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CHAPTER

Highlights in the Pre-Contact Archaeology of the Island Caribbean

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Abstract

The Caribbean islands were the first—and perhaps only—archipelago in the Americas to be settled by Indigenous peoples who went to sea without a guarantee of island inter-visibility. Using dugout canoes and taking advantage of prevailing winds and currents, both major and minor population movements left the South American littoral zone (and perhaps other source regions) in different stages between about 6000 and 1500 years ago. Indigenous groups first settled islands that were closest to the mainland, ultimately reaching the various Greater and Lesser Antilles over a period of some 5000–6000 years. An increasing amount of archaeological research in recent decades, coupled with advances in various analytical techniques, has helped to significantly enhance the understanding of Indigenous origins and cultural lifeways in the Caribbean. This chapter focuses on several areas of research that have led to a better understanding of the origins, environmental interactions, resource use, diet, and mobility of those who first settled these islands and their later descendants: (1) how pottery, as the most ubiquitous artifact type, has played a prominent but disproportionate role in developing cultural chronologies; (2) the role of zooarchaeology—long an important avenue for examining subsistence and anthropogenic impacts on animals—in establishing the antiquity and refining the understanding of non-native animal introductions in the Caribbean; and (3) isotopic analysis, which has been useful for analyzing mobility, nutrition, diet, and health in the insular Caribbean and saw some of its first applications in the region during the method's earliest development.

Keywords: ceramic typology, animal introduction, isotopic analysis, West Indies, Antilles

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Introduction

With one possible exception (see Fitzpatrick 2013b; Hamley et al. 2021; Torres and Rodríguez Ramos 2008; Zangrando and Borrero 2024), the Antilles chain of islands in the Caribbean is the only place in the Americas where peoples used watercraft to reach land they could not see. Compared to many other island regions around the world, the Caribbean has had a relatively long history of archaeological research stretching back to the early days of antiquarianism in the 1800s. The Caribbean's tumultuous and complicated European colonial history, which helped to spur interest in native island populations, has at the same time lent itself to different traditions of how archaeology and cultural resource preservation are done and created an incomplete patchwork of knowledge of the region's first inhabitants. In this chapter, we highlight several areas of research that have been pivotal to our understanding of the region's pre-contact history. We first provide a brief background of the Caribbean's environment, followed by its general cultural historical framework. We then discuss three different analytical realms—ceramics, zooarchaeology, and isotopic analysis—that we believe help contextualize archaeology in the region and how the Caribbean has contributed to broader issues in island and coastal archaeology.

Environmental Background

The Caribbean, one of the world's largest seas, is situated within the Neotropics and stretches from the eastern margins of Central America and Mexico's Yucatán Peninsula along the northern littoral of South America (Figure 1). The region is bordered to the north and east by the Antillean chain, which is part of an island arc system resulting from subduction of the North American Plate beneath the eastern edge of the Caribbean Plate. The largest islands of Cuba, Hispaniola, Jamaica, and Puerto Rico form the Greater Antilles and represent about 90% of the total land area. The Lesser Antilles include more than a dozen major islands, with numerous smaller ones scattered in a north–south configuration east of Puerto Rico and south to Trinidad. These are often divided around Dominica into the Leeward (northern) and Windward (southern) islands due to the persistent trade winds that occur differentially. Beyond these two major chains, other island groups include those fringing the coast of South America (e.g., Aruba, Bonaire, Curaçao, Margarita, and the Los Roques islands) and the Cayman Islands, which lie between Jamaica and Cuba. The Bahamian archipelago, which is technically not in the Caribbean Sea, is still connected culturally and biogeographically to the region in deep time.

Figure 1. Map of the Caribbean showing proposed migration routes for both the Archaic and Ceramic Ages (Saladoid and Ostionoid). Island divisions showing the timing of colonization for different islands reflect the earliest acceptable radiocarbon dates based on chronologies developed by Napolitano et al. (2019) and Rodriguez Ramos et al. (2023) whereas the divisions for the timing of major migrations show patterns of population movement that in some cases included islands that had already previously been occupied (e.g., Ostionoid ceramic-making peoples into Hispaniola and Cuba). For Saladoid (green), SS = stepping-stone hypothesis; SRH = southern route hypothesis. Map produced by Scott M. Fitzpatrick.

