at later sites such as Cueva Gemelos and Cueva María de la Cruz. The presence of remains of activities clearly associated with quotidian food processing and artifact production, together with others that might be related to ceremonial feasting, ancestor worship or any other activities related to the superstructural sphere, indicate that both realms of activities (and others as well) might have taken place concomitantly in this cave, as has been also argued by Oliver and Rivera-Collazo (2015) for Cueva María de la Cruz.

The presence of rock art is particularly notable, given its likely association with the early occupants of this cave sometime between periods II and III. The fact that some of the documented representations mirror some of the personages associated with later "Ostionoid" rock art manifestations, together with their similar spatial location within the cave, underlines the possibility that pre-Arawak engagements with these enclosed spaces and the articulation of their cosmovision served as a substratum for some of the ways in which later societies envisioned such spaces and constructed their worldviews, as has been also noted for other social aspects (Chanlatte Baik and Narganes Storde 1990; Rodríguez Ramos 2005b, 2010). Thus, to understand the varying ways in which precolonial indigenous societies engaged with cavescapes and the myriad of narratives and symbolic behaviors that ensued from such engagements in later cultural contexts, more attention needs to be paid to the subjectivities that were already being emplaced by pre-Arawak societies on such still pulsating lithified bodies.

Acknowledgements

The present work was funded with a HPF Grant from the Puerto Rico State Historic Preservation Office. Much thanks to Cándido Oliveras, from Cueva Ventana, Inc., for access to the terrains where this important cave nestles. A deep gratitude goes to all the volunteers from the *Sociedad Arqueológica del Otoao*, whose dedication was pivotal to bring this research to fruition.

16

The Krum Bay sites revisited. The excavations in the Krum Bay area on St. Thomas, U.S. Virgin Islands

Casper Jacobsen Toftgaard

Introduction

In 1916/17, the Dutch-American Theodoor de Booy was the first anthropologist to excavate a shell midden site in the Krum Bay area, located on the south coast of St. Thomas, U.S. Virgin Islands (USVI). However, the first scientifically acceptable excavations of Archaic Age sites in the Krum Bay area were arguably conducted in 1922/23 by the Danish cultural geographer and archaeologist Dr. Gudmund Hatt, the ethnographer and artist Emilie Hatt (married to G. Hatt) and the Dutch anthropologist J.P.B. de Josselin de Jong. This distinction has been made because de Booy primarily excavated and searched for artifacts without taking stratigraphic information into account (de Booy 1919, 47). He also did not produce site plans or publish his findings in an acceptable scientific format (Hatt 1922, 438–445). In addition, de Booy failed to recognize the shell midden's predominantly pre-Ceramic and hence Archaic Age character and mistakenly associated it with the Ceramic Age Magens Bay site on the north side of St. Thomas, due to the occasional ceramic sherds found in the top layer of the shell midden he excavated at Krum Bay (de Booy 1919, 34–37).

Hatt strongly disagreed with de Booy's methods and conclusions (Hatt 1922), but Hatt himself did not find other Archaic Age sites during his nine-month expedition to the U.S.Virgin Islands, Tortola, and the Dominican Republic, except for "three small shell middens at Krum Bay and the remnants of one at Nisky" (Hatt 1924, 29). Nonetheless, Hatt did find artifacts on both the island of St. Thomas and on St. Croix, especially axes that he related to the artifacts from the Krum Bay middens. This was, nonetheless, insufficient evidence for Hatt, who cautiously wrote, "I am strongly tempted to regard the Krum Bay middens as remnants of a culture, earlier and more primitive than those represented at other sites" (Hatt 1924, 31).

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 215-226.

When Hatt proposed the first relative chronology for the pre-Columbian Caribbean islands, he thus only definitively differentiated between an earlier and later Ceramic phase; he did not claim to have definitively identified an even earlier predominantly pre-Ceramic culture in the Krum Bay sites, even though he writes that he felt strongly tempted to do so. His reluctance was due to the fact that he could not find sufficient similarities between the Krum Bay sites and Harrington's Ciboney culture in Cuba (Harrington 1921) or other pre-Ceramic sites from the Caribbean islands (Hatt 1924, 31). Hatt maintained this position later on, when he reported on his archaeological findings from the Dominican Republic (Hatt 1932).

Hatt reported only very briefly on the expedition's excavations in the Krum Bay area, in about half a page of text (Hatt 1924, 29–31). But the two major excavation units covered $20m^2$ and $28m^2$ of middens that, in total, spanned approximately $250m^2$ and $700m^2$. These two units combined are the largest excavations ever carried out in the area, just as the artifacts' assemblages are the largest compared to latter excavations. The material from these excavations has only briefly been reexamined by Ripley Bullen, who spent a week studying the artifacts in Copenhagen in 1960 without being able to decipher the excavation diaries. Revisiting the 1922/23 Krum Bay excavations, exploring the diaries and subjecting the results to new test methods and a critical reanalysis is therefore long overdue.

Hatt's methods, excavation diaries, plans and artifacts from the Krum Bay sites

Hatt's 1924 article about the archaeology of the Virgin Islands has been much studied, but his prerequisites for undertaking the expedition and excavations have not been extensively discussed, nor have his methods and scientific approach. A short introduction to his academic career is therefore relevant. Hatt was introduced to anthropology when he studied the subject at Harvard University in 1906 and 1907. Some years later, in 1915, he handed in his doctoral dissertation and was awarded a DPhil degree in ethnography from the University of Copenhagen. In 1919, he was permanently employed at the prehistoric department of the National Museum of Denmark (NMD) in Copenhagen, which brought with it an introduction to archaeology, as he was sent on excavations in 1920 and 1921, guided by experienced excavators from the NMD. The methods and the scientific approach he was exposed to during this educational period probably followed the principles set out and published in 1900 by the cross-disciplinary Second Kitchen Midden Committee, an initiative of the NMD (Madsen *et al.* 1900). The committee placed emphasis on conducting excavations with good stratigraphic information, proper drawing of excavation plans and meticulous note-taking throughout; artifacts were only collected until a representative sample size was thought to have been obtained and recorded, after which point additional finds could be discarded. Hatt's excavations in the Caribbean were the first he directed himself, but when the excavation diaries, the Main Artifact Registration Books (MARB) (NMD, Hovedbogen for Amerika O.1.-31.) and preserved artifacts are examined, it is clear that Hatt was thorough and conscientious.

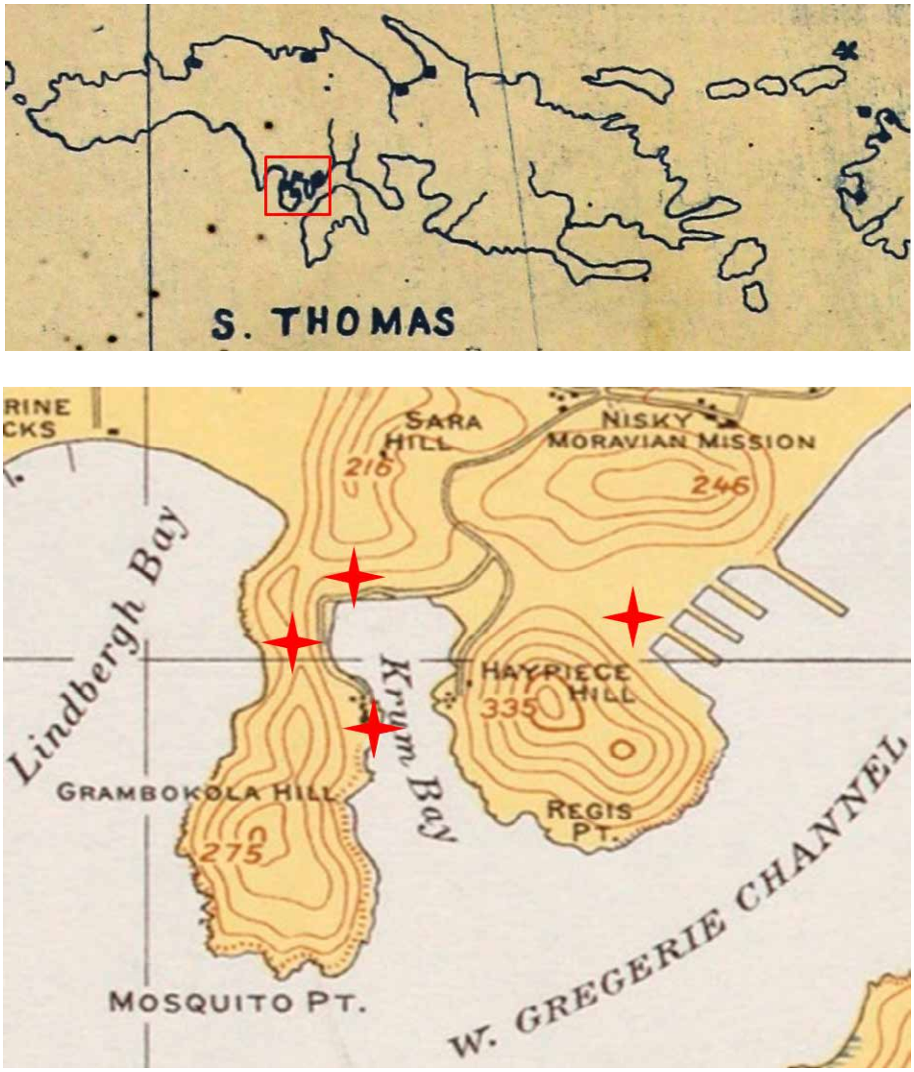


Figure 16.1. Top: A cut-out showing St. Thomas and part of St. John from Hatt's original blueprint map for his 1924 article. The three Krum Bay sites and the Nisky site are marked by ink dots in the red rectangle. Bottom: The red rectangle area, shown on a U.S. Coast Guard chart from 1922, which indicates the probable topography when Hatt arrived in the Krum Bay area in early 1923. The four sites, as they can be deduced from the diaries and the blueprint, have been marked by the red stars.

Hatt's excavation diaries

When reading the various archaeologists' research into the Krum Bay sites in the 1960s, '70s, and '80s, it becomes apparent that Figueredo, Gross, Tilden, and Lundberg had access to a copy of Hatt's excavation diaries. However, it is also obvious that they had difficulties in deciphering the diaries, probably due to them being written in Danish and Hatt's almost illegible handwriting (Gross 1976, 232). There is, however, additional decipherable information about Hatt's three Krum Bay sites in the excavation diaries, whereas there is little further information about the Nisky Bay site.

In his excavation diary, Hatt describes the Krum Bay A site as "the shell midden on the Moravia brethren's property, close to the road on the north side of Krum Bay" [translation by author] (Hatt 1922/23, 131). This piece of information matches the northernmost site at Krum Bay, on the original blueprint map in the NMD Archive (see Figure 16.1), which Hatt used for his 1924 article. However, it becomes confusing when he later writes, "We cut a trench from the WSW toward the ENE through the midden, antiparallel with the road" [translation by author] (Hatt 1922/23, 131).

Here we can assume that Hatt uses the word antiparallel in the mathematical sense, meaning vectors that are parallel, but in opposite directions. This is a plausible interpretation, as Hatt started his five squares, 4 m^2 each, at Krum Bay A in the west and proceeded eastwards, while the road came from Charlotte Amalie in the east and ended at the West Indian & Panama Telegraph Co. power station, in the middle of western Krum Bay, thus antiparallel in a way. This would place Hatt's Krum Bay A site about 100 m further west than Bullen and Sleight's Krum Bay site, which was located in the northeasternmost part of Krum Bay (Bullen and Sleight 1963, Plate I.).

Regarding the second shell midden site, Krum Bay B, Hatt writes that it is "the shell midden on the west side of the bay, just south of the telegraph station" [translation by author] (Hatt 1922/23, 157).

This is important, as it corresponds well with de Josselin de Jong's notes in his excavation diary, in which he writes, "On 10 February Hatt started to excavate at a second location, behind the Telegraph Station" [translation by Knippenberg] (de Josselin de Jong 1923). It also fits well with the southernmost marked site on the blueprint map (NMD Archive; see Figure 16.1).

The Krum Bay C site was small and shallow in depth compared to the Krum Bay A and B sites, covering only 8 m^2, and Hatt did not collect any artifacts from it. The notes in the excavation diary are short, but full of information about the site, so the whole paragraph is quoted here, including spelling mistakes:

> "Krum bay C. On top of the ridge opposite Mon Santo's place chiefly stones. The rest shells, same kind and apparently same proportions quantitatively as in Excavation A. Also some smooth pebbles and hammerstones (two potsherds practically on surface). Nothing that could indicate a culture different from the one found at A. Big lumps of yellow ocher. After an afternoon's digging this excavation ended" (Hatt 1922/23, 44–45).

The Krum Bay C site must be the westernmost site, as marked on the blueprint map (NMD Archive; see Figure 16.1, left).

Hatt wrote about the final site in the Krum Bay area, the Nisky Bay site, together with the other Krum Bay sites in the first pages of his excavation diary. Unfortunately, he did not note down a more precise location for the site, writing only that it was situated in Nisky Bay; otherwise, his only notes are "… visited, but not investigated. Appears to be of the same type as those at Krum Bay" (Hatt 1922/23, 4). On what basis he reached this conclusion is unclear, leaving the Nisky Bay site as elusive as ever.

Hatt's records at the National Museum of Denmark

At the NMD, three types of documents record the artifacts that Hatt sent back to Copenhagen for the NMD collections. The first are the excavation diaries, from which Hatt picked the artifacts he considered important enough to be part of the collections. Secondly, there are the MARB draft papers, often with interesting notes not found in the diaries or in the actual MARB, which lists the artifacts that ultimately entered the NMD collections. While the draft papers and the MARB do not contribute much to the overall interpretation of the location of the Krum Bay sites, they are important for detailed studies of the artifacts themselves. The NMD Archive also has a large photographic collection, which contains a large and varied collection of plans, maps and photos from Hatt's nine-month expedition to the Caribbean islands. Unfortunately, only one map relates to the Krum Bay and Nisky Bay sites: the original blueprint map for Hatt's 1924 article (see Figure 16.1). Nevertheless, it shows the location of the three Krum Bay and the Nisky Bay sites much clearer than Hatt's published map of 1924.

The artifacts that Hatt collected

Hatt entered 70 and 97 artifacts, respectively, from the sites of Krum Bay A and B into the MARB. However, this small number should be interpreted cautiously, as Hatt discarded a substantial number of grinders, hammerstones and huge numbers of shells after recording them in his excavation diaries in accordance with the accepted practice of the time.

Artifact entry no. O.2.2 in the MARB, from Krum Bay A, is a good example of this practice; the MARB only has the following short text, "from sq. II, layer 1: conch chisel, heavily weathered" [translation by author]. In his excavation diary, however, Hatt wrote for the same entry number, "sq. II L 1. A heavily weathered conch chisel. Number of shells: type A, 84 (ark clams); type B (clams), 20; type C (oysters), 14 type J (tobacco conchs), 1. A parcel of red and yellow ocher. Discarded a number of hammerstones" [translation by author] (Hatt 1922/23, 135). The difference is significant and obvious.

A preliminary analysis of stratigraphic and dispositional placement of artifacts also adds substantially to the understanding of Hatt's sites of Krum Bay A and B. Generally, Hatt excavated in 2x2 m squares and in arbitrary layers that were 25 to 30 cm deep. At Krum Bay A, he excavated 20 m^2 in total in four layers, while at Krum Bay B he excavated 28 m^2 in total in only two layers.

At Krum Bay A, layer 1 contains most of the hammerstones, grinders and ochreous stones, while in layer 2 only two grinders and two ochreous stones can be found, and none in layers 3 and 4. Layers 2 (the deepest part) and 3, on the other hand, contain the only two celt preforms from Krum Bay A, both partially ground down after initial shaping with probable bifacial knapping.

In layers 1 and 2 of Krum Bay A, the quantity of conch "picks" and "knives" and animal and fish bones are also noticeably lower than in layers 3 and 4, but this might just be the result of Hatt's collection methods. One of the conch "picks" is totally covered with red ocher. Small numbers of shell scrapers and conch lips are present in each of the three upper layers, but completely absent in layer 4.

Figure 16.2. Left and middle: Axes with artifact no. O.2.101 and O.2.102 from Krum Bay B. Right: Axe from Magens Bay. Artifact no. O.30.629 (Photographs courtesy of the National Museum of Denmark).

The axes from Krum Bay B have attracted much attention over the years. A closer examination reveals that there are between nine and thirteen axes or fragments of axes. Hatt collected two thin, oval-shaped axes from the site's surface, which are quite unlike the common petaloid pre-Columbian Caribbean axes in shape. However, they have an almost identical counterpart from Magens Bay, on the north side of St. Thomas (see Figure 16.2). In layer 1, Hatt found five axes, two axe fragments and possible fragments of two more. These axes can be divided into two closely related groups: the long, thin and narrow ground axes with finely ground bits, unique in the Archaic Age context (Sebastiaan Knippenberg, personal communication, 2011); and the long, thin, slightly broader axes. The latter type is quite similar to the axe and the axe fragment found at Krum Bay A (Bullen and Sleight 1963, 22–23).

The majority of the stone artifacts, however, are edge grinders made from water-rolled pebbles, with approximately equal numbers from layers 1 and 2. A single small anvil stone was also found by Hatt at the Krum Bay B site, which is very similar to the Ortoiroid Period anvil stone from Trinidad illustrated by Boomert *et al.* (2013, Figure 35d).

The shell artifacts from Krum Bay B are similar to the shell artifacts from Krum Bay A, with Hatt's conch "picks" and "knives" being the most common from both sites; similar artifacts from southern Puerto Rico are called "points" and "handpeaks (handpicks?)" by Rodríguez Alvarez in his article about Archaic Age shell tools (Rodríguez Alvarez 2007, 228–234). Shell scrapers are also present in small numbers at both Krum Bay A and B, and are again similar to Archaic Age artifacts found on Puerto Rico (Rouse 1992, 62–67). However, an otherwise common type of Archaic Age shell artifact (Hofman *et al.* 2006, 152–156), the ground conch celt, is completely absent from both Krum Bay A and B. The only clearly ground shell artifacts from Krum Bay A and B are a single conch (or bone) awl/point and a shell disk/pendant, both from Krum

Bay B, with the awl/point having some similarity with a bone point from the St. John site on Trinidad (Boomert *et al.* 2013, Figure 33d).

Hatt also found a very small number of ceramic sherds on the surface or in layer 1 at Krum Bay B and C. Bullen and Sleight wrote that these sherds appeared to be similar to those from the Ceramic Age Magen Bay site on the north shore of St. Thomas. After visually examining the sherds from the abovementioned sites at the NMD collections, this author cautiously concurs, due to the low number of sherds and their generally non-diagnostic nature. However, the best-preserved fragment from Krum Bay B, a globular jar with a narrow neck and thin line incision (see Bullen and Sleight 1963, Plate VIII), are most likely from the colonial period (Corinne Hofman, personal communication, 2016).

The excavation history of the Krum Bay sites after 1923

Bullen and Sleight 1960

The next archaeologists to conduct excavations at Krum Bay were Ripley Bullen and Frederick Sleight, who in April 1960 carried out a four-day excavation of the only substantial remains of a shell midden they could find in the Krum Bay area, as the locality had changed significantly due to construction activities during and after World War II (Bullen and Sleight 1963, 13). The Krum Bay site that Bullen and Sleight excavated was called Krum Bay C to differentiate it from Hatt's two main sites of Krum Bay A and B in the MARB at NMD. Bullen and Sleight used the label "Krum Bay D" for a smaller shell midden site on Sara Hill; although understandable, this designation is unfortunate, as Hatt also had a C site, as mentioned above.

At Bullen and Sleight's Krum Bay C site, located at the northern end of Krum Bay between the two paved roads, they found a shell midden, of which they excavated an "10 x 50 foot area" (Bullen and Sleight 1963, 13), equivalent to approximately 46.5 m^2, "to a maximum depth of 4 feet in arbitrary one-foot levels" (Bullen and Sleight 1963, 13–19). They concluded that typologically, the artifacts from Krum Bay C more closely resembled Hatt's Krum Bay A artifacts than the Krum Bay B artifacts, noting the similarity between the large chipped and pecked blades found at the deeper levels and the absence of ceramics. Shell artifacts were almost completely absent from Bullen and Sleight's Krum Bay C site, with only one possible shell artifact being identified by Bullen and Sleight, whereas Hatt excavated many conch and shell artifacts at both the Krum Bay A and B sites. This difference is puzzling, as Bullen and Sleight concluded that there was a strong likelihood that the Krum Bay A and C sites belonged to the same original shell midden. All three sites, however, contain quantities of hammerstones, ochreous stones and faceted pebbles, so the difference might be explained by an oversight by Bullen and Sleight during the excavation of 1960.

Bullen and Sleight also obtained the first ^{14}C dates for the Krum Bay sites; according to their description, they sampled two *Busycon gigas* shells (Bullen and Sleight 1963, 41) from layer 1 and layer 3, respectively, which produced dates of 195 cal BC – cal AD 565 and 530 cal BC – cal AD 355 (see Appendix, this volume). However, it should be remembered that these dates were achieved during the early years of the ^{14}C

dating technique, with its implied limitations, compared to later or recent ^{14}C dates, after the technique had developed (Fitzpatrick 2006).

The 46-page booklet that Bullen and Sleight published in 1963, however, is the first more comprehensive description and analysis of the Archaic Age cultural heritage of Krum Bay, and thus is a necessary starting point for all students of the earliest prehistory of the Virgin Islands. Hatt's short paragraphs about the sites in his 1924 article can only serve as an introduction to this subject.

Figueredo, Gross and Tilden 1973–76

The third generation of archaeologists to conduct investigations in the Krum Bay area were Alfredo Figueredo, Bruce Tilden, and Jeffrey Gross.

Figueredo excavated at three sites. The first of these was at the northeastern end of Krum Bay, between the two roads, where he found part of a previously excavated shell midden; here he excavated an undisturbed area of approximately 6 m^2 to a depth of 1.25 m (Figueredo 1974a, 2). The second site, Grambokola Hill, was brought to Figueredo's attention by the chief engineer of the VI Water and Power Authority (WAPA), on whose land the site was found. This site had mostly been destroyed by the establishment of the desalination plant and roads, and only a small remnant of the original site remained. The third site was located at Cancel Hill, a small hill in the northeastern part of the Krum Bay area, on the ridge between Sara Hill and Grambokola Hill (Gross 1976, 233).

At Figueredo's first site, which he concluded was part of Bullen and Sleight's Krum Bay site, the upper layers (layers II – VI) were packed with shell remains, primarily ark clams and oysters, but these layers did not contain many stone artifacts, except for hammerstones. The lowest layer with artifacts, however, contained relatively few shells and more stone artifacts than the upper layers (Figueredo 1974a, 2–3). Among the artifacts that Figueredo found were shell disks, numerous conch shell "picks," grinders and hammerstones, stone beads, fine-grained basalt flakes, a conch shell scoop, an axe fragment and an exotic brown chert point (Figueredo 1980). This brown chert point's closest parallel has been suggested as Bullen and Sleight's single quartz core (Bullen and Sleight 1963, Plate XIb), or Gross's flint blades from Krum Bay and Grambokola Hill – one from each site (Gross 1976, 233–234). In "the Hatt Collection," there is also a triangular, red-yellowish, flint-like artifact and a dark gray, flint-like flake (see Figure 16.3); these two artifacts, however, have been judged to be rhyolite, a kind of flinty volcanic rock (Gareth Davies, personal communication, 2017). These few, but recurrent flint-like artifacts may indicate connections with rare rock resources in either the Greater or the Lesser Antilles, but more research is needed to confirm or reject this hypothesis.

The second shell midden, Figueredo's Grambokola Hill site, was very homogenous throughout, and consisted primarily of dark, ashy soil and shells, of which the predominant species was *Arca zebra*, just like at his Krum Bay site. The Grambokola Hill assemblage of artifacts, however, was only similar to the finds from the upper layers of Figueredo's Krum Bay site (Figueredo 1974a).

The third shell midden site, of which Figueredo excavated one square meter in a test pit, was discovered by Tilden during a survey on Cancel Hill in 1974. According to Gross, it covered an extensive area of the hilltop, but the shell midden deposit was quite

Figure 16.3. Left: O.2.145: Silicified tuff/rhyolite triangular artifact from Krum Bay B, square II, layer 2. Right: O2.179: Glassy dacite/rhyolite flake from Krum Bay B, square V, layer 1 (Photographs courtesy of the National Museum of Denmark).

shallow, being less than 25cm deep. The soil deposit in the midden was dark gray and rich in ash, and the excavated finds consisted of basalt and quartz flakes, two hammerstones and conch "picks," while a discoidal hammerstone and two ground-stone celt fragments were collected on the surface (Lundberg 1989, 136). The shell assemblage consisted of almost equal quantities of *Arca zebra, Cittarium pica, Pteriidae* and *Chama macerophylla* (Gross 1976, 234).

Figueredo's conclusions after his excavations in the Krum Bay area were that the Krum Bay sites had two phases: the earliest he calls the Krum Bay phase I, and the latest Krum Bay phase II, based on the different find assemblages. The Grambokola Hill site he places in the later Krum Bay phase II, together with the upper layers of the Krum Bay site, even though his four ^{14}C samples of shells – from Cancel Hill (785–395 cal BC), Grambokola Hill (770–375 cal BC and two from Krum Bay (795–395 cal BC and 765–370 cal BC), respectively – are clustered closely together, indicating very little temporal separation (Gross 1976, 234 and see Appendix, this volume).

Finally, it should not be forgotten that Figueredo doubled the number of Archaic Age sites in the USVI when, in 1972, he found several non-Ceramic sites in the Magens Bay area, on the north side of St. Thomas. These sites, called Zufriedenheit, Arboretum, Petersborg, Herleins Kob and possibly Loevenlund appear to be characterized by a late occupation. Arboretum produced ^{14}C dates between cal AD 350–655 and 265 cal BC – cal AD 65), therefore indicating a very late Archaic Age phase compared to the Krum Bay sites (Figueredo 1974a, 1974b; Tilden 1976 and see Appendix, this volume).

Lundberg 1989

The most thorough examination of the Krum Bay sites so far was undertaken by Emily Lundberg in her PhD dissertation in 1989. However, she only conducted a small, independent excavation of a 2 m^2 remnant of midden left exposed by Figueredo (Lundberg 1989, 50). She described this block as being very varied, with many separate layers and recognizable features, which she interpreted as fire pits. The layers and features contained a mix of dark gray, ashy soil, fire-cracked stones and tightly packed shells, predominantly *Arca zebra* and *Pinctada imbricata.* The artifacts that Lundberg recovered were similar to the finds of previous excavators, except for a few green, sub-microcrystalline blades and flakes (Lundberg 1989, 91–121). She also attempted to identify plant, pollen and phytolith remains using flotation and soil sampling, and although edible seeds and fruit remains from non-native plants were present, no evidence of domesticated plant remains were found (Lundberg 1989, 152–158, 190–191). A reevaluation of these plant remains in the light of recent research could lead to other conclusions (Rodríguez Ramos 2010, 62–85).

Lundberg also greatly increased the number of ^{14}C dates from Krum Bay, as she had nine samples tested, which yielded ages within the range 3580±270 BP – 1595±75 BP. The earliest date was obtained from a very small charcoal sample and was thus the least secure, so Lundberg warned against placing too much emphasis on this outlier, as seven ages are clustered between 2870±70 and 1595±75 BP, while she discarded the last sample on the basis that she considered it a modern intrusion. Calibrated these dates range between 805 cal BC and cal AD 730 (see also Appendix, this volume).