Geologically, the Caribbean is complex, ranging from uplifted limestone (e.g., Cayman Islands, Barbados), volcanic rock (e.g., Saba), and mixed lithologies (e.g., the Greater Antilles) to surface projections of fossil coral and limestone (e.g., Bahamas, Curaçao). This diversity in geological origin resulted in large differences in the presence of rock types suitable for the manufacture of stone tools on the different islands and created conditions that fostered environmental differences among and between the islands. The Lesser Antillean Arc is volcanically active owing to the island chain's formation within a major subduction zone. The climate is generally stable, with relatively minor seasonal variations in rainfall and temperature, ranging between the mid-20s to 30s ºC (high-70s to low-90s ºF). Heat and humidity are usually higher in the summer months, with rainfall increasing in the summer and fall. The tropical environment and the separation of islands from the different surrounding mainlands have created a bioregion that is distinct with a variety of endemic terrestrial and marine flora and fauna. This has led conservationists to designate the Caribbean Islands as one of the world's thirty-five biodiversity hotspots that cover almost four million km^2 of land and ocean (see Hrdina and Romportl 2017). The region's rich biodiversity was likely a powerful attractor for new migrants in the past, as it continues to be in the present.

Culture History

The Orinoco River and its tributaries—particularly the Delta Amacuro, which drains into the Gulf of Paria south of Trinidad, and the Lower Orinoco, that flows farther eastward into the Atlantic—are thought to be the cultural birthplace for Indigenous peoples who first settled the Caribbean. These mariners seemed to have largely, if not exclusively, ventured out from northern South America (eastern Colombia, Venezuela, and Guyana), where for centuries they honed their skills building dugout canoes, navigating the coastlines, fishing and hunting, and observing the winds, currents, and birds. Given the extent of the river's drainage system, which fans out between the Amacuro and Lower Orinoco and stretches for more than 400 km, it is not surprising that the river's name literally means "a place to paddle" in the local Warao language. Below, we review the two major phases of settlement—the Archaic Age and the Ceramic Age—which represent separate but related occupations of the Caribbean islands.

The Archaic Age

Lasting some four millennia, the earliest archaeologically defined phases of Caribbean island occupation, generally termed "Archaic," are among the least understood due to the paucity of research devoted to their characterization and the comparatively sparse, degraded nature of sites and artifacts from these first waves of occupation (see Hofman and Antczak 2019). A dizzying variety of typological schemes and names, some autochthonous and others borrowed from taxonomies in other world regions, have been assigned to the cultural manifestations of the islands' early inhabitants, making the task of assemblage comparisons within and among islands extremely difficult. Terms including "Paleo-Indian," "Meso-Indian," "Lithic," "Archaic," "Neolithic," "Casimiroid," "Ortoiroid," "Guanahatabey," and "Ciboney," to name but a few used by English-speaking archaeologists alone, make the already difficult task of elucidating regional similarities and differences in early lifeways especially challenging. A further complication for such studies is contemporary geopolitics, which have limited collaborative investigations and the dissemination of research across national borders (e.g., Cuba, Haiti). Despite these difficulties, a great deal of innovative research on the Caribbean's earliest peoples has been conducted since the 1990s. This research has prompted significant revision of long-held assumptions about these first inhabitants, notably demonstrating (1) the diversity of cultural manifestations that were present from the beginning of the islands' occupation and (2) the greater cultural complexity of at least some of the islands' earliest inhabitants.