She systematically compared her ^{14}C dates with those of Bullen, Sleight, and Figueredo as uncalibrated dates, because ^{14}C dating methods had improved considerably between 1960 and 1989, though it was not established how calibrated dates could be obtained from the Caribbean islands, or how to take into account the marine reservoir effect. Vescelius, for example, used isotopic fractionation and secular fluctuation corrections of some 700 to 800 years on Figueredo, Gross and Tilden's ^{14}C dates, but did not correct for the marine reservoir effect (Lundberg 1989, 83–90).

In her conclusions, Lundberg strongly advocates that the Krum Bay sites should be seen as a linked cluster of sites that cannot be interpreted independently, even though they may not have been occupied simultaneously. She does not consider Figueredo's Archaic Age sites from the north side of St. Thomas at Magens Bay to be obviously linked to the Krum Bay sites, despite their interesting character, based upon the evidence that was available at the time (Lundberg 1989, 90, 165–171).

New ^{14}C dates from Hatt's Krum Bay A and B sites

Nine new ^{14}C samples have been tested by Beta Analytic Inc. in 2016/17, one of which, a bone sample, did not contain enough collagen to produce a date yield. However, eight conch shell samples did yield dates, four each from Hatt's Krum Bay A and B sites, respectively.

Krum Bay A:

The two oldest dates from Krum Bay A are 3080±30 BP (988–809 cal BC) and 2900±30 BP (801–621 cal BC) (Beta-445862 and Beta-445863; both conch shells; $\delta^{13}C$ = +3.2 and +2.1); both are from Hatt's layer 3. The third sample, from layer 2, yielded a date of 2600±30 BP (396–216 cal BC) (Beta-455042; conch shell; $\delta^{13}C$ = +1.6), while the fourth sample, from Hatt's layer 4, yielded a date of 2420±30 BP (196–8 cal BC) (Beta-445861; conch shell; $\delta^{13}C$ = +1.1) (see also Appendix, this volume).

The fallout of these dates clearly poses an interpretative problem, as the deepest and supposedly oldest sample gives the youngest date by far. However, both Figueredo and Lundberg commented on the presence of intrusive fire pits in the midden on the north shore, which could explain the last dating. Nevertheless, the three other dates are generally in agreement with Figueredo and Lundberg's ^{14}C dates from their Krum Bay sites, as will be discussed below.

Krum Bay B:

The three samples from Hatt's layer 2 – the deepest layer at Krum Bay B – yielded dates of 3280±30 BP (1262–1047 cal BC), 3190±30 BP (1151–924 cal BC) and 3120±30 BP (1044–841 cal BC) (Beta-455038, Beta-455039 and Beta-455040; all conch shells; $\delta^{13}C$ = +2.6, +1.6 and +3.9). The fourth sample, from layer 1 – the shallowest layer – yielded a date of 2920±30 BP (816–691 cal BC) (Beta-455041; conch shell; $\delta^{13}C$ = +2.8) (see Appendix, this volume).

Given the chronologically expected sequence, the dates are earlier than expected when evaluated against Gross and Figueredo's Archaic Age chronology for the Krum Bay area sites, though they send in only four successful ^{14}C samples: two from their Krum Bay site and one each from their Grambokola and Cancel Hill sites. Thus, they did not obtain a very extensive sequence from any site, which could partially explain why they viewed Krum Bay A as older than the Grambokola/Krum Bay B site.

Conclusions

After an examination of the evidence, it appears likely that Hatt's Krum Bay A site is a now-vanished shell midden that was linked to, but not necessarily spatially identical with Bullen, Sleight, Figueredo, and Lundberg's Krum Bay site.

Hatt's Krum Bay B site was probably the same site as the one Figueredo was shown behind the WAPA desalination plant, the site now known as the Grambokola Hill site. Hatt's Krum Bay C is probably a part of Tilden's Cancel Hill site. The location of the Nisky Bay site was probably where jetties are now located, immediately northeast of Haypiece Hill (see Figure 16.1).

When reviewing the artifactual evidence, it is clear that there are certain differences, both between the different excavators and the contemporary sites on neighboring islands. The absence of ground conch celts, for example, springs to mind, together with the uniqueness of the Krum Bay axes. On the other hand, the similarities between conch "picks," "points" and "knives," the ochreous stones and the few recurring flint-like artifacts are obvious.

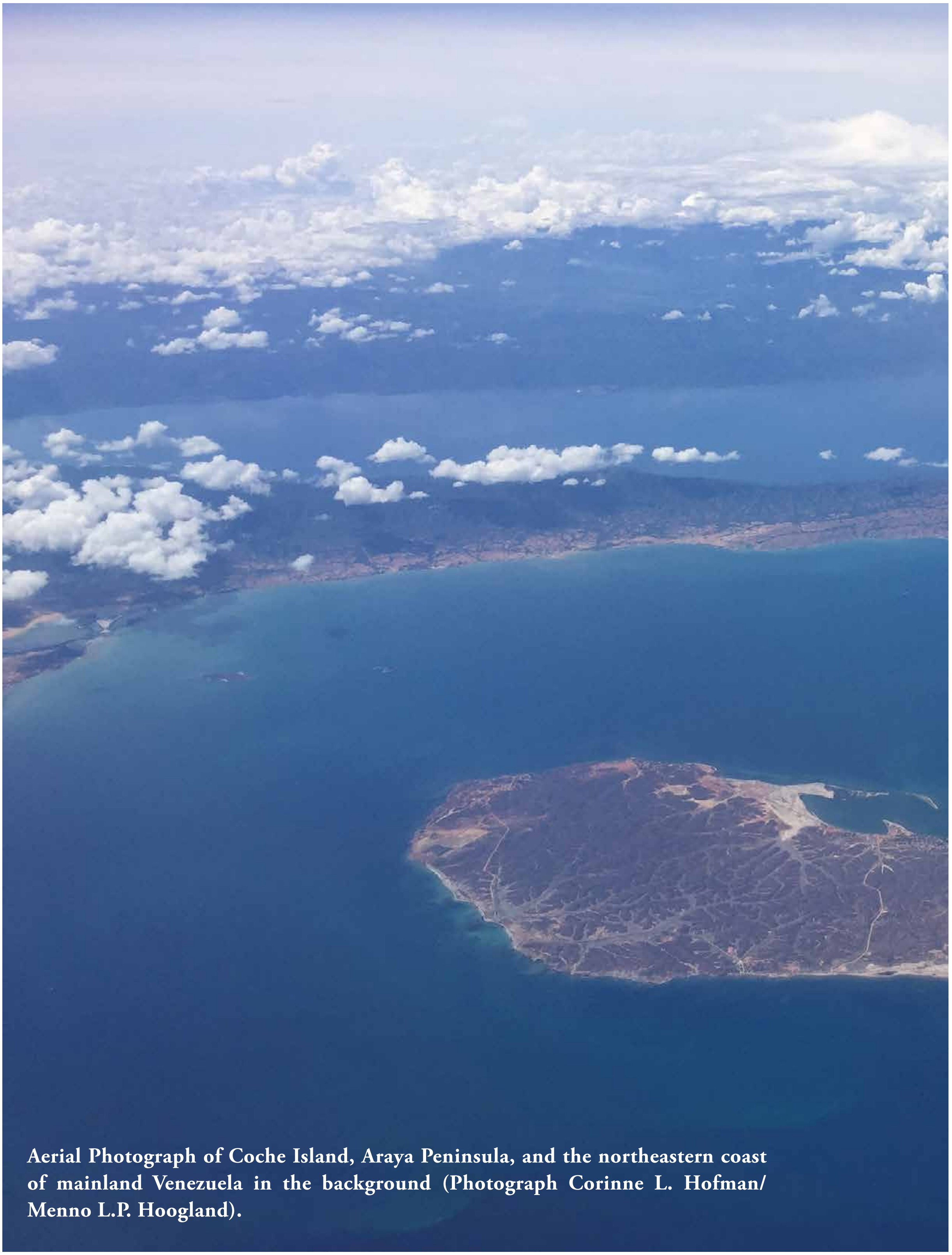
The ^{14}C datings for Hatt's Krum Bay A and B sites and Bullen, Sleight, Figueredo, and Lundberg's Krum Bay C, Grambokola, and Cancel Hill sites generally agree, but some individual dates still present interpretative problems, which can only be solved through further research and analysis. Meanwhile, the single ^{14}C date for the Cancel Hill site is clearly insufficient.

It is also evident that Hatt's excavation diaries, his MARB draft papers and the actual MARB need to be reexamined much more systematically than has been the case so far, as all these documents contain a large amount of unpublished spatial, artifactual and interpretative information – regardless of the problems that Bullen, Sleight, Figueredo, Gross, Tilden, Lundberg, and this author have had in utilizing the documentation in the excavation diaries, the draft papers and the MARB, which is understandable due to the sloppiness of Hatt's handwriting. The results of a thorough reexamination would most likely be especially noteworthy in relation to Hatt's Krum Bay B/Figueredo's Grambokola Hill site and Hatt's Krum Bay C/ Tilden's Cancel Hill site, on which almost nothing has been published, and for which each site has had only one ^{14}C date up to the production of this chapter. Nevertheless, the four recent ^{14}C datings from the Krum Bay B site indicate that the site should be considered the oldest Archaic Age site in the Krum Bay area, and not the Krum Bay A site as thought by Figueredo and Gross, with all the implications this might have for a reanalysis of the artifact assemblage.

The recent results, combined with an in-depth reexamination of Hatt, Bullen, Sleight, Figueredo, Gross, Tilden, and Lundberg's excavated material, together have the potential to provide a much more accurate picture of the Archaic Age in the Virgin Islands.

Acknowledgements

This study of the Archaic Age Krum Bay sites has been a part of the author's PhD project, the funding for which has been provided by the Danish Ministry of Cultural Affairs' Research Council and the National Museum of Denmark. The funding for the ^{14}C sampling has been provided by the Elisabeth Munksgaard Foundation. Warm thanks go to my archaeological predecessors at Krum Bay and in the Virgin Islands, professionals and amateurs alike: Gudmund and Emilie Hatt, J.P.B. de Josselin de Jong, Gustav Nordby, Folmer Andersen, Frieda Møller-Jørgensen, Julie Helweg-Larsen, Ripley Bullen, Frederick Sleight, Alfredo Figueredo, Jeffrey Gross, Bruce Tilden, and Emily Lundberg, as well as to mentors, colleagues, and friends who have supported this study in one way or another: Klavs Randsborg, Corinne Hofman, Ken Wild, Kourtney Donohue, Gareth Davies, Alice Knaf, Sebastiaan Knippenberg, Mikkel Sørensen, Mille Gabriel, Christian Sune Pedersen, Suzan Mefail, Anja Blok Jespersen, Inge Dam, Jesper Kurt-Nielsen, and the "first" editor and my wife, Marianne Jacobsen Toftgaard.



Aerial Photograph of Coche Island, Araya Peninsula, and the northeastern coast of mainland Venezuela in the background (Photograph Corinne L. Hofman/ Menno L.P. Hoogland).

Part Three

Mobility and Exchange

17

An Archaic site at Upper Blakes on Montserrat: Discovery, context and wider significance

John F. Cherry and Krysta Ryzewski

Introduction

Sites of Archaic Age date in the Lesser Antilles have now been reported on Anguilla, Antigua, Barbados, Barbuda, Guadeloupe, Nevis, Saba, St. Eustatius, St. Kitts, St. Martin and St. Thomas (Fitzpatrick 2015, 308–309, Table 1; Keegan and Hofman 2017, 23–50; Gilmore *et al.* 2011; Stouvenot and Casagrande 2015). In most cases, only a small number of sites (ranging from one to four) dating to this time period are known on each island (Fitzpatrick 2011, 598; Hofman *et al.* 2014b; Hofman and Hoogland 2018). Besides St. Martin, the major exception is Antigua, on which there are several dozen sites that have returned appropriate radiocarbon dates, produced lithic assemblages that are manifestly of Archaic Age, or are aceramic locations that can be assumed to be Archaic (Davis 2000, 82, Figure 23) (Figure 17.1). One obvious explanation for this pattern is that Antigua – or, rather, Long Island off its northeast coast – is the source of the finest tool-quality chert found in the eastern Caribbean (van Gijn 1993; Hofman *et al.* 2014b, Hofman *et al.* this volume), a resource that was exploited widely from the earliest stage of settlement on these islands (Knippenberg 2007). It was an oddity, therefore, that no Archaic Age sites were known on neighboring Montserrat, just 48 km to the southwest of Antigua, and a recipient of Long Island chert in prehistoric times; at Early Ceramic Trants, for example, 80% of the lithic raw material in an assemblage of almost 2500 items is a tan and brown chert, "all of which probably originated in neighboring Antigua" (Crock and Bartone 1998, 201). The most likely reason for this dearth of evidence was perhaps the relative scarcity of sustained archaeological research on Montserrat until the inception of the Survey and Landscape Archaeology on Montserrat (SLAM) project, co-directed by the present authors, which commenced in 2010 (Cherry *et al.* 2012, 2014; Opitz *et al.* 2015; Ryzewski and Cherry 2012b, 2015, forthcoming)

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 231-244.

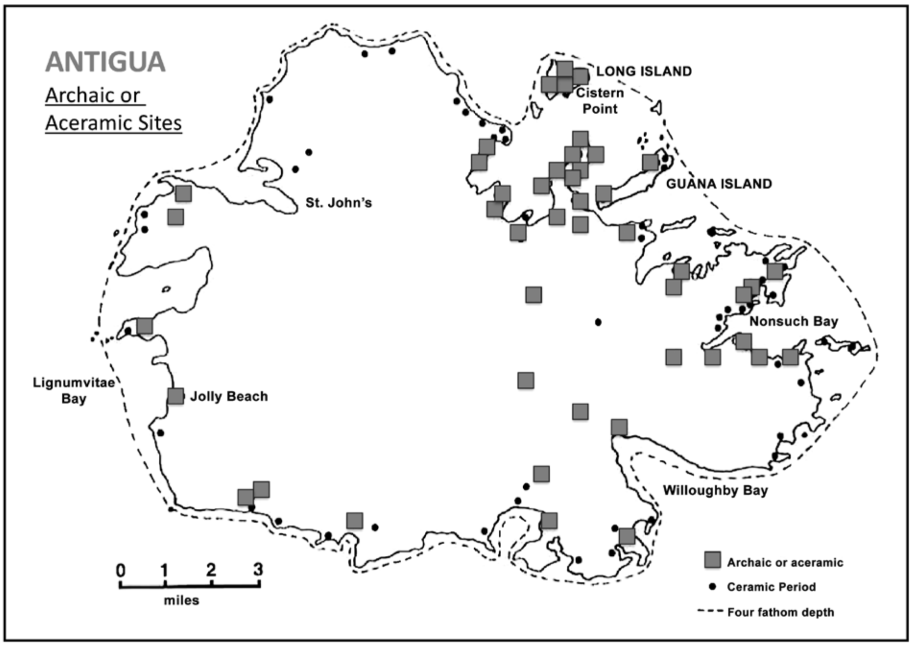


Figure 17.1. Map of Antigua showing locations of sites of Archaic Age date and other aceramic sites, probably also Archaic Age (Adapted from Davis 2000, Figure 23).

This chapter describes a newly discovered site of Archaic Age date on Montserrat, the first known on the island. Previously, the oldest archaeological site was Trants, an Early Ceramic settlement with earliest colonization dates of around 500 BC (Haviser 1997, 61; Fitzpatrick 2015, Table 1; Napolitano *et al.* forthcoming). The site at Upper Blakes may document human activity on Montserrat more than two millennia earlier, thus placing it among the earliest known sites in the Lesser Antilles (Hofman *et al.* 2014, 2018b). Here we recount the circumstances leading to the discovery of Upper Blakes, describe the site and its setting, summarize and comment on the lithic material and its technology (especially in comparison with that of nearby Antigua), present its radiocarbon AMS date and reflect on the wider significance of Upper Blakes for the early occupation of the Lesser Antilles.

Discovery of the Upper Blakes site

Serendipity plays a larger role in archaeology than we often care to admit, and such was the case with the circumstances of the discovery of the Upper Blakes site. When the SLAM research project commenced in 2010, we noticed among the archaeological materials stored at the Montserrat National Trust (MNT) a box of uncatalogued, unprovenienced artifacts that included a few large blades and flakes of Antiguan Long Island chert, described as "Amerindian knives" (Cherry *et al.* 2012, Figure 3). All that was known about them was that they had been handed to the MNT by a farmer, who claimed to have found them "up in the Centre Hills." Centre Hills, a long dormant volcano and now a nature reserve (Holliday 2009), comprises an area of over a dozen square kilometers of steep and relatively inacces-

Figure 17.2. View to the north over the cultivated fields of Upper Blakes (Photograph by John Cherry).

sible jungle-covered slopes; this, obviously, did not provide any useful clue about the precise findspot of these artifacts. A couple of years later, however, in the course of a box-by-box inventory of the entire artifact collection stored at the MNT, we came upon a small bag containing quite similar lithic materials. Included in the bag was a handwritten note by Dr. David Watters, who in 2000 had been led by a local informant to the precise location at which he had collected these artifacts. Watters did not know quite how to interpret these finds: were they perhaps an Archaic Age lithic assemblage (unprecedented on Montserrat), or rather, was this a special-purpose chert-knapping location used by Early Ceramic horticulturalists? Nonetheless, he helpfully specified UTM coordinates that we duly entered into our GIS system and followed to the findspot. It should perhaps be noted here that, eventually, SLAM would have almost certainly discovered this site in the course of systematic survey of the more accessible northern portion of the island, given the sheer density of prehistoric and historic materials at this spot and the unusually favorable surface visibility conditions.

Upper Blakes turned out to be a rather unusual place, at least by Montserrat standards. Following the devastating (and ongoing) volcanic emergency beginning in July 1995, and the wholesale relocation of population to the relatively safe northern part of the island, this is one of the very few places where extensive open-field agriculture is now taking place, by tenant farmers who receive advice and assistance from the Montserrat Department of Agriculture. As a result, the area of Upper Blakes is divided into about two dozen fields, cultivated by hoe in a bank-and-furrow system, and used to grow a wide variety of vegetable crops (Figures 17.2 and 17.3). A dirt road affords fairly easy access, and intensive cultivation means that

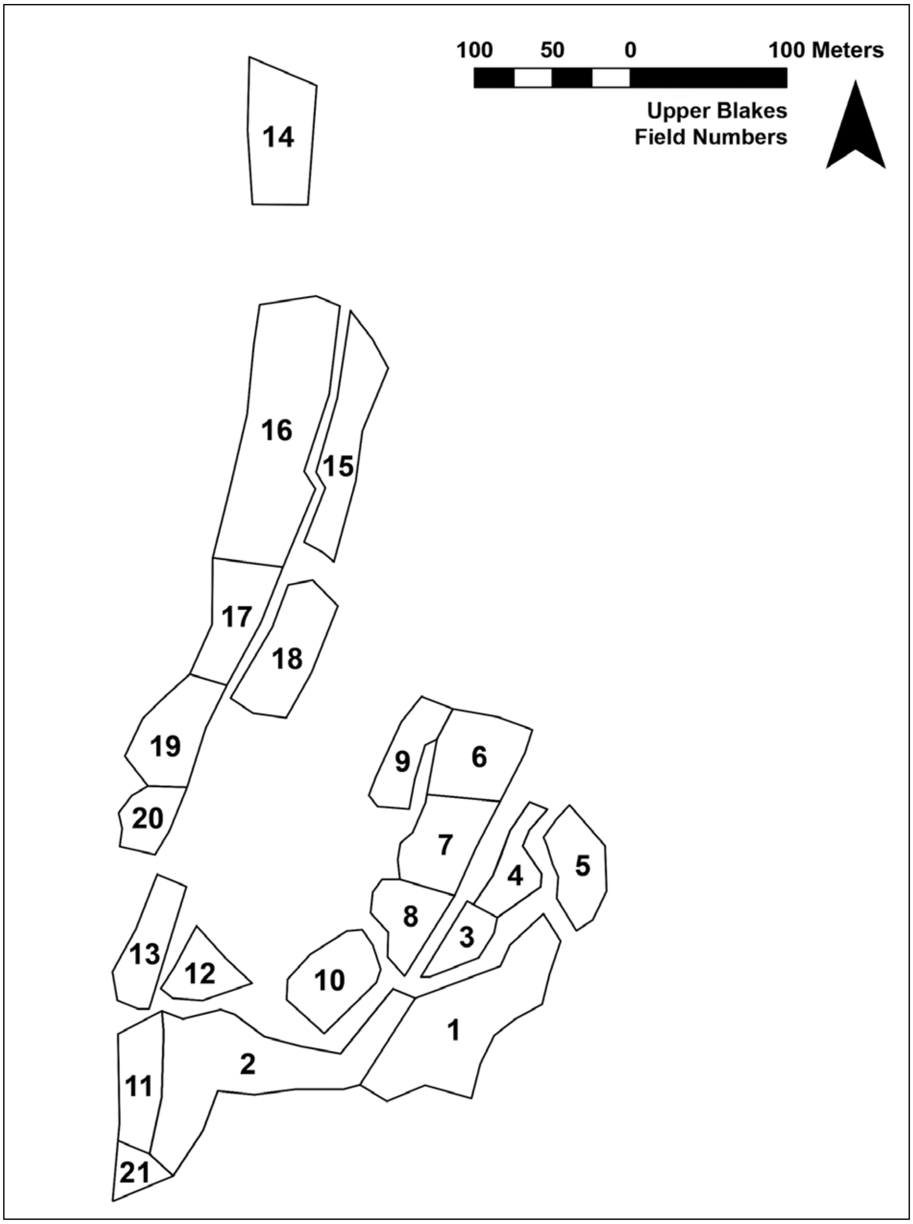


Figure 17.3. Layout of the field system at Upper Blakes, showing individual numbered collection areas (Map by Tom Leppard and Miriam Rothenberg).

surface visibility conditions are excellent. Consequently, it was possible to conduct a furrow-by-furrow survey of this entire field system in 2012.

Unlike nearly all other Archaic Age sites in the Lesser Antilles (sites on Saba are a notable exception [Hofman and Hoogland 2003; Hofman *et al.* 2006, this volume]), the Upper Blakes site lies at fairly high elevation, about 1000 feet above sea level. It sits on a ridge, demarcated by two deeply incised *ghauts* (watercourses), that begins high in the Centre Hills and ends, much lower down, at the historically important colonial-era plantation site of Blakes Estate. This was one of the earliest and most important estates on Montserrat, whose surviving industrial works the SLAM project has investigated and mapped in detail (Ryzewski *et al.* 2012). The cultivated fields of Blakes Estate evidently continued a long way up the ridge to its south (past the present-day FIFA soccer field), and several of the surveyed fields at Upper Blakes contain abundant historic-era artifacts, mainly of mid- to late eighteenth-century date (Cherry and Ryzewski 2017a; Ryzewski and Cherry 2012a, forthcoming). Considering the density, character and distribution of these finds, it seems likely that this was an area once occupied and cultivated by enslaved laborers on the Blakes Estate. These artifactual finds of relatively recent historical date, however, are wholly distinct from the far earlier lithic finds at the site. Some 347 lithic items were collected in this first survey work at the site in 2012. Although at that stage no absolute date for the site was available, the likelihood – on the basis of its distinctive lithic technology – that Upper Blakes was indeed the first known Archaic Age site on Montserrat encouraged publication of a short preliminary note on the site (Cherry *et al.* 2012).

Before moving on to discuss this lithic industry and its significance, we describe more recent work at Upper Blakes. Local access difficulties prevented a return there until 2016, when it became possible to conduct further fieldwork. Equipped with a drone, we imaged the entire field system from which the lithic finds had been retrieved and generated a photogrammetric model of the area. We also conducted a brief resurvey of some of the most productive fields, collecting over 100 further lithic finds. Finally, a very small sondage was excavated at the center of the densest lithic concentration (Area 2, Feature 206 in SLAM's nomenclature) – evidently an *in situ* knapping area, to judge from the large quantities of micro-debitage – in order to collect a charcoal sample suitable for radiocarbon analysis. This came from a sealed context about 10 cm below the current surface.

This charcoal sample gave us a very early date of 4160±30 BP (see below), and it naturally encouraged us to plan a small-scale excavation at Feature 206 in May 2017. Unfortunately, a major European Union-funded civil engineering project for the stabilization of slope erosion and flood control also began in the spring of that year. Despite providing detailed information to all relevant authorities about the precise location and cultural importance of the prehistoric site at Upper Blakes, to our dismay we discovered on arrival that a newly bulldozed road and a system of concrete drainage channels had entirely obliterated the area that was intended to be the focus of the planned excavations. Nonetheless, noticing that some lithic items were visible in the scarp cut by the bulldozer, we switched to an alternative plan and excavated four units 1.0 to 1.5 m wide, cutting back into the scarp up to 50 cm. These excavation units lay immediately below the surface of the actively cultivated modern fields, raising the very real likelihood of stratigraphic contamination. This in fact turned out to be the case. The excavated units revealed cultural deposits of up to one meter in depth, from which were retrieved 147 artifacts (86% of them lithics). The non-lithic items were clearly intrusive historic-era glass or ceramic artifacts; no bone or shell was encountered. The volcanic soils of Montserrat are generally vertisols: that is, they experience severe shrinkage and expansion, dependent on moisture and temperature, creating vertical cracks that provide a path for artifacts

Survey Unit	Cores	Retouched pieces	Blades	Blade-flakes[a]	Flakes	Spall[b]	Micro-débitage[c]	TOTAL
Area 2	1	3	16	12	84	121	71	308
Area 2 F. 206	4	3	15	19	46	66	34	105
Area 5			1		1	4		6
Area 5 F. 205						1		1
Area 6			1			1		2
Area 8	1				5	1		7
Area 10					5	3		8
Area 11	2	1	4	6	17	8	1	39
Area 12					6		1	7
Area 13			1		3	5	1	10
Area 16 F. 208	1			1	2			4
Area 18						1		1
Area 19 F. 209					1	1		2
Area 21					3	8	2	13
TOTAL	**9**	**7**	**38**	**38**	**173**	**220**	**110**	**595**

Table 17.1. Breakdown of the Upper Blakes lithic assemblage by survey area.
a *"Blade-flake" indicates flakes that are twice as long as they are wide, but without precisely parallel margins; these are likely removals at an intermediate stage of blade-core reduction.*
b *"Spall" refers to knapping debris that is difficult to classify, but includes fragmentary flakes, irregularly-shaped pieces lacking any platform, spines, and other miscellaneous shatter. The majority of it is corticated to some extent.*
c *"Micro-débitage" is the term used to describe extremely small-scale débitage with a maximum measured dimension less than 10 mm and an average weight of 0.7 g (many in fact weigh less than 0.1 g).*

to travel downwards, as seems to have been the case here (Howard 2015). Evidence for this may perhaps be found in the several charcoal samples that were collected and subsequently submitted to Beta Analytic for ^{14}C analysis, all of which returned essentially modern dates. Finally, as part of SLAM's 2017 activities at the site, half a dozen of the fields that have been most productive of lithic finds were resurveyed, resulting in the collection of 139 additional artifacts (Table 17.1 and Figure 17.3).