The Caribbean was first settled during the Archaic Age in a series of multiple major, and likely many smaller, population movements that originated from different parts of South, and possibly Central, America (Yucatán and Belize) (Fitzpatrick 2015; Fitzpatrick, Napolitano, and Stone 2021; Hofman and Antczak 2019). The earliest Archaic sites are found on Trinidad and date to ca. 8400–7300 cal. BP (Giovas and Fitzpatrick 2014; Napolitano et al. 2019; Rodríguez Ramos, Rodríguez López, and Pestle 2023; Tankersley et al. 2018). During this period, Trinidad was separated by a small water gap or may have still been connected to the South American mainland. At least a millennium passed, however, before the first islands requiring significant overwater travel were settled by Indigenous peoples. This initial dispersal into the Caribbean appears to have occurred across a number of mostly larger islands, including Puerto Rico, Cuba, Hispaniola, St. Martin, Curaçao, and Barbados, ca. 6500–4500 cal. BP. Interestingly, the majority of these early dates are found in the more northerly islands of the archipelago, notably the Greater Antilles (see Napolitano et al. 2019; Rodríguez Ramos, Rodríguez López, and Pestle 2023; for an exception regarding Curaçao, see Kraan et al. 2024).

Based on recently conducted Bayesian analysis of available radiocarbon assays from across the archipelago, the modeled timing of arrival of the first Archaic groups to the oceanic islands of the Caribbean appears to fall between ca. 6250 and 2500 cal. BP (Fitzpatrick 2006, 2011; Kraan et al. 2024; Napolitano et al. 2019; Rodríguez Ramos, Rodríguez López, and Pestle 2023). Puerto Rico, Barbados, Curaçao, Cuba, and St. Martin are the only

islands that have modeled date ranges for first settlement that extend earlier than 5000 cal. BP; Hispaniola, Vieques, Bonaire, Aruba, and Guadeloupe were first reached by as early as 5000–3750 cal. BP, with Barbuda, Antigua, St. Thomas, Montserrat, and Tobago settled in the period beginning 3750–2500 cal. BP. The spatial distribution of the earliest modeled dates for human arrival on the various islands seems to support a colonization strategy that generally focused on the largest islands first (i.e., the Greater Antilles) or those closest to the South American mainland (i.e., Trinidad or Curaçao) (also see Giovas and Fitzpatrick 2014). Archaic Age sites are relatively rare in the southern (Windward) islands between Guadeloupe and Trinidad (Fitzpatrick and De Waal 2019, 72) and usually quite ephemeral, making them more difficult to discover (Hofman and Antczak 2019). These characteristics have to do with the nature of Archaic sites themselves, which often, but not always, lack ceramics, represent temporary use, and are covered by later deposits and sediments or are in areas now submerged.[1]

The biological origins of the Caribbean's first inhabitants are a matter of ongoing debate. Two recent genetic/genomic studies arrived at disparate conclusions regarding the number of early migratory waves and their place(s) of origin, although the limited number of samples dating to this earliest period and their biased geographic distribution could explain the divergent outcomes of the studies and potentially limit their applicability to the region more broadly. Nägele et al. (2020) analyzed fifty-two "Archaic" individuals, all from sites in Cuba, and identified two early migratory waves, one that preceded the diversification of early Americans into genetically distinct Central and South American populations and another originating in South America. In contrast, Fernandes and colleagues (2021), who analyzed fifty Cuban individuals and one from the Dominican Republic, identified only one source region (from either Central or northern South America) for these early inhabitants of the Greater Antilles. Seafaring simulations (Callaghan 1999, 2001, 2003) suggest that northwestern South America is a more likely source area for the first islanders and that ocean currents would have made canoe travel between, for instance, Cuba and the Caribbean coast of Mesoamerica a more perilous undertaking (see also Fitzpatrick 2013b).