To summarize, therefore, the prehistoric site at Upper Blakes lies at fairly high altitude, with sweeping views over northern Montserrat and beyond. In this respect, it is unlike nearly all of the Ceramic Age prehistoric sites on the island, which are coastal – as is also the case for the majority of known Archaic Age sites in the Lesser Antilles. The assemblage recovered by surface survey, and by necessarily very limited excavation, lacks any evidence of ground-stone, bone or shell tools or other ecofactual remains, but instead comprises a large collection of 722 lithics, most (perhaps all) of chert from Long Island, Antigua.

Figure 17.4. Lithic artifacts from Upper Blakes. Left: A selection of blades and (top left) a prismatic blade core from Feature 206. Right: A complete macroblade from Area 5 (Photographs by John Cherry).

The Upper Blakes Archaic Age lithic assemblage

The lithic assemblage represented by the finds at Upper Blakes stands out as altogether different in character and technology from those found at all other known prehistoric sites on Montserrat. As a result of Watters's pioneering survey of several parts of Montserrat (Watters 1980) and follow-up excavations (Watters 1994; Watters and Petersen 1995), and SLAM's excavations at the Late Ceramic sites of Valentine Ghaut (Bocancea *et al.* 2013) and Indian Creek (Cherry and Ryzewski 2017b), along with their accompanying ^{14}C dates, we now have a good idea of the Ceramic (Saladoid) prehistoric sequence on the island. From these data, it is clear that the lithics at Ceramic Age sites are the product of expedient, flake-based technologies using hard-hammer (and even bipolar) percussion knapping (Bartone and Crock 1991; Crock and Bartone 1998). The desired outcome was sharp-edged flakes to be used for cutting or scraping, without further modification. Formal tools with intentional retouch are almost completely absent; blades, or blade-like flakes, where they exist, seem to be a very rare and probably accidental by-product of a flake-focused reduction technology. This characterization, incidentally, would apply to most other Ceramic Age sites throughout the Lesser Antilles, at least where they have been published in sufficient detail (which is not often: see Walker 1980).

The assemblage at Upper Blakes, by contrast, reveals a sophisticated blade-core technology, and it was this feature, in fact, that first drew attention to the site and its chert materials. It is overall more massive in scale: for example, the average weight of a lithic item (excluding micro-debitage weighing less than one gram) from Upper Blakes is two to three times as great as from the Ceramic Age prehistoric sites recorded by SLAM on Montserrat. A complete macroblade of 16 cm in length has been recovered, as have fragments of others probably similar in size (Figure 17.4). It is incontrovertible that knapping took place at the site, almost certainly using raw material brought in from Antigua (Montserrat, an entirely volcanic island, has no chert sources).[1] The evidence for this is that by far the majority of the lithics retain at least some cortex, and some largely unmodified nodules of raw material weighing up to 300 grams have been found; conversely, both excavation and careful survey have recovered numerous minute debitage flakes weighing less than 0.1 gram, clearly an indication of *in situ* knapping. It is conceivable that macroblades, which were being made at the chert workshop on Flinty Bay (van Gijn 1993, Figure 10), came to Montserrat ready-made; but the scarcity of discarded cores, and the sheer quantity of irregular corticated knapping debris, argues against the idea that high-quality prepared cores were brought to the island for the immediate production of blades and flakes (as suggested by van Gijn 1993, 194). Thus, we suggest that, for the most part, raw material came to Montserrat without any prior preparation.

This is not the place to describe the reduction process in detail, more details of which, with drawings, are provided elsewhere (Cherry and Ryzewski forthcoming). Table 16.1 provides a coarse quantitative overview of the constituent parts of the assemblage, broken down by find context. It is possible to document most phases of a classic direct percussion, prismatic blade-core technology: trimming flakes to set up the cores, examples of rejected, exhausted or "test" cores, blades and blade-flakes with characteristic wide striking-platforms, along with a variety of flakes, chunks, spines, shatter and micro-debitage created along the way. The cores and core fragments are not limited to blade-cores, but also include polyhedral cores, indicating that this industry was not solely focused on blade (or even macroblade) production. The lack of formal tools and the scarcity of retouched items are very notable. One exceptional example is a long lunate blade that has received a very neat invasive dorsal retouch to create a backed blade. Careful inspection using a 20-power loupe, nonetheless, has revealed extremely few examples of either intentional- or use-retouch. It is possible to detect a quite sophisticated knowledge of blade technology at work: for example (Figure 17.5), rejuvenation flakes removed from the distal end of a prismatic core by means of a lateral blow, in order to prolong the use-life of the core when it became too pointed; or the correction of a knapping error, such as a step fracture, by the further removal of a

1 In fall 2016, SLAM team member Miriam Rothenberg attempted to source samples from Upper Blakes geochemically using non-destructive pXRF in the laboratories of the Dept. of Earth, Environmental and Planetary Sciences at Brown University. The results were not conclusive for the purposes of linking the Upper Blakes material with the Long Island source on Antigua; further testing using alternative methods is planned for the future. However, visual comparison of the chert employed at Upper Blakes with lithic finds from Antigua, both on display and in storage at the Museum of Antigua and Barbuda, indicates very close similarity. Rothenberg notes that while Montserrat has no sedimentary layers containing chert nodules or micro- or crypto-crystalline rocks suitable for knapping, there are some hydrothermally-precipitated cherts/opals associated with heated groundwater movement through siliceous volcanic layers. These, however, are small and full of inclusions that would make them unsuitable for knapping.

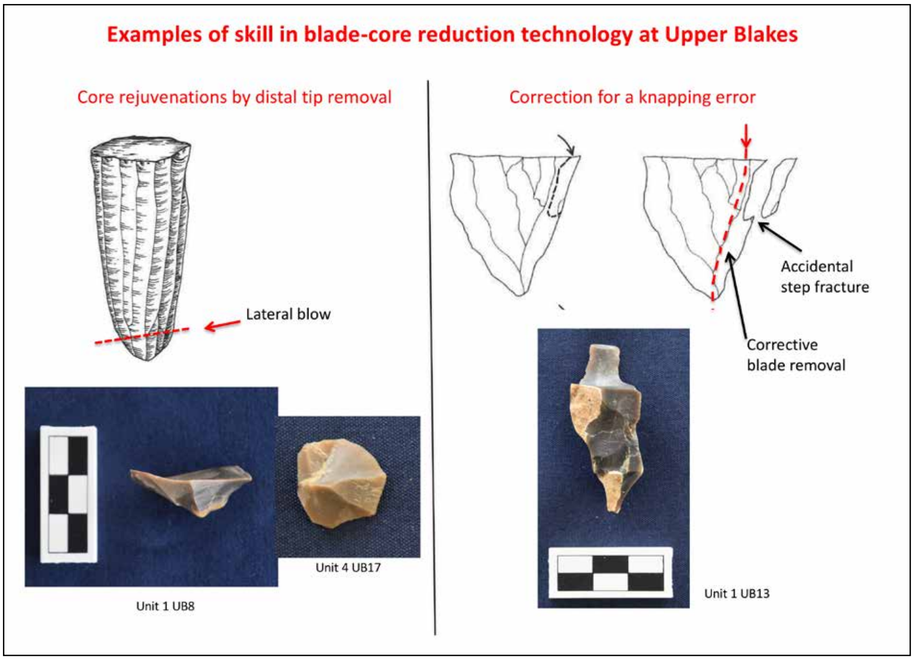


Figure 17.5. Examples of sophisticated knowledge of prismatic blade-core manufacturing technology at Upper Blakes. Left: Distal truncations of prismatic cores to prolong core life (Unit 1 UB8, Unit 4 UB17). Right: Correction for an accidental step fracture by a subsequent blade removal (Unit 1 UB13).

plunging blade-flake. These are well-documented strategies adopted by knappers thoroughly familiar with the techniques of producing blades from cores in a standardized and efficient manner (Torrence 1986).

Lithics from Archaic Age sites in the Lesser Antilles have generally not been published in much technical detail, making comparison with Upper Blakes difficult. The closest parallels, of course, come from nearby Antigua, which, as already noted, anomalously has over 40 known Archaic Age sites, many of them first located by the late Desmond Nicholson (1994). Their lithic technology studied many years ago by Dave Davis (1974; 1993; 2000), is also primarily blade-based; but the Antiguan blades are generally smaller than many of those from Upper Blakes, and seemingly were also not produced by using a classic prismatic blade-core technology. The reduction sequence described by Davis for Jolly Beach and elsewhere is, in fact, a rather peculiar one. Evidence from the chert source on Long Island, Antigua (van Gijn 1993) actually provides closer parallels to the technology seen on Montserrat than to that at some of the published sites on Antigua. It should also be emphasized that the output of knapping at Upper Blakes included both macroblades and regularly-size blades, as well as sharp-edged flakes produced by much simpler core-reduction processes.

There are some obvious similarities between the Montserrat material and the macroblades struck from prismatic cores known from Lithic Age (Casimiroid) or Early Archaic Age sites on Cuba and Hispaniola, which were probably used for processing marine and smaller terrestrial animals, woodworking and making other tools (Wilson *et al.* 1998). Like Upper Blakes, Casimiroid sites have been described as lacking ground-stone tools, and many of them are simple lithic scatters or knapping areas, although sites such as Levisa I in northeast Cuba (Wilson 2007, 34–37, Figure 2.4; Fitzpatrick 2015, 309; Valcárcel Rojas and Ulloa Hung, this volume) are more complex and, interestingly, show a decrease over time (6300–5700 cal BP) in blade tools at the expense of flake tools and the increasing use of shell tools made from queen conch. This parallel, which is rather loose in terms of both geography and chronology, is perhaps not one to be pressed; but it does index a matter of wider interest that has received little attention in the literature.

As a generality, it seems, macroblades are present in some Caribbean lithic technologies more or less from the beginning – whether or not these were ultimately derived from industries in Belize or the Isthmo-Colombian region, as has been suggested (Wilson *et al.* 1998; Wilson 2007, 27–33; cf. discussion in Keegan and Hofman 2017, 24–27, who also rightly treat the former Lithic and Archaic Age periods as a single, long era). Blade (but not necessarily macroblade) technologies persist throughout the Archaic Age period. Antigua, again, is the prime example (Davis 1993), although it should be acknowledged that blades are scarce or lacking at Archaic Age sites on a number of other islands in the Lesser Antilles. Hofman and Hoogland (2018, 41), in fact, make the perceptive observation that large blades have been found mainly at Jolly Beach on Antigua, and at interior, high-altitude sites on other islands (The Level on Saba, Upper Blakes on Montserrat and Capesterre Belle Eau on Basse Terre, Guadeloupe). However, for the sake of clarity, the Upper Blakes assemblage is not wholly focused on macroblades: while complete and fragmentary macroblades have certainly been found, the assemblage also indicates production of blades of smaller proportions (Figure 17.4), and the occurrence of some polyhedral cores suggests reduction sequences aimed at producing usable flakes, as well as blades.

Although it is not easy to generalize about Archaic Age lithic assemblages, coming, as they do, from such a wide variety of sites over such a broad area and such a long time period, one thing is worth emphasizing here: deliberately struck blades are more or less completely nonexistent during the Ceramic Age. Why this should be so is doubtless due to multiple factors, including shifts in the subsistence base, differing needs of horticulturalists versus hunter-foragers, or lack of interaction and technological exchanges between populations arriving in the Caribbean at different times with disparate lithic traditions. Nonetheless, similar examples of the long-term replacement of technologically-sophisticated blade-based industries by expedient flake-based ones are known in a number of other parts of the world: examples include the transition from the Chalcolithic to the Bronze Age in the western Mediterranean (Freund *et al.* 2015), or between the Middle Bronze and Iron Ages in the southern Caucasus (Cherry, unpublished data from the Vorotan Project, southern Armenia). Generally, these changes have been explained by the substitution of metal tools to perform most of the functions formerly served by stone tools. Such an explanation, obviously, cannot apply in the metal-free prehistoric Caribbean. This, then, is a worthwhile topic for future research, especially once more lithic assemblages from the Lesser Antilles have been published in adequate detail.

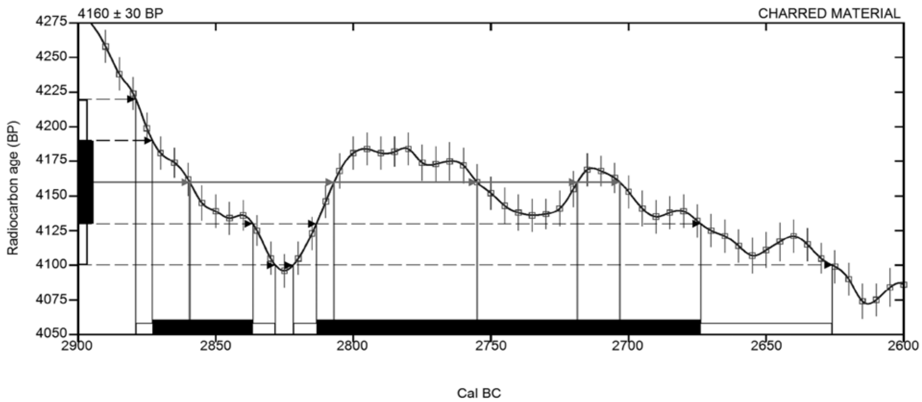


Figure 17.6. Calibration of radiocarbon age to calendar years for Montserrat ^{14}C sample Beta-451179. The conventional radiocarbon age (4160±30 BP), using the INTCAL13 calibration curve at 95% probability, results in a date of 2880–2830 cal BC, 2820–2627 cal BC.

Dating the Upper Blakes site

When the lithics from Upper Blakes were first encountered, it seemed quite apparent that they could not have been produced by Ceramic Age knappers, and must certainly be earlier, likely of Archaic Age (Cherry *et al.* 2012). But confirmation via an absolute, radiometric date was lacking. This was obtained in 2016, via the charcoal sample collected that year at the center of Feature 206, as described above. The date returned by the Beta Analytic lab (Beta-451179) is 4160±30 BP, or calibrated 2878–2832 cal BC, 2820–2675 cal BC, and 2654–2633 cal BC (Figure 17.6). This is far older than any other site currently known on Montserrat. In fact, it is among the earliest dates reported from anywhere in the Lesser Antilles (see Appendix, this volume and Napolitano *et al.* forthcoming for a catalogue and analysis of the almost 2000 ^{14}C dates now available from archaeological sites in the Caribbean).

Discussion

As Fitzpatrick (2011, 595) pointed out in his discussion of the problems involved in confirming an Archaic Age occupation of Barbados, there are a number of issues associated with reliance on a single date to establish a cultural colonization horizon. On Montserrat, nonetheless, both an Archaic Age date for the Upper Blakes site and the considerable antiquity of its assemblage seem soundly established. The date of the single available ^{14}C determination is plausible. It was obtained from a charcoal sample (not from a shell such as queen conch, which can be long-lived), derived from a buried context, located at the very center of the densest concentration of lithic artifacts at the site, which arguably represents an *in situ* knapping area. The characteristics of the lithic industry manifestly reflect an Archaic Age rather than Ceramic Age technology. Finally, the absolute date itself falls in line with the chronometric evidence from several other Lesser Antillean islands that have yielded relatively early dates for Archaic Age assemblages, including nearby Antigua.

How can this new evidence from Montserrat contribute to our understanding of the Archaic Age period in the Lesser Antilles? First, since the assemblage is predominantly composed of Long Island chert, and since the evidence clearly suggests that raw materials were brought from Antigua and knapped on the spot, we may suppose that Upper Blakes represents a visit to Montserrat by people resident on Antigua. (An alternative hypothesis, of course, is that settlers on Montserrat itself traveled to and from Long Island to obtain chert, but, in the absence of any known Archaic Age settlement on Montserrat, that is merely speculation). The lack of reliable excavated stratigraphic contexts and the availability of only a single ^{14}C date unfortunately mean that we cannot know with certainty whether this was a one-off visit to exploit resources on Montserrat, or an aspect of some longer-term venture on the island for which we currently lack evidence. The fact that this is a lithics-only site, lacking any evidence of shell, animal bone or ground-stone artifacts, suggests that it was a special-purpose site – not dissimilar to some of those on Antigua itself – rather than an established settlement.

Several other islands in the Lesser Antilles have thus far produced evidence of only one or two Archaic Age sites, so in this regard the situation on Montserrat is not atypical. Over the course of eight fieldwork seasons, the SLAM project has surveyed virtually all accessible areas in the north of the island, a level of exploration without parallel on most other islands; Upper Blakes is the only site of Archaic Age date to have been encountered. Of course, some of the central, and all of the southern, parts of the island (the "Exclusion Zone" still threatened by the Soufrière Hills volcano) cannot be examined for the foreseeable future, and their archaeological record may anyway have been either destroyed or permanently obscured by volcanic deposits. Unfortunately, the circumstances surrounding the destruction of the central portion of the Upper Blakes site (as described above) may mean that this is the only evidence we will ever have concerning its date, or indeed for the Archaic Age period on Montserrat as a whole.

These limitations mean that it is difficult to know just what this Archaic Age presence on the island represents. "Island colonization" can be taken to mean several things (Cherry 1990, 197–201; for a thorough discussion of theories of island colonization, see Dawson 2014, 42–68):

1. the earliest signs of a human presence on an island (in some cases indicated not by archaeological artifacts or ecofacts, but by anthropogenic impacts on natural landscapes: Siegel 2018, this volume);
2. evidence of repeated, perhaps seasonal, visits to an island from other nearby islands or the mainland (without any evident attempt to colonize it permanently: Hofman *et al.* 2006, this volume;); or
3. permanent settlement (although also in some cases with periods of abandonment and resettlement).

For Montserrat, only the first of these possibilities seems supportable by the presently available evidence. That is substantially less than what is normally understood by the term "colonization." In other words, while it can be claimed with some confidence that there were people on Montserrat in the first half of the third millennium cal BC, we cannot also assert that the island had been "colonized." (In fact, tables that list earliest median ^{14}C dates as alleged evidence of an island's first colonization – for example, Fitzpatrick

2015, Table 1, or, comparatively, the data for Mediterranean islands presented in Dawson 2014 – need to be critically examined on a case-by-case basis in light of this semantic differentiation.)

It seems clear that the evidence from Montserrat should be understood in the wider context of the available data on Lesser Antillean prehistory that clearly indicate the existence of close networks of interaction between adjacent islands, in some cases even from the very beginning of their histories – although such connections manifestly become more intense in the Ceramic, and especially in the Late Ceramic era (Hofman *et al.* 2014, this volume). The literature of Caribbean prehistory has become dominated by studies that focus on connections, interactions and networks: some recent examples include Hofman *et al.* 2007; Curet and Hauser 2011; Bright 2011; Hofman and van Duijvenbode 2011; Mol 2013; Keegan and Hofman 2017; and Hofman and Hoogland 2018. Antigua, first settled early in the Archaic Age period, quickly became an intensively occupied key node in northern Lesser Antillean interaction networks, an importance that only increased with time (see also Hofman *et al.* 2014, this volume). It is no coincidence that its substantial permanent population was most strongly attracted to the low-lying coastal plain in the northeast of the island (Figure 17.1), an area that provided good marine food resources and offered ready access to the chert sources of Long Island. Knippenberg's (2007, 223–243) meticulous mapping of the distribution of Antiguan cherts through several phases of the Early and Late Ceramic eras has amply confirmed that, for the region from Anguilla to Guadeloupe, they were the main rock type employed in the manufacture of flake tools. Yet in the Archaic Age, too, communities resident on islands as far afield as Guadeloupe, Barbuda, St. Kitts, Saba, St. Eustatius, Anguilla, St. Martin, St. Thomas and Puerto Rico were participating in this distribution network – although we cannot be sure whether by direct access to the sources or via webs of exchange relationships (but see Hofman *et al.* 2006).

In short, there was a substantial and well-established population on Antigua from early in the Archaic Age period; it persisted for several millennia and sat at the center of one of the most important resource distribution networks in the northern Lesser Antilles. While Archaic Age population density was probably low on most islands, on Antigua, with the densest concentration of Archaic Age sites anywhere in the Lesser Antilles, it may have been much higher, requiring more intensive resource extraction. One possible symptom of that may be the likely anthropogenic impacts on endemic fauna, seen in the nine taxa of snakes, lizards, bats, birds and rodents from Antiguan sites dating to between 2350 and 550 BC that are now extinct or have never been recorded historically (Steadman *et al.* 1984). Seen against this background, it would in fact be quite surprising if people living on Antigua did not travel to explore the food and other resources available on nearby Montserrat as part of their wider adaptation strategy.

Finally, if the foregoing interpretation is accepted, it follows that the Upper Blakes site can contribute little to our overall understanding of the early movements of people, including first colonizations and population source areas, within the Lesser Antilles. The Archaic Age, as it is now defined, has become a very long stage (6000–4000 BC to at least AD 100), one that displays enormous variability in material culture and subsistence from one island to another and even between sites on the same island, as well as overlapping with the Ceramic Age itself. Relevant data have been presented in recent articles (Fitzpatrick 2015, 307–311; Keegan and Hofman 2017, 23–50; Hofman and Hoogland 2018, 37–46), and need no repetition here. In general, sites of Archaic Age date are very abundant throughout the Greater Antilles, well represented in the Leeward Lesser Antilles, and very sparse in the Windwards (perhaps because of poor site preservation: Hofman and Hoogland 2018, 40). One model to account for such a pattern suggests expansion (perhaps from Central America) into the Greater Antilles, spreading through Cuba, Hispaniola and Puerto Rico, and thence into the more northerly islands of the Lesser Antilles – but not much further. Alternatively, what has come to be termed "the southward route hypothesis" envisions populations moving northwards into the islands from northeastern South America, but essentially bypassing the southern islands in a push for Puerto Rico, and from thence colonizing the Leeward islands in a southward movement that did not extend much beyond the Guadeloupe Passage (Fitzpatrick 2013a).

Upper Blakes adds another welcome dot to the Archaic Age distribution map for the Lesser Antilles and shows that humans came to Montserrat as early as the middle of the third millennium BC. But if these people came from Antigua and were not colonists, then the evidence has little bearing on the pattern of island colonization or the models we propose to explain it. Conversely, if Upper Blakes was in fact a location used by people living elsewhere on Montserrat, we currently have no evidence of their settlements, so the suggestion must remain in the realm of speculation. The Upper Blakes site can certainly make useful contributions to the archaeology of the Archaic Age Caribbean – but not in this respect with the currently available data.

Acknowledgements

We thank the Director of the Montserrat National Trust, Mrs. Sarita Francis, OBE, for her help in facilitating our fieldwork on the island. We are also grateful to Mrs. Melissa O.V. O'Garro and Mr. Elvis Gerald (Department of Agriculture) and Mr. Clement Meade (Physical Planning Unit) for their cooperation in making it possible for our work at Upper Blakes to take place, as well as Dr. Roy Lee (landowner of Upper Blakes). Tom Leppard and Miriam Rothenberg both made helpful comments on an earlier draft of this chapter. Lastly, we salute the angry carrot farmers of Upper Blakes and wish them good harvests in the future.

18

Archaic Age voyaging, networks and resource mobility around the Caribbean Sea

Corinne L. Hofman, Lewis Borck, Emma Slayton, and Menno L.P. Hoogland

Introduction

Geographically, although they have always been regarded as having had separate cultural trajectories, the Leeward and Windward Islands and the Leeward Antilles – consisting of the present-day Venezuelan and Dutch Caribbean ABC islands of La Tortuga, La Sola, Los Testigos, Los Frailes, Patos, Los Roques Archipelago, Blanquilla, Los Hermanos Archipelago, Orchila, Las Aves Archipelagos, Bonaire, Curaçao, Aruba and Los Monjes Archipelago – are all included in the Lesser Antilles (Hofman and Hoogland 2018). Based on what is visible in the archaeological record (Antczak *et al.* 2017), people settled some of these small islands off the Venezuelan coast from various parts of the mainland starting about 2900 cal BC. The earliest sites on these islands are around 2500 to 3000 years later than the initial human occupation on Trinidad and Margarita Islands, where the sites of St. John, Banwari Trace and Quebrada de Guacuco have produced radiocarbon dates of 5800–4000 BP (Antczak *et al.,* this volume; Boomert 2000, this volume; Pagán-Jiménez *et al.* 2015). Although the cultural developments in coastal South America may have influenced those on the offshore islands, based on current archaeological reconstructions, the earliest expeditions to Curaçao do not predate 2900 cal BC. While there is little evidence of Archaic Age settlement in the Windward Islands, the Leeward Islands and Puerto Rico host many Archaic Age sites dating between 2000 cal BC and cal AD 250 (Hofman *et al.* 2011, 2014b).

The available data suggests that at both ends of the Lesser Antillean archipelago (Figure 18.1), Archaic Age communities have managed extensive subsistence/resource/activity systems, likely guided by seasonality and intensive intra-archipelagic and mainland – island voyaging factors. These sea-based connections become pivotal to the de-

in: Hofman, C.L. and Antczak, A.T. (eds) 2019: *Early Settlers of the Insular Caribbean. Dearchaizing the Archaic,* Sidestone Press (Leiden), pp. 245-262.

Figure 18.1. Map of the Lesser Antilles with location of the two case study areas (Map by Menno L.P. Hoogland).

velopment of competitive social networks in later Ceramic Age communities (Hofman *et al.* 2007, 2011b, 2014b; Hofman and Bright 2010; Hofman and Hoogland 2011).

Recently, experimental canoe voyages (e.g., Bérard *et al.* 2016; see Cherry and Leppard 2015 for a critique of experimental canoe voyage analogies), network analysis of interactions between island communities (e.g., Broodbank 2000; Knappett *et al.* 2008), and global seafaring modeling (Arcenas 2015; Cooper 2010; Davies and Bickler 2015; Gustas and Supernant 2017; Irwin *et al.* 1990; Leidwanger 2013; Montenegro *et al.* 2016; Slayton 2013) have been used to explore connections between mainland–island or island–mainland. In line with these examples, computer modeling has been applied to studies of Caribbean interisland networks to explore and explain water travel patterns (Altes 2011; Callaghan 1999, 2001, 2003). While studies using drift models have proven valuable for mapping colonization routes, in this chapter we use directed models of reciprocal voyaging to explore the continued, and in some cases annual or multi-annual, connections between communities inhabiting the different islands. The use of directed models allows us to explore how time and route location between past communities can change based on factors such as the movement of modern currents, winds, estimated constant traveling speed, and the location of archaeological sites as start and end points of the voyages based on connections apparent in the archaeological record (Slayton 2018; Slayton *et al.* 2015). These studies are then synthesized using formal social network analysis to explore seasonal and directional prominence in islands and archaeological settlements.

These travel routes include often unconsidered physical and environmental costs of sea travel. These analyses can also be used to add a temporal layer to interisland connections, as seasonal changes in currents may influence access to resources and the time needed to reach certain points. Relating such seasonal connections with reciprocal voyages can help reconstruct which months of the year people may have traveled between the islands and to and from the coastal areas of mainland South America.

A northeastern Caribbean mobility cycle

The search for high quality flint may have been one impetus for movement to and settlement of the small islands of the Leeward chain. Flinty Bay on Antigua, off Long Island, is one of the best known, and only, sources for high quality flint in the Lesser Antilles. Antiguan Archaic Age sites have a plethora of flint artifacts and debitage, and Long Island flint is found at most, if not all, Archaic Age sites in the Leeward Islands. During the Ceramic Age on Puerto Rico and many of the Windward Islands, Long Island flint was also present. Its omnipresence across the region highlights the importance of this raw material from the onset of island settlement up until European colonization (Hofman and Hoogland 2011, 2014; Knippenberg 2007; Rodríguez Ramos 2010).

Early flint workshops on Long Island were exploited for the production of prepared blade cores (Davis 1982, 2000; van Gijn 1993). This blade technology is very similar to that of the Casimiroid tradition, known from the site of Barrera-Mordán (southwestern Dominican Republic), and also from Puerto Rico, where such blades are produced of local Mocca flint (Hofman *et al.* 2011b, 2014b). This similarity in technology strongly reinforces the idea that people coming from Hispaniola or Puerto Rico initially made voyages to the Lesser Antilles to gain access to local flint sources.

The earliest Archaic Age Leeward island campsites date to ca. 3000 cal BC. Blade technology has been found on Antigua, St. Martin, Saba, Anguilla, and Montserrat. At the site of Féfé in Capesterre on the island of Basse Terre, Guadeloupe, blade technology has also been reported, although not using Long Island flint. This site has a much later date of around 1435–1290 cal BC (Stouvenot and Casagrande 2015).

The main occupation of the Leewards is ca. 1500 cal BC. Sites are mainly located in the coastal mangroves, lagoons and beaches of St. Martin, Barbuda, Anguilla and St. Thomas. The coastal habitat is reflected in the subsistence remains at these sites, which mainly consist of mangrove, sea grass, mollusks and fish remains (Bonnissent 2013; Crock *et al.* 1995; Lundberg 1989, 1991; Rousseau 2014). Saba hosts Archaic Age sites in the interiors at relatively higher altitudes. While blade technology is found on a few islands, flake technology mainly characterizes these Archaic Age assemblages. For example, at Plum Piece, Saba, pre-worked cores and possibly flakes entered the site, where they were further reduced following an expedient flake tool technology. Core sizes diminish when moving away from the Long Island source (Hofman and Hoogland 2003; Hofman *et al.* 2006).

The Plum Piece campsite

On Saba, seven Archaic Age sites (Plum Piece, The Level, Great Point, Old Booby Hill, Old Booby Hill cave, and Fort Bay Ridge 1 and 2) have been recorded (Hofman and Hoogland 2016b). They are all located at relatively higher altitudes and thus differ in assemblage composition from the low-lying coastal sites on the surrounding islands. To date, ^{14}C dates have been obtained from Plum Piece, the Old Booby Hill cave site and Fort Bay Ridge 1 and 2. The Old Booby Hill cave site is located on the southeastern side of the island – at an elevation of approximately 100 m amsl above the well-known Ceramic Age sites of Spring Bay (Hofman 1993; Hofman and Hoogland 2016b; Hoogland 1996) – and is dated to 2135–1225 cal BC. The Fort Bay Ridge site is located in the southwestern part of the island, near the present-day harbor, at an elevation of 100 m amsl. The site comprises two phases that range between ca. 1725–1530 cal BC and 735–475 cal BC respectively (see also Appendix, this volume). The find of a feline or bat-shaped head in coral in the later component at Fort Bay Ridge reveals it to be one of the earliest ritual expressions in the northern Lesser Antilles (Hofman and Hoogland 2016b). Unfortunately, the site has recently been covered and partly destroyed by the construction of a power plant, thus hampering further investigations at this interesting Archaic Age location (Hofman and Hoogland 2016a).

The Plum Piece site provided three dates in the range of ca. 1875–1500 cal BC (see Appendix, this volume). Its unique location at 400 m amsl in the Saba mountains evidences its importance for the procurement of wood for canoe-building, the targeting of specific food resources and the management of plants for subsistence, domestic and medicinal purposes (Hofman and Hoogland 2003, 2016b, 2018; Hofman *et al.* 2006; Keegan and Hofman 2017). To the north of Plum Piece, there is the ephemeral campsite of Great Point, characterized by a surface scatter including comparable materials as found at Plum Piece. At Plum Piece, a number of shallow posthole features that suggest ephemeral hut construction were found (Hofman and Hoogland 2003). Its midden is built up in several layers, with alternating activity and abandonment phases and caches of shell adzes (Hofman and Hoogland 2003; Hofman *et al.* 2006). The absence of whole *Lobatus gigas* shells at the site, but the presence of unfinished lips and waste products, suggests that the conch shells were pre-worked at the shore (possibly at Well's Bay) or brought in, for example from St. Martin, before they were taken up the mountain where they were further manufactured into adzes and celts for woodworking (Nieuwenhuis 2008). An *in situ* grinding boulder evidences the fabrication and sharpening of shell tools at the site (Hofman and Hoogland 2003).

Contrary to coastal sites, where fish and shell fish were the dominant subsistence components, the midden deposits at Plum Piece were abundant in mountain or black crab remains (*Gecarciunus ruricola*) and Audubon's shearwater (*Pfuffinus pfuffinus*) bones (Hofman and Hoogland 2003; van den Bos 2006; Pagán-Jiménez *et al.*, this volume). The Audubon's shearwater breading season on Saba, between February and July, coinciding with the spawning period of the black crab, has led us to suggest that this was the season that people camped at Plum Piece (Hofman and Hoogland 2003; Hofman *et al.* 2006). The volcanic and tropical soils near the site provide excellent conditions for the growing of roots and crops, and the abundance of plants makes the area well-suited for gathering nuts, seeds, leaves, and fibers (Hofman and Hoogland 2003). The large amounts of multifunctional stone tools evidencing intensive plant processing and use wear on the flint flakes point toward fiber treatment (Hofman *et al.* 2018b; van Gijn *et al.* 2008). Starch grains of maize (*Zea mays*), sweet potato (*Ipomoea batatas*), manioc (*Manihot esculenta*), marunguay (*Zamia* sp.), bean (Fabaceae; *Phaseolus* sp.) and possibly annatto (*Bixa orellana*), greenbriar (*Smilax* cf. *coriacea*), and palm fruit (*Acrocomia* sp.) were found on the mortars and grinding/pounding tools (Hofman *et al.* 2018; Pagán-Jiménez *et al.*, this volume). *Zamia* is not known to have been endogenous to the Lesser Antilles during that period, but the plant could have been transported from the Greater Antilles (Puerto Rico), where it was, and still is, widely distributed and processed (Pagán-Jiménez *et al.* 2005). Its transmission throughout the islands suggests it acquired great economic or symbolic importance since the Archaic Age (Hofman *et al.* 2018).

From the archaeological record and tool kit at Plum Piece, including seasonal indicators and regional connectedness, one gets the impression of a campsite with a forest-oriented activity spectrum. The site had been recurrently occupied, abandoned and reoccupied over an extended period. It has been proposed elsewhere that Plum Piece may have functioned in alternation and complementarily with comparable campsites on nearby islands in a yearly mobility cycle determined by the seasonality of biotic resources (Hofman *et al.* 2006). Communities would have benefited from times that voyaging across the islands would have been the most advantageous, and they would have combined the targeting of specific resources with particular activities like woodworking or the exploitation of lithic sources.

Pre-worked flint cores and possibly flakes were brought to Saba from Long Island, 150 km away. The scarcity of flint cores suggests that these were transported from Saba to other sites in the region to enable tool manufacture at those locations (Hofman and Hoogland 2003; Hofman *et al.* 2006). The abundance of Long Island flint on Saba confirms its general importance, and also presumes that the exploitation of the flint quarries near Antigua was at the center of a resource mobility cycle that integrated the seasonal exploitation of *Lobatus gigas* and possibly turtles on Barbuda, St. Martin, and Anguilla (Bonnissent 2013; Crock *et al.* 1995; Rousseau 2014). Similar seasonal exploitation has been postulated for the Krum Bay site on St. Thomas and several sites on St. Martin (Bonnissent 2013; Bonnissent *et al.* 2016; Lundberg 1989, 1991).

Interestingly, during the time of Archaic Age-Ceramic Age interactions – around 500 BC–AD 200 – the importance of the Long Island flint quarries increased, and this became a pivotal hub in the northeastern Caribbean network (Hofman *et al.* 2014b). At the same time, the first settlements of the so-called Huecoid and Saladoid cultural traditions appeared. Huecoid and Saladoid settlements occur side by side between Puerto Rico and Grenada, at a time that there is supposedly still an Archaic Age presence in the Leeward Islands (Bonnissent 2013). Next to flint, other lithic materials (i.e., St. Martin greenstone, calcirudite) and semiprecious stones (e.g., nephrite, serpentinite, chalcedony, jadeite, turquoise, amethyst) were targeted and began to circulate throughout the region, either as a raw material or as finished tools and body ornaments (Boomert 2000; Hofman *et al.* 2007; Watters and Scaglion 1994). Access to, and eventually control over, these materials may have been acquired through the establishment of important settlements next to key lithic quarries, such as the sites of La Hueca/Sorcé (Vieques), Hope Estate (St. Martin), Trants (Montserrat), and Pearls (Grenada) (Hofman *et al.* 2007; 2014b).

Interest in particular resources, known and exploited for many centuries, was probably foundational to the sociocultural, political, and economic dynamics at play during the Late Archaic and Ceramic episodes in the Antilles. Feasting offers a particularly compelling explanation. While the performative act of feasting (i.e., Mills 2007) can be used to either consolidate power (e.g., Weiner 1988) or democratize power, the latter often as an act of community resistance (e.g., Borck 2016; Borck and Mills 2017), competitive feasts often involve the redistribution of valued material types (e.g., Drucker 1940; Friedman and Rowlands 1977; Goldschmidt and Driver 1940; Swenson 2006). The distribution of resources to other locales throughout the Caribbean may have taken place through competitive distributions during public feasting ceremonies, which themselves may have been seasonal. The overwhelming presence of semiprecious materials at sites like La Hueca/Sorcé, Trants or Pearls may be the reflection of such competitive feasting events (Hofman *et al.* 2014b; Keegan and Hofman 2017; see also Hayden 2014).

A northeastern Caribbean reciprocity voyaging model

Integrating the archaeological data with reciprocal voyaging models helps us obtain a better understanding of the advantages of targeting specific resources during certain periods of the year, and determining the best voyaging periods. The modeled voyages were based on data gathered by the National Oceanic and Atmospheric Administration (NOAA) and the northern Gulf Institute, and were simulated to start at 9:36am in the beginning of January, April, July, and October of 2011, with the canoe traveling at a constant speed of 1.5 meters/second or 3 knots. These months were chosen to represent four different seasons for sailing during the year. This information was then used to calculate time-cost for each route based on a previously defined model (Slayton *et al.* 2015).

The resulting modeled routes demonstrate the change between the sites of Plum Piece and Long Island throughout the year (Figure 18.2). Traveling from Plum Piece to Flinty Bay took between roughly 36 and 37 hours at the beginning of July, making it the most consistent period for travel times using our case study values. The July cost values are also the lowest travel costs of the periods compared. The model shows a cost between 35 and 40 hours for April routes from Plum Piece to Flinty Bay, more similar to the October values, 37 to 40 hours, for the same year. January, with a time-cost of around 40 hours, has the highest costs overall for traveling in this direction. Though this is similar to the April and October results, the January values are consistently 40 hours, suggesting that it may represent the relative highest cost. This data signals that though the traveling cost over these seasons was similar, the saving of one to four hours could make traveling in July from Plum Piece to Flinty Bay preferable (Benoit Bérard, personal communication, 2015).

These travel times are the opposite of the reciprocal voyage traveling from Flinty Bay to Plum Piece. This trip consistently took 27 hours in July but only 23 to 25 hours in January. This represents an inversion in the months with the highest and lowest costs and an overall greater ease of movement from the site of Flinty Bay. The difference between time-costs for all periods tested when traveling from Flinty Bay on Long Island to Plum Piece on Saba, and the reverse, is around 9 hours at their greatest separation. These results, ranging anywhere from 8 hours to 17 hours for each period, show that the direction of travel influences cost. Considering the westerly moving current past these islands, this is unsurprising.

In addition to looking at the time-cost of these routes, there is also the potential to evaluate how the position of these pathways could have influenced relationships between neighboring communities on a seasonal basis. For example, the layout of the

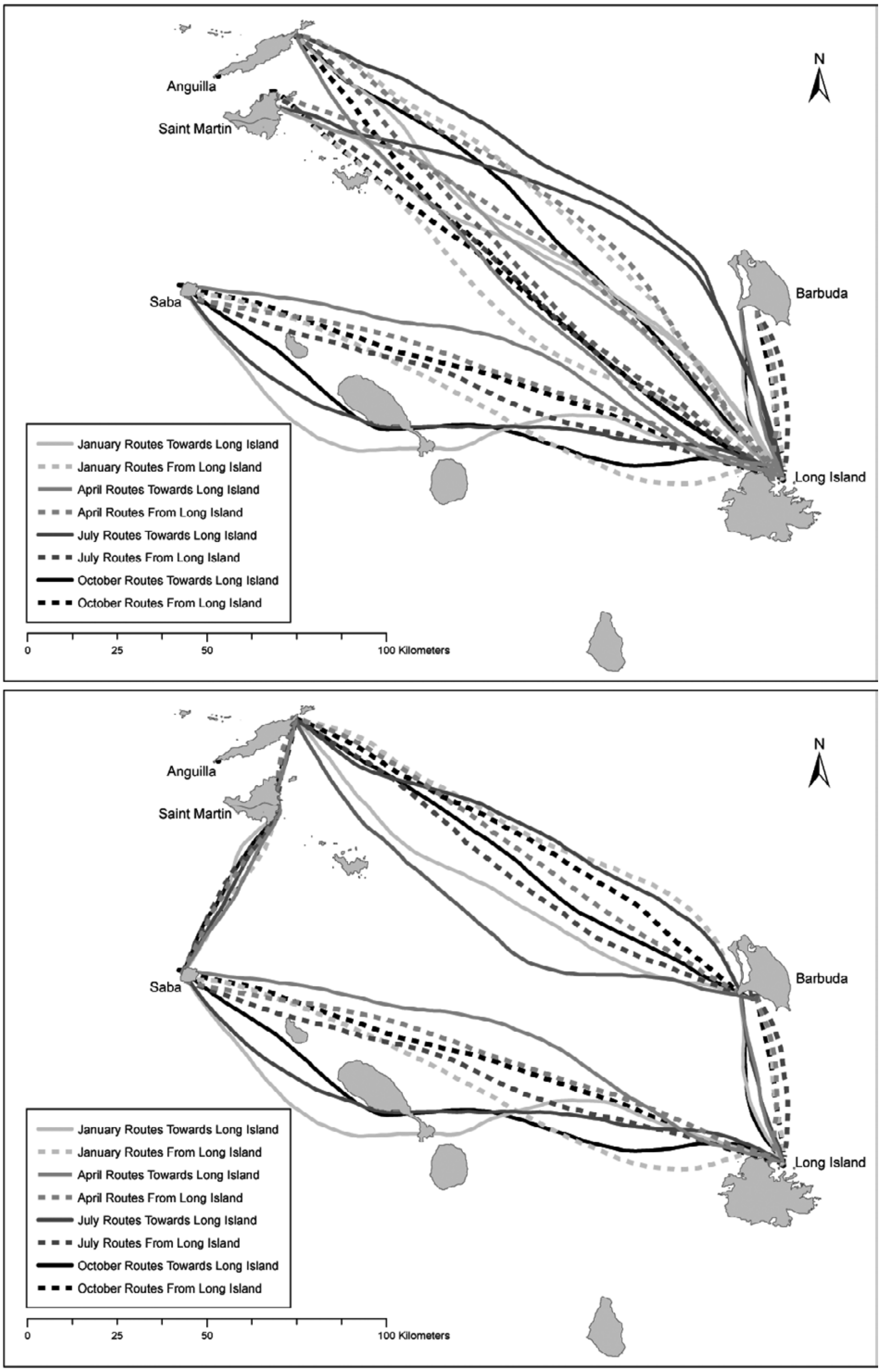


Figure 18.2. Maps depicting possible canoa routes. The first map depicts possible canoe routes between Long Island and the islands of Saba, Saint Martin, Anguilla, and Barbuda during the months of January, April, July and October. The second map depicts possible canoe routes between Long Island and Saba, but also with reciprocal travel from Long Island through Barbuda and Saint Martin to Saba during the months of January, April, July, and October (Maps by Emma Slayton).

routes (Figure 18.2) demonstrates that in January, July, and October, the pathways from Saba to Long Island pass very close to St. Kitts, something not observed in April. The placement of these routes, especially in July and October, shows movement directly past the Saint Kitts site of Sugar Factory Hill, indicating a possible link between these three islands.

Archaeological remains of Long Island flint suggest that prior to reaching Plum Piece, cores were increasingly worked and processed while the material and people moved to other islands. These down-the-line arguments can be examined by modeling movement from Saba to Long Island through St. Martin, Anguilla, and Barbuda (Figure 18.2; Hofman and Hoogland 2003; Hofman *et al.* 2006). Cost values from Long Island to St. Martin to Saba range between 37 to 66 hours, with travel in January costing the least and July the most. Adding stops on Barbuda and Anguilla increases costs to between 40 to 74 hours, with October travel costing the least and travel in July costing more than the other seasons. July is a clear cost outlier when the additional stops are added. April, January and October remain relatively low, with time-costs between 40 and 46 hours.

Testing down-the-line travel in the opposite direction – from Saba to St. Martin, to Long Island – results in cost values between 26 to 51 hours. The costliest months are inverted from the previous analysis, with January returning the highest time-costs and July the lowest. Adding the additional stops on Barbuda and Anguilla causes the time-cost range to increase to between 48 to 59 hours. As with travel between all of these islands in the other direction, October returns the lowest cost values. Instead of July, though, January has the largest associated oceanic travel costs.

Most direct routes from Long Island to Saba range from 23 to 27 hours and 37 to 40 hours in the other direction. Depending on the season, direct travel between these two islands is not dramatically less than using routes that incorporate other islands as stopovers. There are still advantages to a direct journey, though. Moving through these other islands toward Saba, besides benefiting from the additional resources present on the islands, also allows travelers to approach Saba's coastline near Plum Piece rather than arriving at, and then having to circumvent the coastline of Saba, which is what occurs if you travel from Long Island directly.

Critically, the nature of social relationships and material exchange as represented by artifacts in the archaeological record of the region during the Archaic Age suggests that a combination of pathways, rather than direct island-to-island travel, took place. Comparing the physical placement of these tracks can provide insight into theories of where down-the-line exchange occurred and where it may have been prudent to pause a voyage before continuing across another channel. Comparing the relationships between travel costs between archaeological settlements can also lead to new insights.

A northeastern Caribbean reciprocity network

Cost analyses that incorporate directional differences in travel allow us to calculate networks to understand differences in the optimal placement of archaeological settlements during the seasonal rounds. Network analysis is an emerging methodology within archaeology (e.g., Borck *et al.* 2015; Brughmans 2013; Crabtree 2015; Hofman *et al.* 2011b; Mills *et al.* 2013; Mol 2014; White 2013). When combined with spatial analysis, it can lead to interesting geosocial insights into human behavior and historical experiences (see Borck 2016; Borck and Mills 2017). Networks comprise nodes and the connections, or edges, between those nodes. Edges are either binary (i.e., present/absent) or weighted (i.e., present because of an associated value). The edges can be directed (i.e., A connects to B, but B does not connect to A) or undirected (i.e., there is a connection, but direction is unknown). In this chapter, nodes are the archaeological settlements used in the reciprocity model above. The edges are weighted and are created using the cost values from the modeled time-cost routes above. This means that these networks are inherently dissimilarity networks, which in this case are better understood as distance or cost networks.

Various measures can be applied to the shape of networks to calculate metrics that reflect a variety of nodal traits, such as the relative importance of various nodes. Centrality measures are one such suite of measurements. They are often used to interpret the importance of nodes within a network (Bonacich 1987; Borgatti 2005). Closeness centrality is one type of centrality that is useful with cost data. Closeness centrality can be calculated in many ways, but its interpretive essence has not changed significantly since Bavelas (1950) defined it as the reciprocal of farness. The closeness centrality measure of a node essentially displays its relationship to all of the other nodes. Thus, the larger the node's closeness value, the closer it is to all of the other nodes in the network. Directionality adds another component to the metric. Each node in the network is assigned two closeness centrality measures. The first, in-closeness, measures how close a node is to all other nodes if they are traveling *to* it. The second, out-closeness, measures how close a node is to all other nodes if you are traveling *from* that node to the others.

One issue that arises in networks with weighted edges is that many centrality measures rely on binary connections. Network analysts often transform their weighted connections to binary connections to make them work with this measure. However, this transformation essentially removes data. It is generally considered best to work with weighted values if possible (see Peeples and Roberts 2013). For this analysis, we measure the closeness centrality of nodes on the values, in this case the costs of travel, of those connections. In this way, closeness centrality can determine, based on the modeled cost routes between the islands, which of the archaeological settlements were nearer to all of the other settlements.

For this analysis, data from the cost paths between the archaeological sites and islands in the northeastern Caribbean that was used in the above reciprocity voyaging analyses was compiled into an adjacency matrix. This is a symmetrical matrix with columns and rows. Each archaeological site appears once in both the columns and rows. Cost distances between each of the settlements were used to determine the connection between the sites. Since the network is directional, meaning that costs moving to a node will be different than costs moving from the node, and the edges are weighted, which standard measures of closeness centrality cannot accommodate, the closeness centrality measurement was calculated using the *closeness_w* function in the tnet package (Opsahl 2009) in the statistical software R (R Core Team 2013). To incorporate directionality, since tnet does not do so automatically, the adjacency matrix (out-closeness centrality) was transposed and a closeness analysis was run on the matrix from the new direction (in-closeness centrality).

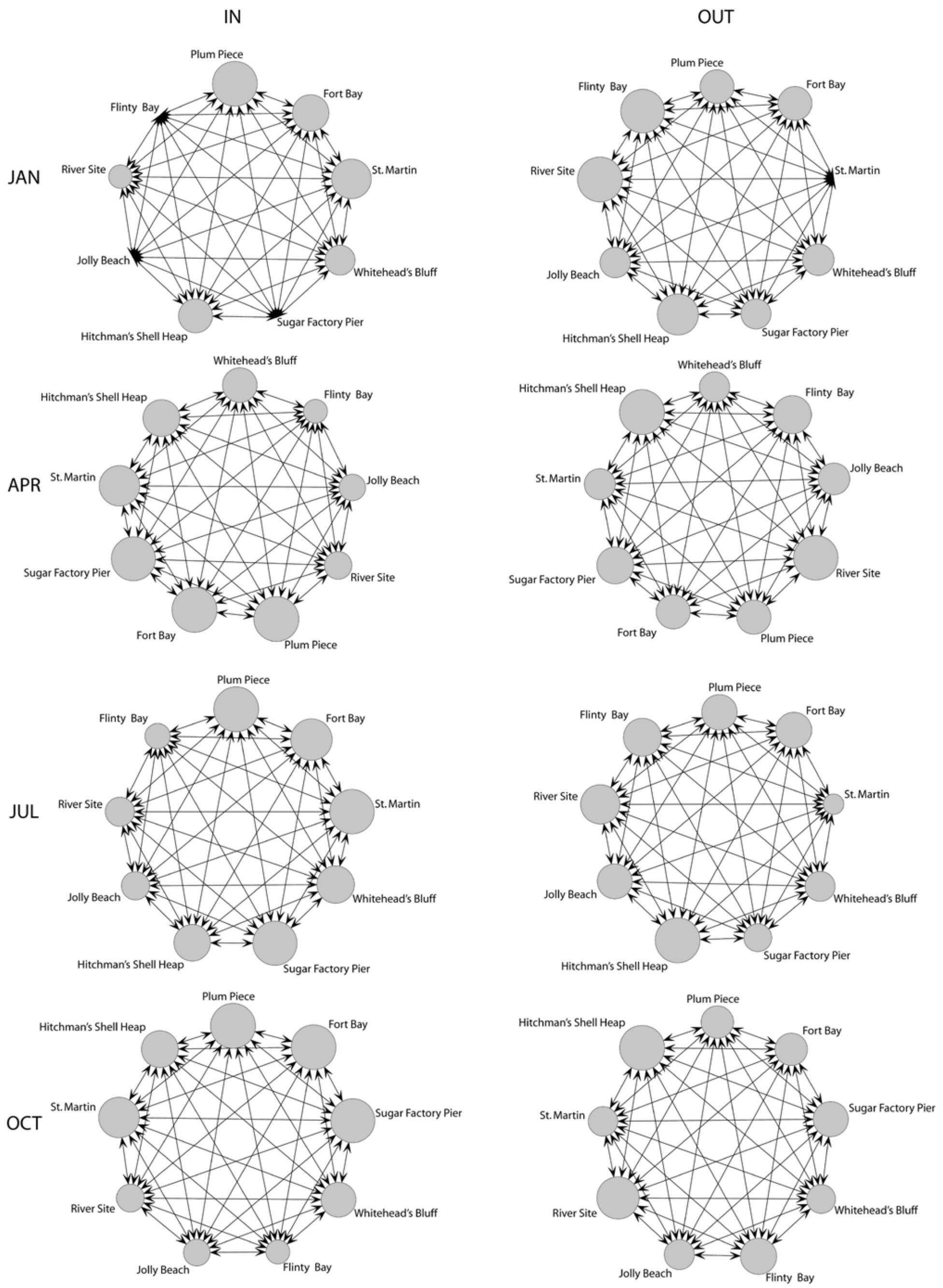


Figure 18.3. Networks of in- and out-closeness centrality for sites modeled in Figure 18.2. The larger the node, the closer it is to all the other sites in the network (Networks drafted by Lewis Borck).

Figure 18.3 is a compilation of the in- and out-networks created from the modeled cost routes for the months of January, April, July, and October. Throughout all of the months, Plum Piece remains either the closest to travel to, or near to the closest archaeological site to all of the other archaeological sites. Flinty Bay on Long Island remains one of the farthest, or least close, sites to travel to throughout all four months. However, the closeness of Flinty Bay, when traveling *from* it, changes seasonally. In January, Flinty Bay is very close to all other sites when departing. The only site closer to all other sites is River Site. River Site maintains this out-closeness position throughout all of the seasons, indicating that it may have been an important site for setting out to other sites. Plum Piece and Flinty Bay both remain in the moderate-to-far category when traveling *from* them between April and July. Plum Piece remains distant in October as well, but Flinty Bay's closeness increases in October.

The consistency of Flinty Bay's distant in-closeness, but its seasonally changing out-closeness could indicate that people may not have scheduled their travel to Flinty Bay based on a particular season (because it is generally far regardless of the season), but may have scheduled their *departure* from Flinty Bay for fall and winter months to take advantage of the changing current conditions. Since the rainy season often occurs in fall and early winter in the Lesser Antilles, departures may have been focused on mid- to late-winter months, represented by January in our analysis.

Sites like River Site and Hitchman's Shell Heap are generally closer than most other sites when departing from them in all four months and may have been logical places for voyaging stops. This does not change the closeness of sites between individual paths, such as Sugar Factory Hill being close to the route between Plum Piece and Flinty Bay during January, July, and October. However, it does give us a sense of what sites may have been more important as stopping and departure points for the seasonal round of resource acquisition.