Composed principally of lithic implements and debitage, the material culture of the Greater and Lesser Antilles' first inhabitants provides similarly muddled, sometimes conflicting clues as to settler origin(s) and subsequent interaction among islands and with later-arriving "Ceramic-Age" peoples. This muddied picture is likely due to multiple waves of "first" occupations flowing into the various islands of the archipelago from the surrounding continents, a conclusion supported by the archaeological diversity of early assemblages across the islands. While lithic blade traditions from Cuba, Hispaniola, and portions of Puerto Rico share similarities with some industries in eastern Mesoamerica (Wilson 2007; Wilson, Iceland, and Hester 1998), ground stone complexes (some with high quantities of shell tools) in the northern Lesser Antilles and eastern Puerto Rico have affinities to assemblages from both Trinidad/Tobago and farther south into lowland South America and/or to the Isthmo-Colombian region, from Panama to Venezuela (Rodríguez Ramos, Pagán-Jiménez, and Hofman 2013). To add to this confusion, while ground stone tools typically are absent from the earliest assemblages of the western Greater Antilles, the converse is not true as the manufacture and use of flaked stone technology continue side by side with ground stone implements in many assemblages across the islands (Keegan and Hofman 2017). As noted above, the paucity of investigation, adverse impacts of formation processes, limited chronological control in many excavations, and chaotic/inconsistent systems for naming/describing assemblages all combine to make it difficult to determine whether observed material culture diversity results from multiple origins, varying lithic traditions, distinct site types, or diachronic change in lithic toolkits.

While it was once thought that Archaic groups were small-scale, nomadic marine foragers lacking ceramics, research since the turn of the twenty-first century suggests that they were cultivating numerous plants, seasonally exploiting terrestrial resources such as land crabs and birds, exchanging or moving lithic resources around and between islands, and possibly producing pottery (e.g., C. L. Hofman, Rodríguez Ramos, and Jiménez 2018; Keegan 2006; Pagán-Jiménez et al. 2015; Rodríguez Ramos et al. 2008). Regardless of the challenges to reconstructing early lifeways, it is clear that long-held depictions of the islands' first inhabitants as uniformly

itinerant, pre-ceramic foragers understate their diversity and complexity. Long-used cemetery sites in Cuba and Puerto Rico attest to limited residential mobility and possible territoriality among the islands' early residents (Chinique de Armas et al. 2020; Pestle, Perez, and Koski-Karell 2023). Not infrequent evidence of ceramics from early sites in Cuba, Hispaniola, and Puerto Rico (Rodríguez Ramos et al. 2008), which form the so-called Pre-Arawak Pottery Horizon, calls into question whether some/many early aceramic sites lack pottery not because it was an unknown technology but because pottery was not required for the tasks undertaken there. Finally, the study of microbotanical remains has identified the presence of translocated domesticates in sites on Cuba, Puerto Rico, and the Lesser Antilles (Pagán-Jiménez et al. 2005; Pagán-Jiménez 2009, 2013), which, along with evidence of landscape modification through burning (Burney, Pigott Burney, and MacPhee 1994; Siegel et al. 2005, 2015), indicates that food production formed at least part of the subsistence base from early on in occupational histories.

The Ceramic Age

The second major colonization wave in the Caribbean occurred around 2500 BP when migrants originating from the Orinoco River basin in Venezuela appeared in Puerto Rico and islands throughout the Lesser Antilles. This harkens the Ceramic Age, which lasts until ca. 500 BP and is divided into early (ca. 2500–1300 BP) and late (ca. 1300–500 BP) periods. Early Ceramic Age (ECA) peoples were horticulturalists who introduced to the islands domesticated and non-native plants and animals; produced large quantities of well-made, intricately designed pottery (traditionally labeled "Saladoid"); and intensively harvested marine resources (Keegan and Hofman 2017; LeFebvre and deFrance 2018; Pagán-Jiménez and Mickleburgh 2022; Pestle and Laffoon 2018; Reid 2018). The exact routes of dispersal are still debated (e.g., see Fitzpatrick 2013a; Siegel 2018), and for reasons that are still unknown, these groups initially migrated no farther west than Puerto Rico but may have had contact with far eastern Hispaniola. Settlement of Puerto Rico is characterized by a ca. 1000-year "long pause" before subsequent ceramic traditions disperse westward (Hispaniola and Cuba) and northward (Bahamas). These later groups then ultimately expanded across all the major Lesser Antillean islands, establishing small villages along mostly coastal zones to secure easy access to a broad range of marine and terrestrial resources. Not unlike the chronological pattern that occurred in the Archaic, the earliest Saladoid sites are also found in the northern Caribbean. This suggests that peoples may have found it easier to travel directly across the sea to the northern islands first, with a back-migration toward the South American mainland, a phenomenon termed the "southward route hypothesis" (see Callaghan 2001; Fitzpatrick 2006, 2013a; Giovas and Fitzpatrick 2014).