Positioning for the seasonal round may have been particularly important when choosing settlement locations. St. Martin's consistently high in-closeness throughout all of the seasons may be one of the primary reasons that the island is one of the most heavily inhabited islands – consisting of about one third of all of the absolute dated archaeological settlements – in this region during the Archaic Age (see Bonnissent 2013). It might also indicate that decisions on the costs to travel out to an island were made seasonally, while decisions on when to travel home were not as seasonally restrictive, although intraisland travel on St. Martin may also have been based on seasonal exploitation of food resources (see Bonnissent 2013). Thus, while decisions on inter-island versus intraisland travel were both based on seasonality, decisions on long-term island settlement *may* have been based on the ease of travel to the island of residence from resource-specific islands, instead of the other way around.

The *Mainland-Island* circle

The *Lobatus gigas* resources on the Venezuelan offshore islands are suggested to have had a similar function as the Long Island flint quarries in the mainland – island connections from around 2500 BC. The east – west island chain of oceanic islands is characterized by xeric environments and large salt deposits. Extensive mangroves border most of the islands. The rich sea grass beds are still famous today for conch fisheries.

At present, there is not much evidence of an early Archaic Age settlement on the western offshore islands other than Bonaire, Curaçao, and Aruba (the ABC islands). Margarita and Cubagua are the sole known visited islands on the eastern offshores (Antczak *et al.* 2018, this volume; Kelly and Hofman, this volume). The ABC islands were first temporarily visited by fisher-forager communities from Venezuela and maybe coastal Colombia somewhere around 2900 cal BC for Curaçao, 1550 cal BC for Bonaire, and 1450 cal BC for Aruba (Haviser 1989, 2001, 2015; Hoogland and Hofman 2015; Kelly and Hofman, this volume). Campsites on Curaçao and Bonaire are located on beaches, in mangrove settings, near lagoons, on hilltops like at St. Michielsberg, and in rock-shelters such as at Rooi Rincon on Curaçao (Antczak *et al.* 2018; Haviser 1989; Hoogland and Hofman 2015). The exploitation of mollusks and *Lobatus gigas* was presumably the main impetus for the first explorations of these oceanic islands. The lithic tool kit at these sites is similar to mainland complexes and suggests movement from the Venezuelan and possibly Columbian Caribbean coasts to the ABC islands (Dijkhoff and Linville 2004; Haviser 2001).

The Spanish Water lagoon is located in the southeast of Curaçao, near the well-known Table Mountain. Fourteen shell deposits were found in three different locations (Hoogland and Hofman 2015). From a synchronic perspective, the investigations at Spanish Water have provided an important contribution to the representation of the Archaic Age occupation of Curaçao.

Twelve shell and four charcoal radiocarbon samples point to an extended occupation or use of the site area between 2900 cal BC to cal AD 1650. This suggests a recurrent interest in the area during the Archaic Age, Ceramic Age and contact period (Hoogland and Hofman 2015). The deposits are interpreted as temporary shell collecting and processing camps because they predominantly consist of *Lobatus gigas* next to *Melongena melongena* and various species of mangrove clams and oysters. In and next to three of the shell deposits, shallow postholes, hearths, and an early colonial cooking pit have been found. Archaeological materials include faunal remains, stone flakes, coral tools, beads, many shell percussion tools, and potsherds. The occurrence of pottery associated with otherwise Archaic Age tool kits is notable. The coarse fabric of this pottery is clearly different from the Ocumaroid and Dabajuroid ceramics that typify the Ceramic Age on the ABC islands (Niels Groot, personal communication, 2010; Hoogland and Hofman 2015). Although conch meat is often extracted by cutting the muscle through a hole in the apex of the shell, at Spanish Water the meat was extracted by heating the shells over a fire, then dried and finally prepared for export to one of the mainland home settlements located some 100 km from Curaçao's shore. Several of these hearths have been found with associated burnt conch shells. The lips had been cut off as well, suggesting that these were transported to the homelands together with the meat.

While Bonaire and Aruba both hosted early expeditions from the mainland, the other offshore islands, except for the easternmost ones like Margarita, Cubagua and Blanquilla, as yet have no indications of a human footprint before around 1000 years ago. On the ABC islands, the first Dabajuroid communities settled around cal AD 800. Las Aves de Barlovento, to the east of Bonaire, has been identified as the boundary of the Dabajuroid/Valencioid interaction sphere (Antczak and Antczak 2015). The Los Roques archipelago was a crucial node in the Valencioid Sphere of Interaction that comprised the entire north-central Venezuela region (Antczak and Antczak 2006).

The exploitation of *Lobatus* was the major reason for organizing expeditions to Los Roques, which is located approximately 140 km from the Venezuelan shore. The Late Ceramic Age Dos Mosquises Island site reflects ritualistic behavior around the

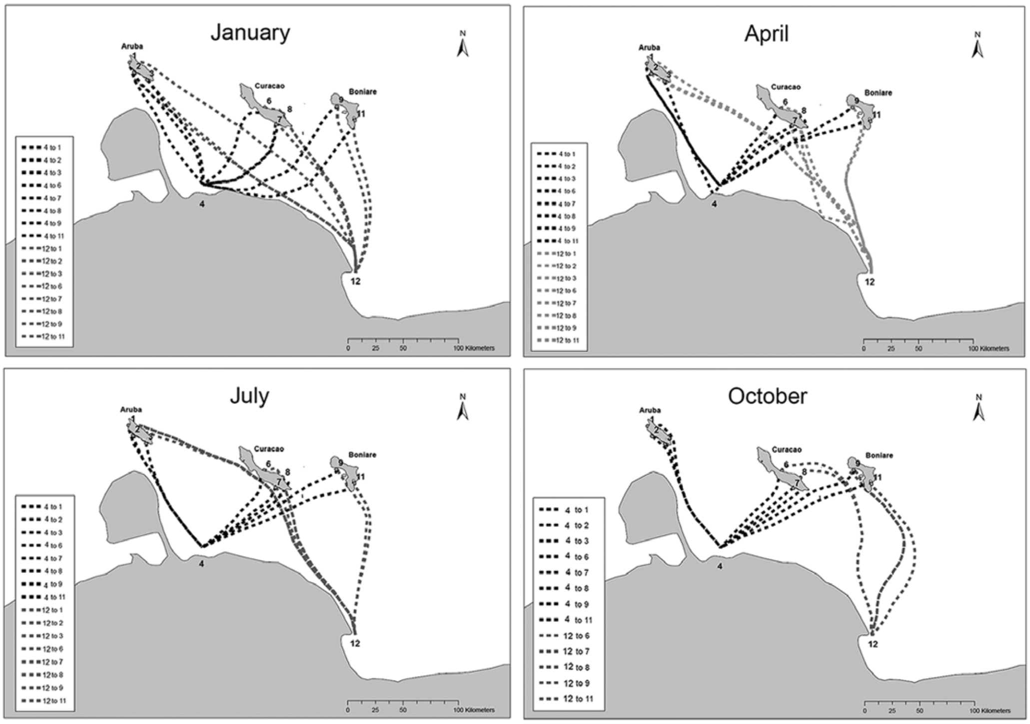


Figure 18.4. Map depicting possible tracts of movement to the islands of Aruba, Curaçao, and Bonaire from two points on coastline of Venezuela in the months of January, April, July, and October (Map by Emma Slayton).

harvesting and preparation of the conch shells that were then transported to the mainland and traded as far as Lake Valencia (Antczak and Antczak 2006). The Archaic Age deposits at Spanish Water, Curaçao, may represent early episodes of this similar phenomenon.

Mainland-Island voyaging models

Routes were modeled between the mainland cost of Venezuela to sites on the islands of Aruba, Curaçao, and Bonaire to explore travel costs from possible launch points (Figure 18.4). Most coastal launch points were linked with known Archaic Age sites (Antczak *et al.* 2018) on the ABC islands. While the chosen launch sites are probable departure points, it is also likely that other launch points were also used in the past.

As with the previous analysis in the northeastern Caribbean, there were seasonal time-cost route variations. For example, it is impossible to reach Aruba from point 12 (near Chichiriviche) in October (Figure 18.4). Similarly, movement from 12 to Curaçao 8 was not possible in October, perhaps indicating that all travel during this time was initially directed to the north of the island. Travel to Curaçao from 4 (near Puerto Cumarebo) and 12 showed significant cost differences between seasons. Connections in April and July demonstrate that movement to Curaçao 8 ranges from 10 to 14 hours more in time-cost when traveling from 12 than from 4. Movement from 12 to all island sites is easiest in January, with travel costs ranging between 20

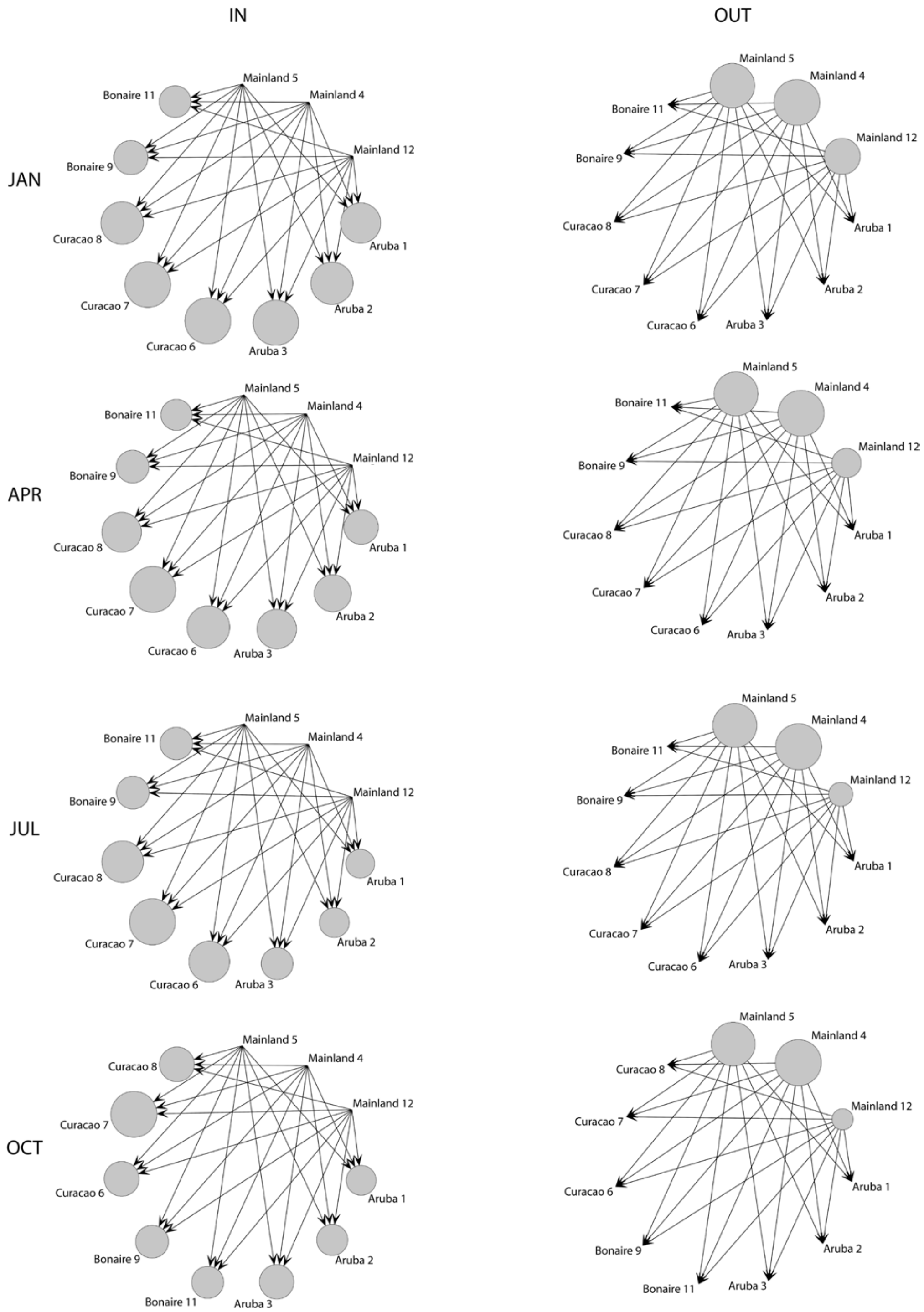


Figure 18.5. Networks of in- and out-closeness centrality for sites modeled in Figure 18.4. The larger the node, the closer it is to all other sites in the network (Networks drafted by Lewis Borck).

and 28 hours. In all other months, it takes between 30 to 39 hours to make the trip. These costs should be weighed against the inaccessibility of Aruba, and some parts of Curaçao, from 12 in certain months.

A comparison of pathways reveals that cost routes tend to be more direct when moving from mainland points 4 and 5, while movement from mainland 12 is usually more curved (Figure 18.4). All modeled routes tend to hug the coastline or travel within the shelter of an island whenever possible. This is a real-world Caribbean seafaring preference that the model is able to capture. Moreover, a seasonal component was observed in the voyages consistent with those observed in the case of the Lesser Antilles connections.

Mainland-Island networks

The networks constructed for the Mainland-Island voyaging networks follow the method outlined above for the northeastern Caribbean. A major difference, however, is that the analysis focuses on travel from the mainland to the coastal islands. This decision was based on the presence of lithic tool assemblages, similar to those of mainland sites on the Caribbean coasts of Venezuela and Columbia, at coastal island resource sites, demonstrating directed travel from the coast to the islands. Due to this, the constructed dissimilarity matrix was asymmetrical, with the mainland locations placed on the *y*-axis and the ABC island locations on the *x*-axis. Figure 18.5 is a compilation of the in- and out-networks created from the modeled cost routes between the mainland and coastal islands for the months of January, April, July, and October. The in-closeness column displays which coastal islands were closest to travel *to* from the mainland sites. The out-closeness column shows the mainland sites that were closest to the islands when traveling *from* the mainland. Thus, we have closeness for destination and for departures.

The closeness centrality analyses demonstrate that locations on Curaçao are either closest, or near closest, when traveling to them from the mainland. In January and April, the Aruba locations are similarly close to Curaçao. In July, Curaçao is easily the closest island to travel to from the mainland sites. The locations on Bonaire are consistently the farthest from the mainland sites. Of note, however, is that in October, Spanish Water (Curaçao 7) is the closest of all of the coastal island sites to travel to from the mainland. This means that, regardless of season, Spanish Water is consistently the closest, or near closest, location to travel to from all of the points on the mainland.

In terms of travel from locations on the mainland, 12 is consistently the farthest site to travel from. It does become dramatically closer in January (and even April), suggesting that winter and into early spring may have been the best departure times from this location. Mainland 4 is consistently the closest area to travel from regardless of the season, and Mainland 5 is moderately close throughout the year. Thus, the only mainland site that seems to be affected much by decisions on when to leave for travel throughout the year is the Mainland 12 location.

Conclusions

The island territories attracted peoples of various origins. The Long Island flint sources likely functioned as one of the main attractions for newcomers to the Leeward Islands, integrated with the exploitation of biotic resources like *Lobatus gigas*. These abundant resources also probably facilitated social gatherings and feasting, both on the islands where the resources are found, as well as throughout the landscape as goods to be distributed during these events (e.g., Hayden 2014). Earlier in the Archaic Age, flint quarries were mainly visited during yearly mobility cycles that were probably seasonally determined; later Archaic Age communities possibly monopolized access to the sources in order to exchange the flint with newly settled Huecoid and Saladoid communities. Over time, entrenched networks emerged around Long Island, with supply zones and areas of down-the-line exchange stretching vast distances between Grenada and Puerto Rico. Increased interest in the area's resources encouraged competition between local and foreign communities and stimulated exploitation and control of lithic resources. Large settlements were established near important lithic quarries, which then served as social hubs in the network to cement regional unity and as arenas for community interactions and ceremonial gatherings. Interestingly, the time-cost and resulting network analyses also demonstrate that choices of when to travel to Long Island may have been less affected by the cost of traveling to the island and more by the cost of *leaving* the island. It is uncertain exactly when people may have traveled to the island, but they may have planned their departure during the fall and winter months to take advantage of the best current conditions for the year.

The time-cost analyses and resulting network analyses also indicate that settlement location may have been chosen to take advantage of relative closeness to multiple places that were visited during the seasonal round. This is particularly visible on heavily inhabited St. Martin, whose location and the behavioral particulars of canoe travel gives it one of the most consistently high in-closeness values throughout all of the seasons. This suggests that while interisland and intraisland travel were both impacted by seasonal environmental changes, long-term island settlement may have been decided based on how easy it was to travel to the island of residence *from* resource-specific islands, instead of *to* the resource from the island of residence.

The *Lobatus* exploitation at Spanish Water, Curaçao connects mainland communities with island resources during the Archaic Age. The events at Dos Mosquises in Los Roques archipelago show the continuation of *Lobatus* expeditions to the offshore islands during the Late Ceramic Age (Antczak and Antczak 2006). The Valencioid sites around Lake Valencia played a major role in these expeditions. Dos Mosquises also exhibits grand spectacles of competitive emulation very similar to the Huecoid and Saladoid displays in major sites in Puerto Rico, the Leeward and Windward Islands, all located near important sources of lithics and semiprecious stones. The seasonal exploitation of natural resources during the Archaic Age is suggested to have guided the formation of Ceramic Age procurement strategies at both ends of the Lesser Antilles. These Archaic Age strategies were at the cradle of emergent, shifting and expanding multi-scalar social networks, in which competitive emulation and costly displays were played out during large intercommunal feasts at the source or at the settlement of the organizing party, during which food and objects may have been competitively distributed (e.g., Hayden 2014; Hofman *et al.* 2014b; Keegan and Hofman 2017). The overall closeness of Spanish Water to mainland sites may partially explain why it presents some of the earliest evidence in the region for ritualistic behavior surrounding resource exploitation.

Acknowledgements

The results leading to this chapter have received funding from the Netherlands Organization for Scientific Research (NWO), Research Grant No. 360–62–060, Island Networks project under the direction of Prof. dr. Corinne L. Hofman. The seafaring models have been developed by Emma Slayton in the context of her dissertation within this project. The northern Lesser Antilles case study is also published in her dissertation in another form. All other authors are part of the Island Network project and are responsible for the data, context and interpretation of the data.

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Appendix: list of radiocarbon dates

This list is a compilation of radiocarbon dates provided to us by the contributors to this volume. The appendix is edited by Menno L.P. Hoogland and the dates are retrieved from unpublished and published information from the early 1970s onwards. We are, however, aware of the fact that the quality of the dates is varied, and that some, especially those that were obtained in the Greater Antilles between the 1970s and '80s, have much larger 2 sigma ranges due to poorer quality of the samples or the limited availability of high-precision laboratory facilities. The table has been organized per island group, i.e., Greater Antilles, including the Virgin Islands, the Lesser Antilles and the southern Antilles including Trinidad and Tobago. The convention for notation of ^{14}C dates has been adopted from *Radiocarbon* https://www.cambridge.org/core/journals/radiocarbon/information/instructions-contributors. All calibrated dates are presented as 2 sigma ranges using CALIB 7.04 and IntCal13 and Marine13 radiocarbon age calibration curves published by Reimer *et al.* 2013. The calibrated dates in the table can deviate from the ones mentioned in the literature as these can be calibrated with another program or calibration curve.

GREATER ANTILLES and VIRGIN ISLANDS							
Cuba							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Abra del Cacoyoguín I	Beta-133947	1210 ± 60	intcal13.14c		cal AD 675 – cal AD 904 cal AD 917 – cal AD 966	0.906397 0.093603	Ulloa Hung and Valcárcel Rojas 2002
Abra del Cacoyoguín I	Beta-133948	1640 ± 130	intcal13.14c		cal AD 126 – cal AD 649	1	Ulloa Hung and Valcárcel Rojas 2002
Abra Rio Cacoyoguín II	Beta-133950	2780 ± 40	intcal13.14c		cal BC 1016 – cal BC 830	1	Ulloa Hung and Valcárcel Rojas 2002
Abra Rio Cacoyoguín II	Beta-133951	3270 ± 70	intcal13.14c		cal BC 1733 – cal BC 1718 cal BC 1693 – cal BC 1414	0.012813 0.987187	Ulloa Hung and Valcárcel Rojas 2002
Abra del Cacoyoguín IV	Beta-140079	4180 ± 80	intcal13.14c		cal BC 2918 – cal BC 2566 cal BC 2523 – cal BC 2497	0.982466 0.017534	Ulloa Hung and Valcárcel Rojas 2002
Arroyo del Palo	Y-1555	760 ± 60	intcal13.14c		cal AD 1154 – cal AD 1316 cal AD 1354 – cal AD 1389	0.945659 0.054341	Pino 1995

Arroyo del Palo	Y-1556	970 ± 80	intcal13.14c		cal AD 895 – cal AD 929 cal AD 939 – cal AD 1224 cal AD 1237 – cal AD 1241	0.037212 0.960700 0.002088	Pino 1995
Belleza	unknown	1120 ± 60	intcal13.14c		cal AD 772 – cal AD 1020	1	Ulloa Hung and Valcárcel Rojas 2002
Birama	unknown	820 ± 40	intcal13.14c		cal AD 1058 – cal AD 1064 cal AD 1068 – cal AD 1072 cal AD 1154 – cal AD 1277	0.006445 0.003144 0.990411	Angelbello *et al.* 2002
Caimanes III	UM-1953	1745 ± 175	intcal13.14c		cal BC 100 – cal AD 647	1	Pino 1995
Canimar I	GD-0203	1010 ± 110	intcal13.14c		cal AD 774 – cal AD 1225 cal AD1233 – cal AD 1243	0.992248 0.007752	Cooper 2007a
Canimar Abajo	A-14315	2515 ± 75	intcal13.14c	-28.2	cal BC 800 – cal BC 428 cal BC 419 – cal BC 416	0.994242 0.005758	Roksandic *et al.* 2015
Canimar Abajo	A-14316	2845 ± 90	intcal13.14c	-26.3	cal BC 1259 – cal BC 1244 cal BC 1234 – cal BC 820	0.011269 0.988731	Roksandic *et al.* 2015
Canimar Abajo	AA-101052	2946 ± 33	intcal13.14c	-15.0	cal BC 1377 – cal BC 1346 cal BC 1304 – cal BC 995 cal BC 984 – cal BC 981	0.023490 0.974787 0.001722	Roksandic *et al.* 2015
Canimar Abajo	AA-101053	3057 ± 39	intcal13.14c	-25.6	cal BC 1414 – cal BC 1218	1	Roksandic *et al.* 2015
Canimar Abajo	AA-101054	2999 ± 61	intcal13.14c	-15.3	cal BC 1404 – cal BC 1053	1	Roksandic *et al.* 2015
Canimar Abajo	AA-101055	1661 ± 52	intcal13.14c	-19.1	cal AD 252 – cal AD 305 cal AD 311 – cal AD 476 cal AD 483 – cal AD 536	0.129650 0.738455 0.131895	Roksandic *et al.* 2015
Canimar Abajo	AA-101056	1289 ± 46	intcal13.14c	-19.7	cal AD 652 – cal AD 778 cal AD 790 – cal AD 829 cal AD 838 – cal AD 865	0.905369 0.054298 0.040333	Roksandic *et al.* 2015
Canimar Abajo	AA-101057	2996 ± 53	intcal13.14c	-15.6	cal BC 1393 – cal BC 1334 cal BC 1325 – cal BC 1056	0.132596 0.867404	Roksandic *et al.* 2015
Canimar Abajo	AA-101059	2791 ± 51	intcal13.14c	-20.0	cal BC 1082 – cal BC 1078 cal BC 1075 – cal BC 1065 cal BC 1057 – cal BC 822	0.002461 0.008364 0.989175	Roksandic *et al.* 2015
Canimar Abajo	AA-89060	1420 ± 59	intcal13.14c	-18.1	cal AD 434 – cal AD 453 cal AD 470 – cal AD 487 cal AD 534 – cal AD 694 cal AD 702 – cal AD 708 cal AD 746 – cal AD 763	0.011858 0.012402 0.959006 0.003008 0.013726	Roksandic *et al.* 2015
Canimar Abajo	AA-89061	2960 ± 33	intcal13.14c	-14.1	cal BC 1265 – cal BC 1054	1	Roksandic *et al.* 2015
Canimar Abajo	AA-89062	1536 ± 51	intcal13.14c	-16.1	cal AD 412 – cal AD 620	1	Roksandic *et al.* 2015
Canimar Abajo	AA-89063	2922 ± 34	intcal13.14c	-16.3	cal BC 1217 – cal BC 1014	1	Roksandic *et al.* 2015
Canimar Abajo	AA-89064	1617 ± 46	intcal13.14c	-14.0	cal AD 338 – cal AD 549	1	Roksandic *et al.* 2015
Canimar Abajo	UBAR-170	4270 ± 70	intcal13.14c		cal BC 3089 – cal BC 3052 cal BC 3033 – cal BC 2832 cal BC 2820 – cal BC 2632	0.031115 0.622386 0.346499	Roksandic *et al.* 2015
Canimar Abajo	UBAR-171	4700 ± 70	intcal13.14c	na	cal BC 3251 – cal BC 2850	1	Roksandic *et al.* 2015
Canimar Abajo	UNAM-714a	800 ± 50	intcal13.14c	-25.8	cal AD 1055 – cal AD 1076 cal AD 1153 – cal AD 1287	0.021957 0.978043	Roksandic *et al.* 2015
Canimar Abajo	UNAM-715	6460 ± 15	intcal13.14c	-26.9	cal BC 5477 – cal BC 5461 cal BC 5451 – cal BC 5376	0.219985 0.780015	Roksandic *et al.* 2015
Canimar Abajo	UNAM-716	3460 ± 60	intcal13.14c	-26.2	cal BC 1922 – cal BC 1629	1	Roksandic *et al.* 2015
Canimar Abajo	UNAM-717	2520 ± 60	intcal13.14c	-27.3	cal BC 802 – cal BC 475 cal BC 464 – cal BC 453 cal BC 445 – cal BC 431	0.973829 0.010142 0.016029	Roksandic *et al.* 2015
Catunda	Beta-93862	1890 ± 60	intcal13.14c		cal BC 37 – cal BC 27 cal BC 24 – cal BC 9 cal BC 3 – cal AD 252 cal AD 305 – cal AD 311	0.007806 0.012815 0.975698 0.003681	Ulloa Hung and Valcárcel Rojas 2002