The material culture in these villages has been characterized as "simple and available to everyone" (Keegan 2000, 143). Stone and shell were used for the manufacture of tools, such as axes and adzes, ornaments (including pendants and beads) that were often made of exotic lithics, and objects related to ceremonial use in the form of three-pointer idols known as *zemis*/*cemis* (Oliver 2009). Coral was often used for ad hoc tools such as grinding implements for debarking wood, grinding coloring pigments and clays, and sharpening shell tools. Artifacts were also made from wood, calabash (bottle gourds), and basketry (see below); but preservation conditions in Caribbean archaeological sites rarely allow for the survival of easily perishable organic materials. Most abundant in ECA sites is pottery, often in the form of well-fired vessels with decoration consisting of intricately painted and incised designs and the application of anthropomorphic and zoomorphic adornos. ECA pottery traditions are typically stylistically homogenous, although small local variations existed (Keegan and Hofman 2017).

The Late Ceramic Age (LCA) is characterized by the diversification of pottery traditions into myriad types between about 1300 and 500 cal. BP, including the major traditions of Troumassoid, found in the southern and many of the northern Lesser Antilles; Suazoid, a more limited and later occurrence in the Windward Islands; Ostionoid, Meillacoid, and Chicoid, found in the Greater Antilles; and Palmetto Ware known from the Bahamas. This scheme is simplified and essentialized, with each tradition in fact exhibiting varying, often quite localized,

pottery styles whose boundaries were neither solid nor static across space and time due to mobility, interaction, and exchange among the Caribbean islands, with South America and possibly Mesoamerica (e.g., De Waal 2006; Harlow et al. 2019; C. L. Hofman and Hoogland 2004; Keegan and Hofman 2017). While it is beyond the scope of this chapter to examine each of these pottery styles and series in detail, readers are referred to Keegan and Hofman (2017) and Petersen, Hofman, and Curet (2004) for additional reviews of the subject.

While it might be expected that late pre-contact ceramics would exhibit higher technological and aesthetic quality than earlier pottery complexes, archaeologists have instead noted that pottery significantly decreases in quality over time in the Lesser Antilles, particularly the Windward Islands (e.g., De Waal 2006; Descantes, Speakman, and Glascock 2008, 9; C. L. Hofman 1993; Rouse 1992). Saladoid pottery from the ECA is generally thin-walled, well-fired, and often finely decorated (Figure 2). LCA pottery styles, such as those traditionally labeled "Troumassoid" and "Suazoid," are thicker, coarser, and generally softer ceramics that are rarely decorated (Rouse 1992) (Figure 3). Archaeologists have attributed this relatively abrupt change to the arrival of new groups (e.g., Bullen and Bullen 1976, 7–8; McKusick 1960), but others see these later pottery styles as local developments (see C. L. Hofman 1993 for an overview) or a reflection of shifting investment in specialized production away from ceramics toward perishable media such as wood and textiles. This decreased investment in the technological and aesthetic attributes of ceramic wares continued until the end of the pre-contact period, although at a few very late sites, a different type of pottery emerged, representing a return to higher technological standards. For example, pottery from the late LCA (based on one sample dating to cal. AD 1440–1460) found at two sites on La Désirade (Guadeloupe) is characterized by thin-walled, well-fired wares, with fine and precise decorations, and adornos indicative of influences from the Venezuelan mainland (De Waal 2006; C. L. Hofman 1995; C. L. Hofman et al. 2004).

Figure 2. Selection of both ECA and LCA pottery from the both the Greater and Lesser Antilles. a-e: Saladoid pottery from Puerto Rico (photos by Jose Oliver). f: spindle whorl; g-h: adornos, all from Barbados (photos by Alistair Bright)

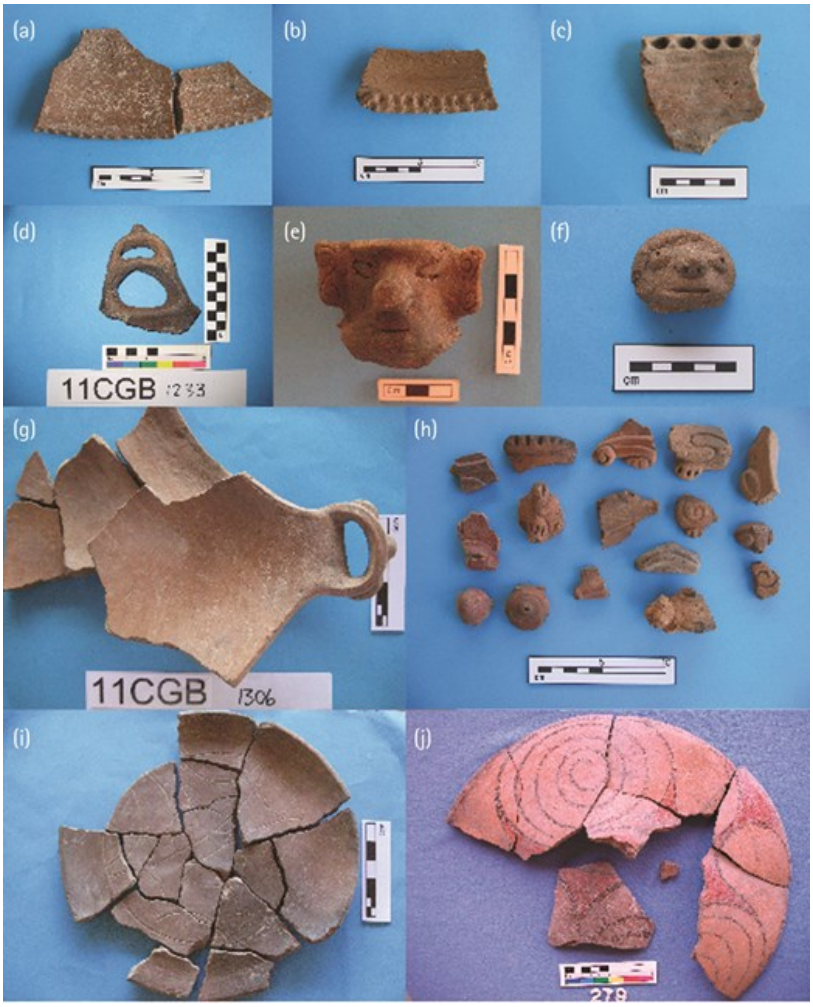

Figure 3. Selection of late ECA and LCA pottery from the Grand Bay site on Carriacou. a-c: finger impressed decoration from the LCA; d: ornate looped handle; e-f: human face adornos; g: partially reconstructed plate with looped handle; h: assortment of punctate and incised decoration; i: nearly complete plate with fine line incision; partially reconstructed bowl with curvilineal slipped decoration on the exterior (all photos taken by Quetta Kaye).

While it is difficult to examine all the complexities and nuances of Caribbean culture history in a single chapter, below we review some of the major topics that hold relevance for the region generally and those that have changed the scope of our understanding since the mid-1990s. We begin with an overview of why ceramics have played a pivotal role in developing cultural chronologies and then discuss the role that zooarchaeology has played in our understanding of animal domestication and introductions across time and space. We end with a short review of isotopic analysis, which has revolutionized our understanding of ancient health, diet, nutrition, and mobility.

Ceramics and Cultural Chronologies

A noteworthy aspect of the pre-contact archaeology of the insular Caribbean is the ubiquity of ceramics in many site assemblages. This phenomenon results from several factors. First, ceramics are usually quite durable and preserve well in the archaeological record, with well-fired pottery almost as imperishable as stone. Second, most of the known pre-contact sites date to the Ceramic Age as many more islands were settled by larger groups of people and populations began to grow and expand.