Catunda	Beta-93866	1850 ± 50	intcal13.14c	cal AD 57 – cal AD 258 cal AD 284 – cal AD 322	0.954509 0.045491	Ulloa and Valcárcel 2002
Catunda	Beta-140078	1280 ± 60	intcal13.14c	cal AD 652 – cal AD 882	1	Ulloa and Valcárcel 2002
Cayo Jorajuria	GD-591	2925 ± 75	intcal13.14c	cal BC 1378 – cal BC 1345 cal BC 1305 – cal BC 919	0.027520 0.972480	Pino 1995
Cayo Jorajuria	GD-613	2875 ± 65	intcal13.14c	cal BC 1258 – cal BC 1244 cal BC 1234 – cal BC 897	0.009106 0.990894	Pino 1995
Cayo Jorajuria	GD-1046	2840 ± 60	intcal13.14c	cal BC 1193 – cal BC 1143 cal BC 1132 – cal BC 888 cal BC 882 – cal BC 845	0.058657 0.899325 0.042017	Pino 1995
Cayo Jorajuria	LE-1782	3760 ± 40	intcal13.14c	cal BC 2291 – cal BC 2112 cal BC 2103 – cal BC 2036	0.813291 0.186709	Cooper 2007a
Cayo Jorajuria	LE-1783	4110 ± 50	intcal13.14c	cal BC 2874 – cal BC 2568 cal BC 2517 – cal BC 2500	0.973143 0.026857	Cooper 2007a
Cayo Jorajuria	LE-1784	3870 ± 40	intcal13.14c	cal BC 2467 – cal BC 2273 cal BC 2256 – cal BC 2208	0.885668 0.114332	Cooper 2007a
Corinthia III	Beta-133952	2300 ± 60	marine13.14c	cal BC 136 – cal AD 184	1	Ulloa Hung and Valcárcel Rojas 2002
Corinthia III	Beta-133953	2220 ± 70	marine13.14c	cal BC 39 – cal AD 320	1	Ulloa Hung and Valcárcel Rojas 2002
Corinthia III	Beta-140080	1700 ± 70	marine13.14c	cal AD 558 – cal AD 858	1	Ulloa Hung and Valcárcel Rojas 2002
Cueva 1 Punta del Este	GD-618	910 ± 85	intcal13.14c	cal AD 989 – cal AD 1267	1	Cooper 2007a
Cueva 4 Punta del Este	LC-H-1106	1100 ± 130	intcal13.14c	cal AD 666 – cal AD 1170 cal AD 1174 – cal AD 1182	0.995085 0.004915	Cooper 2007a
Cueva de los Bandoleros	unknown	4045 ± 75	intcal13.14c	cal BC 2875 – cal BC 2452 cal BC 2419 – cal BC 2406 cal BC 2377 – cal BC 2350	0.976360 0.008356 0.015284	Godo 2001
Cueva Calero	Beta-72801	1670 ± 70	intcal13.14c	cal AD 217 – cal AD 555	1	Ulloa Hung 2008
Cueva Calero	Beta-72802	1590 ± 60	intcal13.14c	cal AD 342 – cal AD 597	1	Ulloa Hung 2008
Cueva Calero	AA-101063	1384 ± 50	intcal13.14c	cal AD 568 – cal AD 714	0.953433	Chinique de Armas *et al.* 2015
Cueva Funche	SI-426	2070 ± 150	intcal13.14c	cal BC 409 – cal AD 258 cal AD 284 – cal AD 322	0.990294 0.009706	Pino 1995
Cueva Funche	SI-427	2510 ± 200	intcal13.14c	cal BC 1118 – cal BC 152 cal BC 138 – cal BC 113	0.994633 0.005367	Pino 1995
Cueva Funche	SI-428	3110 ± 200	intcal13.14c	cal BC 1873 – cal BC 1844 cal BC 1814 – cal BC 1800 cal BC 1778 – cal BC 890 cal BC 880 – cal BC 845	0.008902 0.003991 0.977250 0.009858	Pino 1995
Cueva Funche	SI-429	4000 ± 150	intcal13.14c	cal BC 2902 – cal BC 2133 cal BC 2081 – cal BC 2060	0.993227 0.006773	Pino 1995
Cueva de la Lechuza	LE-4267	2220 ± 160	intcal13.14c	cal BC 759 – cal BC 678 cal BC 673 – cal AD 70	0.050681 0.949319	Pino 1995
Cueva de la Lechuza	LE-4269	1470 ± 110	intcal13.14c	cal AD 340 – cal AD 771	1	Pino 1995
Cueva de la Lechuza	LE-4270	3110 ± 80	intcal13.14c	cal BC 1859 – cal BC 1854 cal BC 1771 – cal BC 899	0.000977 0.999023	Pino 1995
Cueva de la Lechuza	LE-4271	2380 ± 80	intcal13.14c	cal BC 771 – cal BC 356 cal BC 285 – cal BC 252 cal BC 250 – cal BC 235	0.965311 0.024751 0.009938	Pino 1995
Cueva de la Lechuza	LE-4272	2750 ± 160	intcal13.14c	cal BC 1383 – cal BC 1341 cal BC 1308 – cal BC 506 cal BC 504 – cal BC 489	0.015448 0.979947 0.004605	Pino 1995
Cueva de la Lechuza	LE-4273	2420 ± 100	intcal13.14c	cal BC 799 – cal BC 357 cal BC 281 – cal BC 257 cal BC 242 – cal BC 238	0.985764 0.011935 0.002301	Pino 1995

Cueva de la Lechuza	LE-4274	2030 ± 160	intcal13.14c	cal BC 401 – cal AD 337	1	Pino 1995
Cueva de la Lechuza	LE-4275	2580 ± 90	intcal13.14c	cal BC 900 – cal BC 429	1	Pino 1995
Cueva de la Lechuza	LE-4276	2250 ± 150	intcal13.14c	cal BC 762 – cal AD 19	1	Pino 1995
Cueva de la Lechuza	LE-4279	2390 ± 170	intcal13.14c	cal BC 887 – cal BC 884 cal BC 843 – cal BC 50	0.000567 0.999433	Pino 1995
Cueva de la Lechuza	LE-4281	2610 ± 120	intcal13.14c	cal BC 999 – cal BC 409	1	Pino 1995
Cueva de la Lechuza	LE-4282	2930 ± 300	intcal13.14c	cal BC 1878 – cal BC 1838 cal BC 1828 – cal BC 1791 cal BC 1785 – cal BC 402	0.008302 0.007229 0.984469	Pino 1995
Cueva de la Lechuza	LE-4283	5270 ± 120	intcal13.14c	cal BC 4344 – cal BC 3905 cal BC 3897 – cal BC 3896 cal BC 3880 – cal BC 3800	0.937631 0.000493 0.061875	Pino 1995
Cueva de la Lechuza	LE-4287	3030 ± 180	intcal13.14c	cal BC 1657 – cal BC 1651 cal BC 1645 – cal BC 830	0.002351 0.997649	Pino 1995
Cueva de la Lechuza	LE-4288	3030 ± 180	intcal13.14c	cal BC 1657 – cal BC 1651 cal BC 1645 – cal BC 830	0.002351 0.997649	Pino 1995
Cueva de la Lechuza	LE-4290	2610 ± 120	intcal13.14c	cal BC 999 – cal BC 409	1	Pino 1995
Cueva de la Pintura	GD-591	2930 ± 80	intcal13.14c	cal BC 1386 – cal BC 1340 cal BC 1645 – cal BC 830	0.043178 0.956822	Cooper 2007a
Cueva de la Pintura	GD-601	2805 ± 60	intcal13.14c	cal BC 1118 – cal BC 826	1	Cooper 2007a
Cueva de la Pintura	GD-613	2880 ± 70	intcal13.14c	cal BC 1264 – cal BC 895 cal BC 864 – cal BC 857	0.996329 0.003671	Cooper 2007a
Cueva de la Pintura	GD-614	2720 ± 65	intcal13.14c	cal BC 1010 – cal BC 795	1	Cooper 2007a
Cueva de la Pintura	GD-1039	2160 ± 55	intcal13.14c	cal BC 364 – cal BC 85 cal BC 80 – cal BC 55	0.957009 0.042991	Cooper 2007a
Cueva de la Pintura	GD-1046	2840 ± 60	intcal13.14c	cal BC 1193 – cal BC 1143 cal BC 1132 – cal BC 888 cal BC 882 – cal BC 845	0.058657 0.899325 0.042017	Cooper 2007a
Cueva del Perico 1	AA-101095	1594 ± 47	intcal13.14c	cal AD 354 – cal AD 366 cal AD 380 – cal AD 572	0.010739 0.989261	Chinique de Armas *et al.* 2015
Cueva del Perico I	GD-616	1350 ± 70	intcal13.14c	cal AD 562 – cal AD 778 cal AD 790 – cal AD 830 cal AD 837 – cal AD 866	0.939985 0.033931 0.026083	Pino 1995
Cueva del Perico I	GD-617	1495 ± 60	intcal13.14c	cal AD 428 – cal AD 648	1	Pino 1995
Cueva del Perico I	GD-1051	1990 ± 80	intcal13.14c	cal BC 196 – cal AD 179 cal AD 186 – cal AD 213	0.979987 0.020013	Pino 1995
Cueva de San Martin	unknown	3200 ± 80	intcal13.14c	cal BC 1659 – cal BC 1277	1	Godo 2001
Cueva de San Martin	unknown	3290 ± 120	intcal13.14c	cal BC 1885 – cal BC 1367 cal BC 1364 – cal BC 1293	0.956927 0.043073	Godo 2001
Damayajabo	Y-1764	3250 ± 100	intcal13.14c	cal BC 1762 – cal BC 1277	1	Cooper 2007a
La Escondida de Bucuey	unknown	1060 ± 150	intcal13.14c	cal AD 674 – cal AD 1224 cal AD 1234 – cal AD 1242	0.994044 0.005956	Pino 1995
Guayabo Blanco	AA-101064	1495 ± 47	intcal13.14c	cal AD 429 – cal AD 495 cal AD 507 – cal AD 521 cal AD 526 – cal AD 647	0.203505 0.026237 0.770258	Chinique de Armas *et al.* 2015
La Guira	Beta-140077	1390 ± 70	intcal13.14c	cal AD 434 – cal AD 451 cal AD 470 – cal AD 487 cal AD 534 – cal AD 774	0.008335 0.008643 0.983023	Ulloa Hung and Valcárcel Rojas 2002
La Herradura	Beta-140075	2050 ± 70	intcal13.14c	cal BC 351 – cal BC 302 cal BC 220 – cal AD 86 cal AD 108 – cal AD 118	0.037499 0.957955 0.004546	Ulloa Hung and Valcárcel Rojas 2002
La Luz	Beta-93863	1350 ± 50	intcal13.14c	cal AD 606 – cal AD 769	1	Ulloa Hung and Valcárcel Rojas 2002
El Purial	UBAR-169	3060 ± 180	intcal13.14c	cal BC 1689 – cal BC 887 cal BC 884 – cal BC 844	0.985451 0.014549	Pino 1995

La Vega del Palmar	Y-465	960 ± 60	intcal13.14c	cal AD 984 – cal AD 1212	1	Pino 1995
Levisa 1	GD-204	3460 ± 160	intcal13.14c	cal BC 2206 – cal BC 1412	1	Pino 1995
Levisa 1	GD-250	5140 ± 170	intcal13.14c	cal BC 4333 – cal BC 3639	1	Pino 1995
Levisa 1	MC-859	4240 ± 100	intcal13.14c	cal BC 3262 – cal BC 3250 cal BC 3099 – cal BC 2565 cal BC 2531 – cal BC 2528 cal BC 2525 – cal BC 2496	0.004225 0.982317 0.000902 0.012556	Pino 1995
Levisa 1	MC-860	4420 ± 100	intcal13.14c	cal BC 3363 – cal BC 2888	1	Pino 1995
Levisa 8	LE-2717	2010 ± 40	intcal13.14c	cal BC 153 – cal BC 139 cal BC 112 – cal AD 75	0.015430 0.984570	Pino 1995
Levisa 8	LE-2718	2610 ± 40	intcal13.14c	cal BC 893 – cal BC 874 cal BC 846 – cal BC 750 cal BC 683 – cal BC 668 cal BC 637 – cal BC 620 cal BC 616 – cal BC 590	0.014443 0.933915 0.017248 0.010327 0.024068	Pino 1995
Levisa 8	LE-2719	2160 ± 40	intcal13.14c	cal BC 360 – cal BC 92	1	Pino 1995
Levisa 8	LE-2720	2680 ± 40	intcal13.14c	cal BC 905 – cal BC 798	1	Pino 1995
Los Chivos	Beta-140074	1150 ± 60	intcal13.14c	cal AD 718 – cal AD 742 cal AD 766 – cal AD 1015	0.032100 0.967900	Ulloa Hung and Valcárcel Rojas 2002
Los Chivos	Beta-140076	2710 ± 80	intcal13.14c	cal BC 1107 – cal BC 1101 cal BC 1087 – cal BC 766	0.002686 0.997314	Ulloa Hung and Valcárcel Rojas 2002
Los Pedregales	GD-619	1170 ± 85	intcal13.14c	cal AD 682 – cal AD 1013	1	Pino 1995
Marien 2	Lv-2062	780 ± 100	intcal13.14c	cal AD 1031 – cal AD 1324 cal AD 1345 – cal AD 1393	0.916181 0.083819	Pino 1995
Marien 2	Lv-2063	2020 ± 80	intcal13.14c	cal BC 351 – cal BC 300 cal BC 227 – cal BC 224 cal BC 210 – cal AD 139 cal AD 197 – cal AD 207	0.026456 0.000699 0.969614 0.003232	Pino 1995
Mejias	SI-347	1020 ± 100	intcal13.14c	cal AD 776 – cal AD 794 cal AD 798 – cal AD 1216	0.019506 0.980494	Pino 1995
Mogote de la Cueva	SI-424	1620 ± 150	intcal13.14c	cal AD 78 – cal AD 669	1	Cooper 2007a
Mogote de la Cueva	SI-425	650 ± 200	intcal13.14c	cal AD 904 – cal AD 917 cal AD 966 – cal AD 1668 cal AD 1781 – cal AD 1797 cal AD 1947 – cal AD 1949	0.002949 0.992413 0.004028 0.000610	Cooper 2007a
Mogote de la Cueva	unknown	960 ± 50	intcal13.14c	cal AD 990 – cal AD 1186	1	Cooper 2007a
Playa de Damajayabo	Y-1764	3250 ± 100	intcal13.14c	cal BC 1762 – cal BC 1277	1	Pino 1995
Playita	GD-203	1110 ± 40	intcal13.14c	cal AD 778 – cal AD 791 cal AD 806 – cal AD 818 cal AD 824 – cal AD 841 cal AD 861 – cal AD 1018	0.022386 0.012962 0.023236 0.941416	Pino 1995
Playita	unknown	1280 ± 20	intcal13.14c	cal AD 673 – cal AD 730 cal AD 736 – cal AD 769	0.603670 0.396330	Pino 1995
Punta de Peque	Beta-93860	1400 ± 60	intcal13.14c	cal AD 541 – cal AD 721 cal AD 741 – cal AD 767	0.958349 0.041651	Ulloa Hung and Valcárcel Rojas 2002
Rio Chico	unknown	3100 ± 70	intcal13.14c	cal BC 1507 – cal BC 1191 cal BC 1177 – cal BC 1162 cal BC 1144 – cal BC 1131	0.982120 0.008735 0.009145	Godo 2001
San Benito	Beta-93851	2020 ± 60	intcal13.14c	cal BC 185 – cal AD 86 cal AD 107 – cal AD 119	0.989930 0.010070	Ulloa Hung and Valcárcel Rojas 2002
Victoria I	LC-H-0565	960 ± 50	intcal13.14c	cal AD 990 – cal AD 1186	1	Pino 1995
Victoria I	LC-H-1034	2070 ± 110	intcal13.14c	cal BC 381 – cal AD 130	1	Pino 1995
Victoria I	LC-H-1035	1450 ± 70	intcal13.14c	cal AD 427 – cal AD 677	1	Pino 1995

Haiti							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Caberet	Beta-na	2280 ± 80	intcal13.14c		cal BC 731- cal BC 691 cal BC 660 – cal BC 650 cal BC 544 – cal BC 111	0.019642 0.003895 0.976463	Wilson 2007
Des Cahots	Beta-na	4340 ± 80	intcal13.14c		cal BC 3336 – cal BC 3210 cal BC 3192 – cal BC 3151 cal BC 3138 – cal BC 2861 cal BC 2808 – cal BC 2756 cal BC 2719 – cal BC 2705	0.117778 0.027404 0.817286 0.031462 0.006070	Wilson 2007
Couri II	Beta-41783	1710 ± 70	marine13.14c		cal AD 545 – cal AD 849	1	Moore and Tremmel 1997
Couri II	Beta-71640	3430 ± 70	marine13.14c		cal BC 1519 – cal BC 1160	1	Moore and Tremmel 1997
Gillote	Beta-52888	3260 ± 60	marine13.14c		cal BC 1306 – cal BC 948	1	Moore and Tremmel 1997
Ile Boucanier	Beta-42231	1090 ± 80	marine13.14c		cal AD 1153 – cal AD 1438	1	Moore and Tremmel 1997
Matelas	Beta-na	4370 ± 90	intcal13.14c		cal BC 3352 – cal BC 2871 cal BC 2799 – cal BC 2793 cal BC 2785 – cal BC 2780	0.995033 0.002903 0.002064	Wilson 2007
Phaeton	Beta-na	3260 ±70	intcal13.14c		cal BC 1731 – cal BC 1720 cal BC 1692 – cal BC 1408	0.007446 0.992554	Wilson 2007
Riviere Maurice	Beta-52434	4170 ± 60	marine13.14c		cal BC 2462 – cal BC 2126	1	Moore and Tremmel 1997
Savane Caree II	Beta-42232	4610 ± 90	marine13.14c		cal BC 3126 – cal BC 2585	1	Moore and Tremmel 1997
Vignier II	Beta-na	5270 ± 100	intcal13.14c		cal BC 4336 – cal BC 3939 cal BC 3859 – cal BC 3814	0.974374 0.025626	Wilson 2007
Vignier III	Beta-na	5580 ± 80	intcal13.14c		cal BC 4603 – cal BC 4316 cal BC 4298 – cal BC 4262	0.969292 0.030708	Wilson 2007

Dominican Republic							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Barrera-Mordán	I-8738	1975 ± 300	intcal13.14c		cal BC 756 – cal BC 679 cal BC 671 – cal BC 602 cal BC 600 – cal AD 615	0.023857 0.019239 0.956904	Morbán Laucer 1979
Barrera-Mordán	T-1975-300	1350 ± 80	intcal13.14c		cal AD 551 – cal AD 783 cal AD 786 – cal AD 879	0.893193 0.106807	Morbán Laucer 1979
Barrera-Mordán	IVIC-005	4400 ± 170	intcal13.14c		cal BC 3520 – cal BC 2617 cal BC 2609 – cal BC 2583	0.992164 0.007836	Rouse and Allaire 1978
Barrera-Mordán	T-54	4140 ± 130	intcal13.14c		cal BC 3081 – cal BC 3069 cal BC 3026 – cal BC 2338 cal BC 2317 – cal BC 2310	0.003688 0.994203 0.002109	Rouse and Allaire 1978
Barrera-Mordán	Y-1422	4560 ± 80	intcal13.14c		cal BC 3618 – cal BC 3612 cal BC 3521 – cal BC 3019	0.002684 0.997316	Rouse and Allaire 1978
Batey Negro	I-06781	2585 ± 90	intcal13.14c		cal BC 904 – cal BC 429	1	Morbán Laucer 1979
Batey Negro	unknown	2515 ± 85	intcal13.14c		cal BC 802 – cal BC 413	1	Morbán Laucer 1979
Bavaro	unknown	1180 ± 80	intcal13.14c		cal AD 675 – cal AD 994	1	Morbán Laucer 1979
El Caimito	I-6924	1965 ± 90	intcal13.14c		cal BC 197 – cal AD 244	1	Veloz Maggiolo *et al.* 1973
El Caimito	I-7821	1830 ± 85	intcal13.14c		cal AD 8 – cal AD 12 cal AD 15 – cal AD 392	0.002666 0.997334	Veloz Maggiolo *et al.* 1973
El Caimito	I-7822	1865 ± 85	intcal13.14c		cal BC 42 – cal AD 348 cal AD 370 – cal AD 377	0.994683 0.005317	Veloz Maggiolo *et al.* 1973
El Caimito	I-7823	2130 ± 85	intcal13.14c		cal BC 380 – cal AD 21	1	Veloz Maggiolo *et al.* 1973
La Caleta	unknown	2495 ± 80	intcal13.14c		cal BC 793 – cal BC 415	1	Morbán Laucer 1979
Cueva de Berna	I-9539	3205 ± 90	intcal13.14c		cal BC 1689 – cal BC 1261	1	Veloz Maggiolo *et al.* 1977

Cueva de Berna	I-9540	3840 ± 130	intcal13.14c	cal BC 2833 – cal BC 2819 cal BC 2659 – cal BC 2651 cal BC 2634 – cal BC 1916	0.003833 0.002380 0.993787	Veloz Maggiolo *et al.* 1977
Cueva de Berna	I-9541	3575 ± 90	marine13.14c	cal BC 1743 – cal BC 1293	1	Veloz Maggiolo *et al.* 1977
Cueva del Ferrocarril	I-8737	1315 ± 80	intcal13.14c	cal AD 579 – cal AD 892	1	Morbán Laucer 1979
El Curro	unknown	3400 ± 95	intcal13.14c	cal BC 1941 – cal BC 1496 cal BC 1472 – cal BC 1463	0.995410 0.004590	Morbán Laucer 1979
Estero Hondo (Las Paredes)	unknown	2570 ± 85	intcal13.14c	cal BC 893 – cal BC 875 cal BC 848 – cal BC 415	0.015041 0.984959	Morbán Laucer 1979
Honduras del Oeste	I-6012	2310 ± 95	intcal13.14c	cal BC 758 – cal BC 678 cal BC 672 – cal BC 166	0.079869 0.920131	Morbán Laucer 1979
Hoyo de Toro	I-6756	3980 ± 95	intcal13.14c	cal BC 2863 – cal BC 2806 cal BC 2759 – cal BC 2717 cal BC 2710 – cal BC 2205	0.055635 0.030388 0.913978	Morbán Laucer 1979
Hoyo de Toro	unknown	2540 ± 85	intcal13.14c	cal BC 819 – cal BC 411	1	Morbán Laucer 1979
La Isleta	I-7852	1230 ± 90	intcal13.14c	cal AD 654 – cal AD 982	1	Morbán Laucer 1979
La Isleta	unknown	3180 ± 90	intcal13.14c	cal BC 1658 – cal BC 1223	1	Morbán Laucer 1979
El Porvenir	I-6615	2855 ± 90	intcal13.14c	cal BC 1263 – cal BC 826	1	Rouse and Allaire 1978
El Porvenir	I-6790	2980 ± 95	intcal13.14c	cal BC 1429 – cal BC 971 cal BC 960 – cal BC 936	0.983923 0.016077	Rouse and Allaire 1978
El Porvenir	unknown	3980 ± 95	intcal13.14c	cal BC 2863 – cal BC 2806 cal BC 2759 – cal BC 2717 cal BC 2710 – cal BC 2205	0.055635 0.030388 0.913978	Veloz Maggiolo and Ortega 1973
El Porvenir (Seralles)	unknown	3135 ± 90	intcal13.14c	cal BC 2710 – cal BC 2205 cal BC 1177 – cal BC 1161 cal BC 1144 – cal BC 1130	0.913978 0.009250 0.008260	Morbán Laucer 1979
El Vigia	I-8763	3775 ± 85	intcal13.14c	cal BC 2465 – cal BC 2009 cal BC 2002 – cal BC 1977	0.977414 0.022586	Morbán Laucer 1979
La Madama	I-9780	2795 ± 140	intcal13.14c	cal BC 1396 – cal BC 750 cal BC 683 – cal BC 668 cal BC 638 – cal BC 590	0.982023 0.004778 0.013199	Morbán Laucer 1979
Madrigales	I-7388	2030 ± 95	intcal13.14c	cal BC 357 – cal BC 283 cal BC 256 – cal BC 247 cal BC 235 – cal AD 145 cal AD 150 – cal AD 170 cal AD 194 – cal AD 210	0.060910 0.003704 0.918785 0.008863 0.007739	Morbán Laucer 1979
Musiepedro	I-8646	2255 ± 80	marine13.14c	cal BC 130 – cal AD 284	1	Veloz Maggiolo *et al.* 1976
La Piedra	I-8740	3585 ± 85	marine13.14c	cal BC 1744 – cal BC 1319	1	Rímoli and Nadal 1983
La Piedra	I-8741	3625 ± 85	marine13.14c	cal BC 1808 – cal BC 1383	1	Rímoli and Nadal 1983
Puerto Alejandro	I-10338	3400 ± 95	intcal13.14c	cal BC 1941 – cal BC 1496 cal BC 1472 – cal BC 1463	0.995410 0.004590	Morbán Laucer 1979
Punta Bayahibe	Beta-199781	3380 ± 60	marine13.14c	cal BC 1435 – cal BC 1118	1	Atiles and López Belando 2006
Punta Bayahibe	Beta-199782	3530 ± 70	marine13.14c	cal BC 1639 – cal BC 1288	1	Atiles and López Belando 2006
Punta Bayahibe	Beta-222903	3550 ± 50	marine13.14c	cal BC 1618 – cal BC 1378	1	Atiles and López Belando 2006
Punta Bayahibe	Beta-222904	3600 ± 80	marine13.14c	cal BC 1756 – cal BC 1366	1	Atiles and López Belando 2006
Punta Bayahibe	Beta-222905	3460 ± 50	marine13.14c	cal BC 1508 – cal BC 1249	1	Atiles and López Belando 2006

Punta Bayahibe	Beta-222906	3150 ± 50	marine13.14c		cal BC 1131 – cal BC 837	1	Atiles and López Belando 2006
Sabaneta de Juan Dolio	I-6755	2195 ± 90	intcal13.14c		cal BC 406 – cal BC 20 cal BC 11 – cal BC 1	0.994547 0.005453	Morbán Laucer 1979
Taveras I	I-5818	2095 ± 135	intcal13.14c		cal BC 404 – cal AD 216	1	Morbán Laucer 1979
Taveras II	SI-991	1805 ± 70	intcal13.14c		cal AD 72 – cal AD 385	1	Morbán Laucer 1979
El Vigia	I-8742	3920 ± 85	intcal13.14c		cal BC 2830 – cal BC 2822 cal BC 2629 – cal BC 2140	0.002795 0.997205	Morbán Laucer 1979
El Vigia	I-08763	3775 ± 85	intcal13.14c		cal BC 2465 – cal BC 2009 cal BC 2002 – cal BC 1977	0.977414 0.022586	Morbán Laucer 1979

Mona Island							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Cueva Caracoles	I-13674	4330 ± 100	marine13.14c		cal BC 2833 – cal BC 2251	1	Dávila Dávila 2003
Cueva Caracoles	I-13671	3290 ± 90	intcal13.14c		cal BC 1870 – cal BC 1845 cal BC 1811 – cal BC 1804 cal BC 1776 – cal BC 1392 cal BC 1335 – cal BC 1324	0.011631 0.003076 0.981187 0.004106	Dávila Dávila 2003

Puerto Rico							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Angostura	Beta-29778	5960 ± 250	intcal13.14c		cal BC 5464 – cal BC 5444 cal BC 5421 – cal BC 5409 cal BC 5381 – cal BC 4343	0.005196 0.003256 0.991548	Ayes Suárez 1998
Angostura	Beta-294434	3680 ± 40	intcal13.14c	-26.3	cal BC 2196 – cal BC 2169 cal BC 2147 – cal BC 1948	0.052087 0.947913	Rivera-Collazo *et al.* 2015
Angostura	Beta-294435	2120 ± 30	intcal13.14c	-23.7	cal BC 344 – cal BC 323 cal BC 205 – cal BC 51	0.039720 0.960280	Rivera-Collazo *et al.* 2015
Angostura	GX-28805	3700 ± 30	intcal13.14c	-24.5	cal BC 2198 – cal BC 2165 cal BC 2151 – cal BC 2018 cal BC 1995 – cal BC 1981	0.087617 0.890918 0.021465	Vega 2002
Angostura	GX-28806	3570 ± 40	intcal13.14c	-26.9	cal BC 2028 – cal BC 1867 cal BC 1848 – cal BC 1774	0.840962 0.159038	Vega 2002
Angostura	GX-28807	3920 ± 70	intcal13.14c	-27.5	cal BC 2579 – cal BC 2200 cal BC 2157 – cal BC 2155	0.999028 0.000972	Vega 2002
Angostura	GX-28808	3670 ± 70	intcal13.14c	-26.8	cal BC 2282 – cal BC 2248 cal BC 2232 – cal BC 2217 cal BC 2215 – cal BC 1882	0.024414 0.008660 0.966925	Vega 2002
Angostura	GX-28809	3470 ± 40	intcal13.14c	-28.5	cal BC 1892 – cal BC 1688	1	Vega 2002
Angostura	GX-28810	3980 ± 80	marine13.14c	-7.7	cal BC 2274 – cal BC 1811	1	Vega 2002
Angostura	GX-28811	3830 ± 90	marine13.14c	-7.1	cal BC 2093 – cal BC 1607	1	Vega 2002
Angostura	GX-28812	4120 ± 80	marine13.14c	-6.9	cal BC 2456 – cal BC 2005	1	Vega 2002
Angostura	GX-28813	4010 ± 70	marine13.14c	-6.7	cal BC 2278 – cal BC 1880	1	Vega 2002
Angostura	GX-28814	3740 ± 100	intcal13.14c	-27	cal BC 2462 – cal BC 1909	1	Vega 2002
Cayo Cofresi	I-7424	2275 ± 85	intcal13.14c	-24.7	cal BC 734 – cal BC 689 cal BC 662 – cal BC 648 cal BC 546 – cal BC 91 cal BC 67 – cal BC 65	0.022025 0.005660 0.971619 0.000697	Veloz Maggiolo *et al.* 1975
Cayo Cofresi	I-7425	2245 ± 85	intcal13.14c	-24.4	cal BC 508 – cal BC 498 cal BC 493 – cal BC 53	0.004723 0.990309	Veloz Maggiolo *et al.* 1975
Cueva del Abono	UGM-30015	4780 ± 30	marine13.14c		cal BC 3262 – cal BC 2967	1	Rodríguez Ramos 2017
Cueva Lucero	UGM-30042	3140 ± 40	intcal13.14c		cal BC 1500 – cal BC 1369 cal BC 1360 – cal BC 1298	0.767605 0.232395	Rodríguez Ramos 2017
Cueva Matos	UGM-30016	3200 ± 30	marine13.14c		cal BC 1171 – cal BC 941	1	Rodríguez Ramos 2017
Cueva Soto	UGM-30031	2910 ± 50	intcal13.14c		cal BC 1258 – cal BC 1245 cal BC 1233 – cal BC 973 cal BC 957 – cal BC 940	0.012682 0.968686 0.018633	Rodríguez Ramos 2017

Cueva Tremblada	UGM-30017	4160 ± 30	marine13.14c		cal BC 2417 – cal BC 2180	1	Rodríguez Ramos 2017
Cueva Ventana	UGM-5105	3170 ± 30	marine13.14c		cal BC 1114 – cal BC 904	1	Rodríguez Ramos 2014
Cueva Ventana	UGM-5106	3740 ± 30	intcal13.14c		cal BC 2274 – cal BC 2257 cal BC 2208 – cal BC 2035	0.032101 0.967899	Rodríguez Ramos 2014
Cueva Ventana	UGM-5107	3520 ± 30	marine13.14c		cal BC 1540 – cal BC 1377	1	Rodríguez Ramos 2014
Cueva Ventana	UGM-5108	3740 ± 30	marine13.14c		cal BC 1831 – cal BC 1619	1	Rodríguez Ramos 2014
Cueva Ventana	UGM-17561	3640 ± 25	marine13.14c		cal BC 1673 – cal BC 1505	1	Rodríguez Ramos 2014
Cueva Ventana	UGM-17562	3630 ± 25	marine13.14c		cal BC 1660 – cal BC 1496	1	Rodríguez Ramos 2014
Cueva Ventana	UGM-17564	3120 ± 20	marine13.14c		cal BC 1027 – cal BC 861	1	Rodríguez Ramos 2014
Cueva Ventana	UGM-17565	3810 ± 25	intcal13.14c		cal BC 2339 – cal BC 2313 cal BC 2310 – cal BC 2195 cal BC 2174 – cal BC 2145	0.042938 0.886383 0.070680	Rodríguez Ramos 2014
Cueva Ventana	UGM-17566	4250 ± 25	marine13.14c		cal BC 2484 – cal BC 2301	1	Rodríguez Ramos 2014
Cueva Ventana Int.	UGM-30033	2390 ± 35	intcal13.14c		cal BC 733 – cal BC 690 cal BC 661 – cal BC 649 cal BC 545 – cal BC 394	0.081008 0.017256 0.901735	Rodríguez Ramos 2017
Maruca	Beta-69878	3080 ± 90	marine13.14c	-25.0	cal BC 1155 – cal BC 746	1	Pantel 1994
Maruca	Beta-69879	3870 ± 130	marine13.14c	-25.0	cal BC 2253 – cal BC 1554	1	Pantel 1994
Maruca	Beta-70866	2960 ± 110	marine13.14c	-25.0	cal BC 1045 – cal BC 454	1	Pantel 1994
Maruca	Beta-92890	2950 ± 50	marine13.14c	-25.3	cal BC 902 – cal BC 654	1	Rodríguez López 2004
Maruca	Beta-92891	4160 ± 50	marine13.14c	-25.8	cal BC 2440 – cal BC 2137	1	Rodríguez López 2004
Maruca	Beta-92892	2870 ± 60	intcal13.14c	-25.4	cal BC 1222 – cal BC 900	1	Rodríguez López 2004
Maruca	Beta-92893	2650 ± 60	intcal13.14c	-26.7	cal BC 972 – cal BC 958 cal BC 939 – cal BC 750 cal BC 683 – cal BC 668 cal BC 638 – cal BC 590	0.007988 0.955116 0.010869 0.026027	Rodríguez López 2004
Maruca	Beta-92894	2820 ± 70	marine13.14c		cal BC 773 – cal BC 412	1	Rodríguez López 2004
Paso del Indio	Beta-92894	4110 ± 40	intcal13.14c		cal BC 2853 – cal BC 2812 cal BC 2744 – cal BC 2726 cal BC 2696 – cal BC 2617 cal BC 2609 – cal BC 2583	0.249354 0.005641 0.735294 0.009711	Rodríguez Ramos 2010
Paso del Indio	Beta-77165	4060 ± 60	intcal13.14c		cal BC 2866 – cal BC 2804 cal BC 2774 – cal BC 2769 cal BC 2764 – cal BC 2469	0.141487 0.004151 0.854362	Walker 2005
Paso del Indio	Beta-178677	2330 ± 110	intcal13.14c		cal BC 776 – cal BC 166	1	Walker 2005
Paso del Indio	Beta-178678	2520 ± 40	intcal13.14c		cal BC 797 – cal BC 536 cal BC 528 – cal BC 520	0.993471 0.006529	Walker 2005

Vieques							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Cano Hondo	Uga-995	3010 ± 70	marine13.14c		cal BC 1020 – cal BC 707	1	Figueredo 1975
Cano Hondo	Uga-996	2855 ± 65	marine13.14c		cal BC 799 – cal BC 453	1	Figueredo 1975
Cano Hondo	Uga-997	2705 ± 70	marine13.14c		cal BC 726 – cal BC 317	1	Figueredo 1975
Puerto Ferro	I-16395	2790 ± 100	marine13.14c		cal BC 794 – cal BC 350	1	Narganes Storde 1991; Jaime Pagán-Jiménez, personal communicati-on, 2004
Puerto Ferro	I-16396	3510 ± 100	marine13.14c		cal BC 1690 – cal BC 1188	1	Chanlatte 1991
Puerto Ferro	I-16397	3530 ± 100	marine13.14c		cal BC 1719 – cal BC 1218	1	Chanlatte 1991

Puerto Ferro	I-16406	3850 ± 100	marine13.14c		cal BC 2135 – cal BC 1602	1	Chanlatte 1991
Puerto Ferro	I-16407	2740 ± 100	marine13.14c		cal BC 775 – cal BC 291 cal BC 266 – cal BC 260	0.99776 0.00224	Chanlatte 1991
Puerto Ferro	I-16896	2650 ± 90	marine13.14c		cal BC 697 – cal BC 171	1	Narganes Storde 2007
Puerto Ferro	I-16897	3470 ± 100	marine13.14c		cal BC 1637 – cal BC 1128	1	Narganes Storde 2007
Puerto Ferro	I-16898	2770 ± 90	marine13.14c		cal BC 770 – cal BC 355	1	Narganes Storde 2007
Puerto Ferro	I-16899	3780 ± 100	marine13.14c		cal BC 2027 – cal BC 1506	1	Narganes Storde 2007
Puerto Ferro	I-18971	4095 ± 80	marine13.14c	1.4	cal BC 2432 – cal BC 1970	1	Narganes Storde 2007

			St. Thomas				
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Cancel Hill	I-8693	2820 ± 85	marine13.14c		cal BC 787 – cal BC 393	1	Gross 1976
Grambokola Hill	I-8642	2785 ± 85	marine13.14c		cal BC 769 – cal BC 375	1	Gross 1976
Krum Bay (S of Sara Hill)	Beta-5778	3580 ± 270	intcal13.14c		cal BC 2839 -cal BC 2814 cal BC 2676 – cal BC 1266	0.004109 0.995891	Lundberg 1989
Krum Bay (S of Sara Hill)	Beta-7022	2860 ± 70	marine13.14c		cal BC 807 – cal BC 441	1	Lundberg 1989
Krum Bay (S of Sara Hill)	I-8640	2830 ± 85	marine13.14c		cal BC 793 – cal BC 396	1	Lundberg 1989
Krum Bay (S of Sara Hill)	I-8641	2775 ± 85	marine13.14c		cal BC 764 – cal BC 368	1	Lundberg 1989
Krum Bay (S of Sara Hill)	SI-5847	2030 ± 80	marine13.14c		cal AD 152 – cal AD 549	1	Lundberg 1989
Krum Bay (S of Sara Hill)	SI-5848	1805 ± 75	marine13.14c		cal AD 426 – cal AD 728	1	Lundberg 1989
Krum Bay (S of Sara Hill)	SI-5849	1595 ± 75	marine13.14c		cal AD 664 – cal AD 973	1	Lundberg 1989
Krum Bay (S off Sara Hill)	SI-5850	2130 ± 60	marine13.14c		cal AD 91 – cal AD 391	1	Lundberg 1989
Krum Bay (S of Sara Hill)	SI-5851	2700 ± 65	marine13.14c		cal BC 715 – cal BC 322	1	Lundberg 1989
Krum Bay (S of Sara Hill)	SI-5852	2535 ± 55	marine13.14c		cal BC 379 – cal BC 109	1	Lundberg 1989
Krum Bay A	Beta-445042	2600 ± 30	marine13.14c	1.6	cal BC 396 – cal BC 216	1	Toftgaard, chapter 16
Krum Bay A	Beta-445861	2420 ± 30	marine13.14c	1.1	cal BC 196 – cal BC 8	1	Toftgaard, chapter 16
Krum Bay A	Beta-445862	3080 ± 30	marine13.14c	3.2	cal BC 988 – cal BC 809	1	Toftgaard, chapter 16
Krum Bay A	Beta-445863	2900 ± 30	marine13.14c	2.1	cal BC 801 – cal BC 621	1	Toftgaard, chapter 16
Krum Bay B	Beta-445038	3280 ± 30	marine13.14c	2.6	cal BC1262 -cal BC 1047	1	Toftgaard, chapter 16
Krum Bay B	Beta-445039	3190 ± 30	marine13.14c	1.6	cal BC 1151 – cal BC 924	1	Toftgaard, chapter 16
Krum Bay B	Beta-445040	3120 ± 30	marine13.14c	3.9	cal BC 1044 -cal BC 841	1	Toftgaard, chapter 16
Krum Bay B	Beta-445041	2920 ± 30	marine13.14c	2.8	cal BC 816 – cal BC 691 cal BC 680 – cal BC 665	0.986064 0.013936	Toftgaard, chapter 16
Krum Bay C	I-620	2175 ± 160	marine13.14c		cal BC 196 – cal AD 567	1	Bullen and Sleight 1963
Krum Bay C	I-621	2400 ± 175	marine13.14c		cal BC 528 – cal AD 354	1	Bullen and Sleight 1963
Arboretum (Magens Bay)	L-1380A	1900 ± 70	marine13.14c		cal AD 348 – cal AD 655	1	Tilden 1975
Arboretum (Magens Bay)	L-1380B	2410 ± 60	marine13.14c		cal BC 266 – cal AD 67	1	Tilden 1975

LESSER ANTILLES							
Anguilla							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Whitehead's Bluff	Beta-21865	3240 ± 80	marine13.14c		cal BC 1343 – cal BC 1333 cal BC 1324 – cal BC 891	0.005595 0.994405	Crock *et al.* 1995
Whitehead's Bluff	Beta-60775	3410 ± 60	marine13.14c		cal BC 1481 – cal BC 1171	1	Crock *et al.* 1995
Whitehead's Bluff	Beta-63158	3380 ± 90	marine13.14c		cal BC 1499 – cal BC 1035	1	Crock *et al.* 1995
Whitehead's Bluff	PITT-1263	3605 ± 45	marine13.14c		cal BC 1667 – cal BC 1432	1	Crock *et al.* 1995

Saint Martin							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Baie Longue 2	Beta-187936	3450 ± 40	marine13.14c		cal BC 1482 – cal BC 1263	1	Bonnissent 2008
Baie Longue 2	Beta-187937	3140 ± 40	intcal13.14c		cal BC 1500 – cal BC 1369	0.767605	Bonnissent 2008
Baie Nettle	Beta-261095	4150 ± 40	marine13.14c		cal BC 2413 – cal BC 2138	1	Serrand 2009
Baie Orientale 1	Beta-145372	2420 ± 40	intcal13.14c		cal BC 751 – cal BC 682 cal BC 668 – cal BC 636 cal BC 626 – cal BC 614 cal BC 592 – cal BC 401	0.190743 0.069865 0.012799 0.726592	Bonnissent *et al.* 2001
Baie Orientale 1	Beta-146424	2020 ± 40	intcal13.14c		cal BC 668 – cal BC 636 cal BC 626 – cal BC 614	0.040153 0.959847	Bonnissent *et al.* 2001
Baie Orientale 1	Beta-146425	2270 ± 40	intcal13.14c		cal BC 402 – cal BC 347 cal BC 319 – cal BC 207	0.432582 0.567418	Bonnissent *et al.* 2001
Baie Orientale 1	Beta-146427	2850 ± 60	marine13.14c		cal BC 792 – cal BC 465	1	Bonnissent *et al.* 2001
Belle Creole	Ly-7578	3810 ± 30	marine13.14c		cal BC 592 – cal BC 401	1	Yvon 2009
Etang Rouge 1	Beta-190805	3490 ± 40	intcal13.14c		cal BC 1917 – cal BC 1733 cal BC 1718 – cal BC 1694	0.944795 0.055205	Bonnissent 2008
Etang Rouge 1	KIA-28109	3105 ± 30	marine13.14c		cal BC 1020 – cal BC 826	1	Bonnissent 2008
Etang Rouge 1	KIA-28110	3185 ± 30	marine13.14c		cal BC 1142 – cal BC 918	1	Bonnissent 2008
Etang Rouge 1	KIA-28111	3380 ± 40	marine13.14c		cal BC 1406 – cal BC 1183	1	Bonnissent 2008
Etang Rouge 1	KIA-28112	3775 ± 30	marine13.14c		cal BC 1869 – cal BC 1667	1	Bonnissent 2008
Etang Rouge 1	KIA-28113	3320 ± 30	marine13.14c		cal BC 1343 – cal BC 1333 cal BC 1324 – cal BC 1104	0.008251 0.991749	Bonnissent 2008
Etang Rouge 1	KIA-28114	3800 ± 30	marine13.14c		cal BC 1889 – cal BC 1689	1	Bonnissent 2008
Etang Rouge 1	KIA-28115	4275 ± 30	marine13.14c		cal BC 2549 – cal BC 2335	1	Bonnissent 2008
Etang Rouge 1	KIA-28116	4505 ± 35	marine13.14c		cal BC 2862 – cal BC 2632	1	Bonnissent 2008
Etang Rouge 1	KIA-28117	3095 ± 23	intcal13.14c		cal BC 1420 – cal BC 1291	1	Bonnissent 2008
Etang Rouge 1	KIA-28118	2951 ± 52	intcal13.14c		cal BC 1373 – cal BC 1357 cal BC 1300 – cal BC 1006	0.013788 0.986212	Bonnissent 2008
Etang Rouge 1	KIA-28119	3655 ± 25	intcal13.14c		cal BC 2133 – cal BC 2081 cal BC 2060 – cal BC 1947	0.285230 0.714770	Bonnissent 2008
Etang Rouge 1	KIA-28120	3366 ± 27	intcal13.14c		cal BC 1742 – cal BC 1709 cal BC 1700 – cal BC 1611 cal BC 1571 – cal BC 1566	0.125225 0.868125 0.006651	Bonnissent 2008
Etang Rouge 1	KIA-28121	3828 ± 27	intcal13.14c		cal BC 2452 – cal BC 2441 cal BC 2440 – cal BC 2420 cal BC 2405 – cal BC 2377 cal BC 2350 – cal BC 2198 cal BC 2165 – cal BC 2151	0.008817 0.022392 0.046194 0.907686 0.014911	Bonnissent 2008

Etang Rouge 1	KIA-28123	3684 ± 27	intcal13.14c	cal BC 2191 – cal BC 2180 cal BC 2142 – cal BC 2009 cal BC 2002 – cal BC 1977	0.015213 0.921080 0.063708	Bonnissent 2008
Etang Rouge 1	KIA-28124	3598 ± 29	intcal13.14c	cal BC 2027 – cal BC 1889	1	Bonnissent 2008
Etang Rouge 1	KIA-28125	3235 ± 26	intcal13.14c	cal BC 1607 – cal BC 1582 cal BC 1560 – cal BC 1552 cal BC 1549 – cal BC 1437	0.087414 0.018811 0.893775	Bonnissent 2008
Etang Rouge 1	KIA-28126	3447 ± 26	intcal13.14c	cal BC 1878 – cal BC 1838 cal BC 1829 – cal BC 1792 cal BC 1785 – cal BC 1687	0.191515 0.108207 0.700278	Bonnissent 2008
Etang Rouge 1	KIA-28127	3429 ± 35	intcal13.14c	cal BC 1877 – cal BC 1840 cal BC 1826 – cal BC 1794 cal BC 1783 – cal BC 1638	0.117390 0.064331 0.818278	Bonnissent 2008
Etang Rouge 3	KIA-28108	4770 ± 40	marine13.14c	cal BC 3260 – cal BC 2927	1	Bonnissent 2008
Etang Rouge 3	KIA-28815	4830 ± 40	marine13.14c	cal BC 3318 – cal BC 3034	1	Bonnissent 2008
Hope Hill	Ly-9190 (Sac A28825)	3310 ± 35	marine13.14c	cal BC 1342 – cal BC 1335 cal BC 1322 – cal BC 1075	0.005261 0.994739	Bonnissent *et al.* 2016
Lot 73	Beta-361273	3150 ± 30	marine13.14c	cal BC 1094 – cal BC 887	1	Bonnissent *et al.* 2016
Lot 73	Beta-361277	3120 ± 30	marine13.14c	cal BC 1044 – cal BC 841	1	Bonnissent *et al.* 2016
Lot 73	Beta-361278	3520 ± 30	marine13.14c	cal BC 1540 – cal BC 1377	1	Bonnissent *et al.* 2016
Lot 73	Beta-361279	3390 ± 30	marine13.14c	cal BC 1399 – cal BC 1214	1	Bonnissent *et al.* 2016
Lot 73	Beta-361280	3330 ± 30	marine13.14c	cal BC 1350 – cal BC 1121	1	Bonnissent *et al.* 2016
Lot 73	Beta-361281	3830 ± 30	marine13.14c	cal BC 1930 – cal BC 1731	1	Bonnissent *et al.* 2016
Lot 73	Beta-361282	3750 ± 30	marine13.14c	cal BC 1850 – cal BC 1636	1	Bonnissent *et al.* 2016
Lot 73	Beta-390239	3390 ± 30	marine13.14c	cal BC 1399 – cal BC 1214	1	Bonnissent *et al.* 2016
Lot 73	Beta-390240	3540 ± 30	marine13.14c	cal BC 1572 – cal BC 1398	1	Bonnissent *et al.* 2016
Lot 73	Beta-390241	3580 ± 30	marine13.14c	cal BC 1609 – cal BC 1433	1	Bonnissent *et al.* 2016
Lot 73	Beta-390242	3550 ± 30	marine13.14c	cal BC 1584 – cal BC 1409	1	Bonnissent *et al.* 2016
Lot 73	Beta-390243	3820 ± 30	marine13.14c	cal BC 1920 – cal BC 1721	1	Bonnissent *et al.* 2016
Lot 73	Beta-390244	3850 ± 30	marine13.14c	cal BC 1953 – cal BC 1745	1	Bonnissent *et al.* 2016
Norman Estate 1	Beta-041782	3580 ± 90	marine13.14c	cal BC 1749 – cal BC 1298	1	Hénocq and Petit 1998
Norman Estate 1	GrN-20157	3730 ± 30	marine13.14c	cal BC 1815 – cal BC 1608	1	Knippenberg 1999
Norman Estate 1	GrN-20158	3590 ± 50	marine13.14c	cal BC 1659 – cal BC 1413	1	Knippenberg 1999
Norman Estate 1	GrN-20159	3780 ± 40	marine13.14c	cal BC 1886 – cal BC 1650	1	Knippenberg 1999
Norman Estate 2	Beta-224792	2610 ± 40	intcal13.14c	cal BC 893 – cal BC 874 cal BC 846 – cal BC 750 cal BC 683 – cal BC 668 cal BC 637 – cal BC 620 cal BC 616 – cal BC 590	0.014443 0.933915 0.017248 0.010327 0.024068	Bonnissent 2008
Norman Estate 2	Beta-224793	3240 ± 60	marine13.14c	cal BC 1274 – cal BC 926	1	Bonnissent 2008
Pointe du Bluff	Erl-9064	3463 ± 48	marine13.14c	cal BC 1506 – cal BC 1257	1	Bonnissent 2008
Rue Maurasse	Beta-435488	3140 ± 30	marine13.14c	cal BC 1083 – cal BC 873	1	Sellier-Ségard 2016
Salines d'Orient	Erl-9071	3747 ± 50	marine13.14c	cal BC 1875 – cal BC 1600	1	Bonnissent 2008
Salines d'Orient	Erl-9072	3614 ± 48	marine13.14c	cal BC 1684 – cal BC 1434	1	Bonnissent 2008

Sandy Ground 1	Erl-9065	3338 ± 48	marine13.14c		cal BC 1385 – cal BC 1099	1	Bonnissent 2008
Sandy Ground 2	Erl-9066	4203 ± 50	marine13.14c		cal BC 2476 – cal BC 2188	1	Bonnissent 2008
Trou David 1	Erl-9073	3507 ± 48	marine13.14c		cal BC 1574 – cal BC 1310	1	Bonnissent 2008
Trou David 1	Erl-9074	3517 ± 43	intcal13.14c		cal BC 1952 – cal BC 1740 cal BC 1712 – cal BC 1699	0.983891 0.016109	Bonnissent 2008
Trou David 2	Erl-8235	2070 ± 50	intcal13.14c		cal BC 332 – cal BC 331 cal BC 203 – cal AD 32 cal AD 36 – cal AD 51	0.001504 0.983366 0.015130	Bonnissent 2008

			Saba				
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Fort Bay Ridge	Beta-409000	3670 ± 30	marine13.14c	0.6	cal BC 1726 – cal BC 1530	1	Hofman *et al.*, chapter 18
Fort Bay Ridge	Beta-409001	2880 ± 30	marine13.14c	1.3	cal BC 263 – cal BC 34	1	Hofman *et al.*, chapter 18
Fort Bay Ridge	GrA-63874	3005 ± 35	marine13.14c		cal BC 906 – cal BC 762	1	Hofman *et al.*, chapter 18
Fort Bay Ridge	GrA-63875	3620 ± 35	marine13.14c		cal BC 1670 – cal BC 1467	1	Hofman *et al.*, chapter 18
Fort Bay Ridge	GrA-63876	2770 ± 30	marine13.14c		cal BC 702 – cal BC 417	1	Hofman *et al.*, chapter 18
Fort Bay Ridge	GrA-63878	2800 ± 30	marine13.14c		cal BC 733 – cal BC 474	1	Hofman *et al.*, chapter 18
Old Booby Hill cave	Beta-450521	3980 ± 30	marine13.14c	0.8	cal BC 2134 – cal BC 1924	1	Hofman *et al.*, chapter 18
Plum Piece	GrN-27562	3430 ± 30	intcal13.14c		cal BC 1876 – cal BC 1841 cal BC 1820 – cal BC 1797 cal BC 1781 – cal BC 1643	0.104281 0.043536 0.852183	Hofman and Hoogland 2003
Plum Piece	GrN-27563	3300 ± 30	intcal13.14c		cal BC 1643 – cal BC 1504	1	Hofman and Hoogland 2003
Plum Piece	GrN-27564	3320 ± 30	intcal13.14c		cal BC 1683 – cal BC 1526	1	Hofman and Hoogland 2003

			St. Kitts				
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Sugar Factory Pier	UCLA-2111A	4100 ± 60	marine13.14c		cal BC 2396 – cal BC 2018	1	Goodwin 1978
Sugar Factory Pier	UCLA-2111B	2175 ± 60	marine13.14c		cal AD 37 – cal AD 344	1	Goodwin 1978

			Nevis				
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Hitchman Shell Heap	Beta-63256	3110 ± 60	marine13.14c		cal BC 1099 – cal BC 798	1	Wilson 2007

			Barbuda				
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Burton's Field	UCIAMS-107937 (ULA-3252)	2565 ± 20	marine13.14c		cal BC 802 – cal BC 757 cal BC 678 – cal BC 672 cal BC 602 – cal BC 600	0.984865 0.010862 0.004273	Rousseau 2012
Burton's Field	UCIAMS-107938 (ULA-3253)	3430 ± 15	marine13.14c		cal BC 1859 – cal BC 1854 cal BC 1770 – cal BC 1687	0.007491 0.992509	Rousseau 2012
Cattle Field	UCIAMS-107939 (ULA_3254)	3315 ± 15	marine13.14c		cal BC 1634 – cal BC 1595 cal BC 1589 – cal BC 1531	0.410261 0.589739	Rousseau 2012

River Site	GU-23530	3280 ± 35	marine13.14c	4.0	cal BC 1273 – cal BC 1037	1	Friðriksson *et al.* 2011
River Site	GU-23531	2790 ± 35	marine13.14c	3.0	cal BC 729 – cal BC 442	1	Friðriksson *et al.* 2011
River Site	PITT-717	3650 ± 35	marine13.14c		cal BC 1713 – cal BC 1703 cal BC 1700 – cal BC 1498	0.010763 0.989237	Watters 2001
River Site	PITT-731	3825 ± 25	marine13.14c		cal BC 1914 – cal BC 1733	1	Watters 2001

Antigua							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Birgit's	UM-4005	4810 ± 90	marine13.14c		cal BC 3352 – cal BC 2897	1	Nodine 1990
Cloverleaf West	B-23547	2680 ± 80	marine13.14c		cal BC 706 – cal BC 224	1	Nodine 1990
Deep Bay (Salt Pond)	UM-4003	3445 ± 100	marine13.14c		cal BC 1612 – cal BC 1102	1	Nodine 1990
Five Islands	UM-4001	2390 ± 50	marine13.14c		cal BC 198 – cal AD 70	1	Nodine 1990
Hand Point	UM-4002	3390 ± 120	marine13.14c		cal BC 1593 – cal BC 982	1	Nodine 1990
Jolly Beach (Nodine)	N-31930	3630 ± 80	marine13.14c		cal BC 1786 – cal BC 1396	1	Nodine 1990
Jolly Beach	unknown	3775 ± 90	intcal13.14c		cal BC 2466 – cal BC 1971	1	Davis 2000
North Crabb's Bay	Beta-164056	3430 +/- 50	marine13.14c		cal BC 1478 – cal BC 1218	1	de Mille 2005
North Crabb's Bay	Beta-164057	3800 +/- 70	marine13.14c		cal BC 1982 – cal BC 1610	1	de Mille 2005
North Crabb's Bay	Beta-164058	3540 +/- 70	marine13.14c		cal BC 1651 – cal BC 1301	1	de Mille 2005
Parham Road	UM-4004	3140 ± 100	marine13.14c		cal BC 1239 – cal BC 778	1	Nodine 1990
Twenty Hill	B-31931	4660 ± 90	marine13.14c		cal BC 3256 – cal BC 2697	1	Nodine 1990
Twenty Hill	UM-4000	2940 ± 90	marine13.14c		cal BC 973 – cal BC 489	1	Nodine 1990

Monserrat							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Upper Blakes	Beta-451179	4160 ± 30	intcal13.14c	-25.8	cal BC 2878 – cal BC 2832 cal BC 2820 – cal BC 2657 cal BC 2654 – cal BC 2633	0.200300 0.751483 0.048217	Cherry and Ryzewski, chapter 17

Guadeloupe							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Baie du Nord Ouest	Erl-8228	2606 ± 58	marine13.14c		cal BC 491 – cal BC 172	1	Paulet-Locard and Stouvenot 2005
Baie du Nord Ouest	Erl-8229	3258 ± 59	marine13.14c		cal BC 1301 – cal BC 949	1	Paulet-Locard and Stouvenot 2005
Féfé 2	Beta-407285	3110 ± 30	intcal13.14c		cal BC 1437 – cal BC 1288	1	Stouvenot 2017
Morel zéro	Erl-9069	3481 ± 47	marine13.14c		cal BC 1527 – cal BC 1276	1	Paulet-Locard and Stouvenot 2005
Morel zéro	Erl-9070	3493 ± 48	marine13.14c		cal BC 1550 – cal BC 1288	1	Paulet-Locard and Stouvenot 2005
Pointe des Pies	Ly-6423	2830 ± 50	marine13.14c		cal BC 771 – cal BC 468	1	Richard 1994

Marie-Galante							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Cadet 3	Erl-10156	3052 ± 41	intcal13.14c		cal BC 1419 – cal BC 1208 cal BC 1136 – cal BC 1136	0.999188 0.000812	Stouvenot *et al.* 2014
Grotte Morne Rita	Ly-11571	4295 ± 30	intcal13.14c		cal BC 3010 – cal BC 2976 cal BC 2957 – cal BC 2953 cal BC 2942 – cal BC 2878	0.070246 0.004881 0.924872	Fouéré *et al.* 2015

Martinique							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Pointe Figuier	AA-82677	2600 ± 50	intcal13.14c	-29.1	cal BC 894 – cal BC 870 cal BC 850 – cal BC 733 cal BC 689 – cal BC 662 cal BC 649 – cal BC 545	0.021232 0.730307 0.058738 0.189723	Siegel *et al.*, chapter 6

Barbados							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Heywoods	Beta-297521	4230 ± 50	marine13.14c	0.1	cal BC 2527 – cal BC 2218	1	Fitzpatrick 2011
Heywoods	Beta-297522	4360 ± 40	marine13.14c	0.4	cal BC 3277 – cal BC 2944	1	Fitzpatrick 2011
Heywoods	I-16840	3980 ± 100	marine13.14c		cal BC 2320 – cal BC 1750	1	Drewett 2006; Fitzpatrick 2011

Grenada							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Lake Antoine	AA-91728	4860 ± 45	intcal13.14c	-29.2	cal BC 3760 – cal BC 3742 cal BC 3714 – cal BC 3626 cal BC 3597 – cal BC 3526	0.019017 0.767243 0.213740	Siegel *et al.*, chapter 6
Lake Antoine	AA-91729	2030 ± 40	intcal13.14c	-34.2	cal BC 163 – cal BC 129 cal BC 120 – cal AD 57	0.074658 0.925342	Siegel *et al.*, chapter 6
Lake Antoine	AA-91730	8050 ± 50	intcal13.14c	-28.6	cal BC 7141 – cal BC 6797 cal BC 6792 – cal BC 6776	0.988279 0.011721	Siegel *et al.*, chapter 6
Lake Antoine	Beta-377883	7400 ± 40	intcal13.14c	-28.4	cal BC 6394 – cal BC 6212 cal BC 6132 – cal BC 6120	0.990906 0.009094	Siegel *et al.*, chapter 6
Lake Antoine	Beta-377885	1290 ± 30	intcal13.14c	-23.2	cal AD 125 – 1284	1	Siegel *et al.*, chapter 6
Meadow Beach	AA-82678	5270 ± 50	intcal13.14c	-31.1	cal BC 4234 – cal BC 3981	1	Siegel *et al.*, chapter 6
Meadow Beach	AA-84798	2880 ± 40	intcal13.14c	-27.0	cal BC 1206 – cal BC 1206 cal BC 1195 – cal BC 1141 cal BC 1133 – cal BC 968 cal BC 964 – cal BC 931	0.001038 0.103772 0.834214 0.060977	Siegel *et al.*, chapter 6
Meadow Beach	AA-84799	4420 ± 40	intcal13.14c	-30.4	cal BC 3328 – cal BC 3218 cal BC 3177 – cal BC 3159 cal BC 3122 – cal BC 2918	0.202655 0.023933 0.773412	Siegel *et al.*, chapter 6

SOUTHERN ANTILLES and TRINIDAD							
Tobago							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Milford 1	Beta-153151	2760 ± 40	intcal13.14c	-21.3	cal BC 1001 – cal BC 826	1	Steadman and Stokes 2002
Milford 1	Beta-153936	1760 ± 40	intcal13.14c	-24.3	cal AD 141 – cal AD 160 cal AD 165 – cal AD 196 cal AD 209 – cal AD 384	0.031444 0.057749 0.910807	Steadman and Stokes 2002
Milford 1	GrN-14963	4315 ± 45	marine13.14c		cal BC 2621 – cal BC 2346	1	Boomert 1996
Milford 1	GrN-14964	4020 ± 70	marine13.14c		cal BC 2288 – cal BC 1886	1	Boomert 1996
Milford 1	GrN-14965	4875 ± 45	marine13.14c		cal BC 3351 – cal BC 3083	1	Boomert 1996

Trinidad							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Banwari Trace	IVIC-783	5650 ± 100	intcal13.14c		cal BC 4717 – cal BC 4331	1	Harris 1971
Banwari Trace	IVIC-784	2550 ± 100	intcal13.14c		cal BC 893 – cal BC 874 cal BC 849 – cal BC 405	0.013926 0.986074	Harris 1971
Banwari Trace	IVIC-887	6170 ± 90	intcal13.14c		cal BC 5318 – cal BC 4896 cal BC 4866 – cal BC 4851	0.989525 0.010475	Harris 1971
Banwari Trace	IVIC-888	7180 ± 80	intcal13.14c		cal BC 6224 – cal BC 5965 cal BC 5959 – cal BC 5903	0.910548 0.089452	Harris 1971
Banwari Trace	IVIC-889	6780 ± 70	intcal13.14c		cal BC 5832 – cal BC 5828 cal BC 5811 – cal BC 5602 cal BC 5599 – cal BC 5559	0.002953 0.939910 0.057137	Harris 1971
Banwari Trace	IVIC-890	6100 ± 90	intcal13.14c		cal BC 5290 – cal BC 5265 cal BC 5258 – cal BC 5255 cal BC 5230 – cal BC 4795	0.016591 0.002306 0.981102	Harris 1971
Banwari Trace	IVIC-891	6190 ± 100	intcal13.14c		cal BC 5363 – cal BC 4894 cal BC 4887 – cal BC 4885 cal BC 4868 – cal BC 4850	0.988616 0.000929 0.010455	Harris 1971
Ortoire	Y-260-1	2750 ± 130	intcal13.14c		cal BC 1283 – cal BC 728 cal BC 693 – cal BC 657 cal BC 653 – cal BC 542	0.939451 0.014527 0.046022	Rouse *et al.* 1956
Ortoire	Y-260-2	2760 ± 130	intcal13.14c		cal BC 1367 – cal BC 1363 cal BC 1291 – cal BC 734 cal BC 689 – cal BC 662 cal BC 648 – cal BC 546	0.001026 0.951592 0.010436 0.036946	Rouse *et al.* 1956
Ortoire	Y-260-1	2750 ± 130	intcal13.14c		cal BC 1283 – cal BC 728 cal BC 693 – cal BC 657 cal BC 653 – cal BC 542	0.939451 0.014527 0.046022	Rouse *et al.* 1956
Poonah Road	I-6444	2120 ± 135	intcal13.14c		cal BC 452 – cal BC 446 cal BC 430 – cal AD 218	0.001150 0.998850	Harris 1976
St. John	UGa-12303	6890 ± 30	intcal13.14c	-26.7	cal BC 5841 – cal BC 5719	1	Pagán-Jiménez *et al.* 2015
St. John	UGa-12304	6870 ± 25	marine13.14c	-8.1	cal BC 5491 – cal BC 5364	1	Pagán-Jiménez *et al.* 2015
St. John	UGa-12305	6980 ± 30	marine13.14c	-8.6	cal BC 5597 – cal BC 5470	1	Pagán-Jiménez *et al.* 2015
St. John	UGa-12306	6710 ± 25	marine13.14c	-9.3	cal BC 5353 – cal BC 5216	1	Pagán-Jiménez *et al.* 2015
St. John	UGa-12307	6190 ± 25	marine13.14c	-10.9	cal BC 4768 – cal BC 4595	1	Pagán-Jiménez *et al.* 2015
St. John	UGa-12308	6050 ± 25	marine13.14c	-9.2	cal BC 4604 – cal BC 4441	1	Pagán-Jiménez *et al.* 2015
St. John	UGa-13634	5080 ± 30	marine13.14c	-10.9	cal BC 3593 – cal BC 3372	1	Pagán-Jiménez *et al.* 2015
St. John	ARC-1153	6866 ± 48	marine13.14c	-6.68	cal BC 5521 – cal BC 5327	1	Boomert 2000

Margarita							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
El Tirano	Beta-222322	2270 ± 40	intcal13.14c	-12.6	cal BC 402 – 347 cal BC 319 – cal BC 207	0.432582 0.567418	Antczak *et al.*, chapter 10
El Tirano	Beta-350300	3670 ± 30	intcal13.14c	-25.1	cal BC 2138 – cal BC 1958	1	Antczak *et al.*, chapter 10
El Tirano	Beta-352539	2710 ± 30	marine13.14c	0.9	cal BC 909 – cal BC 809	1	Antczak *et al.*, chapter 10
Quebrada de Guacuco	Beta-455264	6450 ± 30	marine13.14c	3.0	cal BC 5103 – cal BC 4889	1	Antczak *et al.* chapter 10

Coche Island							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Güainima site	Beta-455265	3380 ± 30	marine13.14c	0.3	cal BC 1391- cal BC 1254	1	Antczak *et al.*, chapter 10
La Salina	Beta-455263	1240 ± 30	marine13.14c	-1.6	cal AD 1070 – cal AD 1248	1	Antczak *et al.*, chapter 10

Cubagua Island							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
La Aduana	Y-295	3570 ± 130	intcal13.14c		cal BC 2292 – cal BC 1607 cal BC 1579 – cal BC 1563	0.995387 0.004613	Cruxent and Rouse 1958
La Aduana	Y-296g	3050 ± 80	intcal13.14c		cal BC 1494 – cal BC 1478 cal BC 1456 – cal BC 1055	0.011581 0.988419	Cruxent and Rouse 1958
Punta Gorda	Y-497	4150 ± 80	intcal13.14c		cal BC 2901 – cal BC 2564 cal BC 2533 – cal BC 2495	0.960338 0.039662	Rouse and Cruxent 1963

Bonaire							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Gotomeer	GrN-32748	2412 ± 15	marine13.14c		cal BC 169 – cal BC 28	1	Haviser 2015
Gotomeer	GrN-32749	2785 ± 20	marine13.14c		cal BC 714 – cal BC 468	1	Haviser 2015
Gotomeer	GrN-32750	3095 ± 20	marine13.14c		cal BC 992 – cal BC 832	1	Haviser 2015
Gotomeer	GrN-32751	3245 ± 25	marine13.14c		cal BC 1209 – cal BC 1013	1	Haviser 2015
Gotomeer	PITT-260	2160 ± 55	marine13.14c		cal AD 67 – cal AD 351	1	Haviser 2001
Gotomeer	PITT-261	2105 ± 75	marine13.14c		cal AD 84 – cal AD 435	1	Haviser 2001
Lagun	PITT-258	3320 ± 55	marine13.14c		cal BC 1377 – cal BC 1052	1	Haviser 2001
Lagun	PITT-259	3275 ± 80	marine13.14c		cal BC 1374 – cal BC 936	1	Haviser 2001
Slagbaai	GrN-32752	2705 ± 30	marine13.14c		cal BC 560 – cal BC 363	1	Haviser 2015
Slagbaai	GrN-32753	2575 ± 20	marine13.14c		cal BC 370 – cal BC 212	1	Haviser 2015
Slagbaai	GrN-32754	2665 ± 20	marine13.14c		cal BC 481 – cal BC 348	1	Haviser 2015
Slagbaai	GrN-32755	2735 ± 25	marine13.14c		cal BC 623 – cal BC 387	1	Haviser 2015
Slagbaai	GrN-32756	3610 ± 25	marine13.14c		cal BC 1640 – cal BC 1475	1	Haviser 2015
Slagbaai	GrN-32757	2680 ± 25	marine13.14c		cal BC 509 – cal BC 355	1	Haviser 2015
Slagbaai	GrN-32758	3410 ± 20	marine13.14c		cal BC 1405 – cal BC 1257	1	Haviser 2015
Wanapa	PITT-0270	2975 ± 45	marine13.14c		cal BC 904 – cal BC 727	1	Haviser 2001

Curaçao							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Isla Simo	Beta-146812	1140 ± 60	marine13.14c		cal AD 1128 – cal AD 1360 cal AD 1370 – cal AD 1385	0.988477 0.011523	Haviser 2001
Isla Simo	Beta-146813	1160 ± 60	marine13.14c		cal AD 1087 – cal AD 1332	1	Haviser 2001
Paradise Beach	D-AMS-009261	3965 ± 28	marine13.14c	9.8	cal BC 2118 – cal BC 1913	1	Kraan *et al.* 2017
Punta Mangusa	D-AMS-010112	3803 ± 23	marine13.14c	2.6	cal BC 2332 – cal BC 2327 cal BC 2299 – cal BC 2193 cal BC 2177 – cal BC 2143	0.005784 0.886834 0.107382	Kraan *et al.* 2017
Rooi Rincon	IVIC-234	4110 ± 65	intcal13.14c		cal BC 2879 – cal BC 2562 cal BC 2535 – cal BC 2492	0.932933 0.067067	Haviser 2001
Rooi Rincon	IVIC-240	3990 ± 50	intcal13.14c		cal BC 2832 – cal BC 2820 cal BC 2658 – cal BC 2653 cal BC 2633 – cal BC 2342	0.008927 0.002803 0.988270	Haviser 2001
Rooi Rincon	IVIC-242	4070 ± 65	intcal13.14c		cal BC 2871 – cal BC 2801 cal BC 2780 – cal BC 2471	0.165448 0.834552	Haviser 2001
Rooi Rincon	IVIC-246	4160 ± 80	intcal13.14c		cal BC 2906 – cal BC 2565 cal BC 2531 – cal BC 2529 cal BC 2525 – cal BC 2496	0.969709 0.002049 0.028242	Haviser 2001
Rooi Rincon	IVIC-247	4490 ± 60	intcal13.14c		cal BC 3364 – cal BC 3010 cal BC 2978 – cal BC 2962 cal BC 2951 – cal BC 2942	0.982184 0.011621 0.006196	Haviser 2001

Savonet Painting	PITT-1185	3355 ± 25	intcal13.14c	cal BC 1738 – cal BC 1714 cal BC 1695 – cal BC 1607 cal BC 1582 – cal BC 1559	0.056875 0.903011 0.040114	Haviser 1993
Seru Boca	GrN-32015	4570 ± 35	marine13.14c	cal BC 2908 – cal BC 2703	1	Hoogland and Hofman 2011
Seru Coral/ Zuurzak	PITT-9999.1	3290 ± 35	marine13.14c	cal BC 1286 – cal BC 1046	1	Haviser 2001
Seru Coral/ Zuurzak	PITT-9999.2	2045 ± 30	marine13.14c	cal AD 251 – cal AD 422	1	Haviser 2001
Spaanse Water	GrN-31915	4415 ± 20	marine13.14c	cal BC 2741 – cal BC 2540	1	Hoogland and Hofman 2011
Spaanse Water	GrN-31916	4400 ± 20	marine13.14c	cal BC 2694 – cal BC 2492	1	Hoogland and Hofman 2011
Spaanse Water	GrN-31917	4435 ± 15	marine13.14c	cal BC 2751 – cal BC 2563	1	Hoogland and Hofman 2011
Spaanse Water	GrN-31918	3195 ± 20	marine13.14c	cal BC 1143 – cal BC 952	1	Hoogland and Hofman 2011
Spaanse Water	GrN-31919	1915 ± 20	marine13.14c	cal AD 421 – cal AD 562	1	Hoogland and Hofman 2011
Spaanse Water	GrN-31921	2680 ± 20	marine13.14c	cal BC 500 – cal BC 359	1	Hoogland and Hofman 2011
Spaanse Water	GrN-31922	2625 ± 20	marine13.14c	cal BC 422 – cal BC 297 cal BC 266 – cal BC 257	0.993082 0.006918	Hoogland and Hofman 2011
Spaanse Water	GrN-31923	2450 ± 15	marine13.14c	cal BC 748 – cal BC 685 cal BC 666 – cal BC 641 cal BC 588 – cal BC 579 cal BC 562 – cal BC 415	0.383462 0.121643 0.011772 0.483124	Hoogland and Hofman 2011
Spaanse Water	GrN-31924	2005 ± 15	marine13.14c	cal AD 314 – cal AD 443	1	Hoogland and Hofman 2011
Spaanse Water	GrN-31925	2255 ± 20	marine13.14c	cal AD 16 – cal AD 157	1	Hoogland and Hofman 2011
Spaanse Water	GrN-32018	4455 ± 20	marine13.14c	cal BC 2822 – cal BC 2796 cal BC 2786 – cal BC 2586	0.051546 0.948454	Hoogland and Hofman 2011
Spaanse Water	PITT-xxx	2965 ± 40	marine13.14c	cal BC 887 – cal BC 728	1	Haviser 2001
Spaanse Water	PITT-xxx	2180 ± 55	marine13.14c	cal AD 43 – cal AD 331	1	Haviser 2001
Spaanse Water	PITT-xxx	1965 ± 35	marine13.14c	cal AD 336 – cal AD 546	1	Haviser 2001
St. Joris 1	Beta-146814	4340 ± 70	marine13.14c	cal BC 2756 – cal BC 2312	1	Haviser 2001
St. Joris 1	Beta-146815	4450 ± 70	marine13.14c	cal BC 2858 – cal BC 2489	1	Haviser 2001
St. Michielsberg	DIC-xxx	3820 ± 65	marine13.14c	cal BC 2001 – cal BC 1646	1	Haviser 2001
St. Michielsberg	DIC-xxx	3790 ± 50	marine13.14c	cal BC 1919 – cal BC 1641	1	Haviser 2001
St. Michielsberg	GrN-9994	3820 ± 70	marine13.14c	cal BC 2009 – cal BC 1633	1	Haviser 2001
Tomasitu Cave	Beta-146806	3080 ± 70	marine13.14c	cal BC 1089 – cal BC 773	1	Haviser 2001
Tomasitu Cave	Beta-146807	3060 ± 70	marine13.14c	cal BC 1064 – cal BC 758	1	Haviser 2001
Tomasitu Cave	Beta-146808	4030 ± 70	marine13.14c	cal BC 2305 – cal BC 1896	1	Haviser 2001
Tomasitu Cave	Beta-146809	2970 ± 70	marine13.14c	cal BC 969 – cal BC 595	1	Haviser 2001
Veeris	Beta-146810	4170 ± 65	marine13.14c	cal BC 2475 – cal BC 2110	1	Haviser 2001
Veeris	Beta-146811	4180 ± 70	marine13.14c	cal BC 2518 – cal BC 2514 cal BC 2500 – cal BC 2107	0.002101 0.997899	Haviser 2001

Aruba							
Site	**Laboratory code**	**Radiocarbon Age (BP)**	**Calibration Data Set**	**δ13C Value (‰)**	**Two sigma Range**	**Relative area**	**Reference**
Arashi midden	Beta-450522	2580 ± 30	marine13.14c	4.0	cal BC 380 – cal BC 204	1	Kelly and Hofman, chapter 11
Boca Urirama	GrN-32759	1385 ± 35	intcal13.14c		cal AD 596 – cal AD 685	1	Kelly and Hofman, chapter 11
Bringamosa 5	Beta-450528	3480 ± 30	marine13.14c	-3.2	cal BC 1494 – cal BC 1316	1	Kelly and Hofman, chapter 11
Canashito	Ua-1501	2210 ± 95	intcal13.14c	-11.91	cal BC 477 – cal BC 443 cal BC 432 – cal AD 2	0.012190 0.987810	Klinken 1991
Ser'i Noka	GrN-7341	3300 ± 35	intcal13.14c		cal BC 1302 – cal BC 1057	1	Versteeg *et al.* 1990
Daimari 1	GrN-32760	1430 ± 35	intcal13.14c		cal AD 568 – cal AD 659	1	Kelly and Hofman, chapter 11
Guadirikiri 2	Beta-450527	1760 ± 30	marine13.14c	3.0	cal AD 576 – cal AD 699	1	Kelly and Hofman, chapter 11
Malmok	GrN-16833	2175 ± 85	marine13.14c		cal BC 16 – cal AD 396	1	Versteeg 1991
Malmok	GrN-16834	2070 ± 80	marine13.14c	1.49	cal AD 100 – cal AD 492 cal AD 498 – cal AD 502	0.998339 0.001661	Klinken 1991
Malmok	GrN-16836	2430 ± 150	marine13.14c	2.06	cal BC 500 – cal AD 252	1	Klinken 1991
Malmok	GrN-16837	2210 ± 90	marine13.14c	1.53	cal BC 79 – cal AD 371	1	Klinken 1991
Malmok	GrN-16838	2370 ± 140	marine13.14c	1.15	cal BC 386 – cal AD 283	1	Klinken 1991
Malmok	GrN-17779	2160 ± 40	marine13.14c	2.52	cal AD 91 – cal AD 320	1	Klinken 1991
Malmok	GrN-17780	2120 ± 50	marine13.14c	2.38	Cal AD 121 – cal AD 388	1	Klinken 1991
Malmok	Ua-1340	1520 ± 110	intcal13.14c	-12.47	cal AD 255 – cal AD 300 cal AD 317 – cal AD 689 cal AD 752 – cal AD 759	0.024248 0.972423 0.003329	Klinken 1991
Malmok	Ua-1341	1740 ± 110	intcal13.14c	-10.47	cal AD 55 – cal AD 546	1	Klinken 1991
Malmok	Ua-1342	1520 ± 100	intcal13.14c	-10.35	cal AD 262 – cal AD 277 cal AD 328 – cal AD 679	0.007589 0.992411	Klinken 1991
Malmok	Ua-1514	1420 ± 150	intcal13.14c	-9.69	cal AD 263 – cal AD 275 cal AD 329 – cal AD 904 cal AD 917 – cal AD 966	0.004632 0.973366 0.022002	Klinken 1991
Seru Colorado 3	Beta-450529	1930 ± 30	intcal13.14c	-10.0	cal AD 4 – cal AD 130	1	Kelly and Hofman, chapter 11
Spaans Lagoen 3	Beta-450523	3440 ± 30	marine13.14c	-0.5	cal BC 1448 – cal BC 1266	1	Kelly and Hofman, chapter 11
Spaans Lagoen 4	Beta-450524	1630 ± 30	marine13.14c	0.1	cal AD 679 – cal AD 835	1	Kelly and Hofman, chapter 11
Spaans Lagoen 5	Beta-450525	2000 ± 30	marine13.14c	2.1	cal AD 278 – cal AD 468	1	Kelly and Hofman, chapter 11
Spaans Lagoen 6	Beta-446966	1440 ± 30	intcal13.14c	-8.7	cal AD 568 – cal AD 654	1	Kelly and Hofman, chapter 11
Spaans Lagoen 6	Beta-450526	3450 ± 30	marine13.14c	0.9	cal BC 1463 – cal BC 1278	1	Kelly and Hofman, chapter 11

Early Settlers of the
INSULAR CARIBBEAN

Early Settlers of the Insular Caribbean: Dearchaizing the Archaic offers a comprehensive coverage of the most recent advances in interdisciplinary research on the early human settling of the Caribbean islands. It covers the time span of the so-called Archaic Age and focuses on the Middle to Late Holocene period which – depending on specific case studies discussed in this volume – could range between 6000 BC and AD 1000. A similar approach to the early settlers of the Caribbean islands has never been published in one volume, impeding the realization of a holistic view on indigenous peoples' settling, subsistence, movements, and interactions in this vast and naturally diversified macroregion.

Delivered by a panel of international experts, this book provides recent and new data in the fields of archaeology, collection studies, palaeobotany, geomorphology, paleoclimate and bioarchaeology that challenge currently existing perspectives on early human settlement patterns, subsistence strategies, migration routes and mobility and exchange. This publication compiles new approaches to 'old' data and museum collections, presents the results of starch grain analysis, paleocoring, seascape modelling, and network analysis. Moreover, it features newer published data from the islands such as Margarita and Aruba. All the above-mentioned data compiled in one volume fills the gap in scholarly literature, transforms some of the interpretations in vogue and enables the integration of the first settlers of the insular Caribbean into the larger Pan-American perspective.

This book not only provides scholars and students with compelling new and interdisciplinary perspectives on the Early Settlers of the Insular Caribbean. It is also of interest to unspecialized readers as it discusses subjects related to archaeology, anthropology, and – broadly speaking – to the intersections between humanities and social and environmental sciences, which are of great interest to the present-day general public.

NEXUS 1492
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Sidestone Press
ISBN: 978-90-8890-780-7
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