Another reason many pre-contact sites in the Caribbean yield large numbers of ceramic artifacts is that Caribbean archaeologists have traditionally focused on the investigation of larger settlement sites with long occupation histories, resulting in thick layers of (highly visible and recognizable) settlement refuse (De Waal 2006, 36; 2019, 107). Although many household items were made of perishable materials that rarely survive (such as calabash, wood, and basketry; see Drewett 2007, 49; Drewett and Bennell 2000, 47; Petersen, Watters, and Nicholson 1999), the inhabitants of these villages also produced large amounts of ceramics for utilitarian use, including pots for storage and cooking, griddles, plates (Figure 3i), pot-stands, and objects like spindle whorls (Figure 2f) for making textiles. They also made pottery for or with ornamentation (Figure 2a–e) or special occasions, for example, adornos (Figures 2g, h; 3e, f), body stamps, figurines, effigy bowls, bowls to cover burials, snuff inhaling bowls, and vessels for ritual depositions. The abundance of ceramics in pre-contact site assemblages led Irving Rouse (1977, 5), one of the earliest professional Caribbean archaeologists, to state that ceramics make up no less than 90% of the artifacts recovered from Caribbean pre-contact sites, thereby encouraging archaeologists to emphasize analysis of this material category. While percentages differ between sites, they reflect the general (and relative, when compared to other material categories present) abundance of pottery in early Caribbean archaeological assemblages. This abundance, together with the typical and distinctive stylistic and morphological traits of pottery, ultimately led Rouse and other archaeologists who followed to develop cultural chronologies for different parts of the Caribbean.

A central aspect in these cultural chronologies is the concept of "style," which assumes people within a group use objects with an identifying style, consisting of diagnostic shapes, decorations, appendages, and applications, and that cultural and chronological developments lead to recognizable variations of these aspects (cf. Sanz and Fiore 2014). Rouse, having a background in botany, had developed a keen interest in classification and taxonomy during his studies, an interest that is evident in the way he perceived, analyzed, and structured archaeological assemblages. Applying a derivation of the Midwestern Taxonomic System used in the Great Plains of the United States to classify and group sites and artifactual assemblages such as projectile points, Rouse implemented a phylogenetic approach by naming styles after what he considered to be the type-sites, where a particular kind of pottery was first identified and described. In his cultural–chronological frameworks, a series of styles can be recognized by the suffix "-oid" and subseries within these styles, or local variations, by the suffix "-an" (Rouse 1964, 503; Vescelius 1980, 39). For example, the well-known Saladoid series was first identified at the Saladero site in Venezuela, while the Ostoinoid series is named after the Ostiones site in Puerto Rico.

In addition, the opportunities for, and significance of, building regional cultural chronologies based on pottery analysis may have favored the study of Ceramic Age sites, which in turn have influenced the way we perceive the Archaic Age, typically described as "pre-ceramic" or "aceramic" (Antczak and Hofman 2019, 30, 33–34; Keegan and Hofman 2017, 43–47). Also problematic is the use of identified styles not only as the archaeological constructs they are but as actual names for pre-contact groups, such as the Saladoids or the Ostionoids (e.g., Reid 2009, 68). This neglects that communities likely had their own group-specific names and identifications, which unfortunately have been lost over time. Related to this, and emphasizing the significance of injudicious group labeling, is the fact that the focus on pottery decorations to construct different series of cultural–historical changes may have blurred the underlying social and political interactive processes on both regional and local scales (Keegan 1999, 237; Pestle et al. 2013).

Two other limitations have to do with the focus on so-called diagnostic pottery traits. Identifying these depends not only on cultural chronology but also on site type (function and dating) and the collection and sampling methods used. For example, surface grab samples taken during survey may contain fewer diagnostic materials when compared to ceramics from excavated contexts. Also, even if diagnostic pottery is present in an assemblage, this usually only represents a small percentage of what might have been used, especially in later-period sites. By using cultural chronologies, we typically focus on the outliers, not what might be commonly found in an assemblage. In addition, when archaeologists focus exclusively on decorative traits, they run the

risk of neglecting technological information that is also diagnostic. In Barbados, for instance, the relatively thick, crude LCA pottery that is labeled “Barbados incised crosshatching” (Harris 2019, 83, 91–93) is often confused with the thin and well-fired ECA zoned-incised-crosshatched pottery as they share the same type of decoration. This can lead to misdating assemblages by centuries. The same goes for tempering agents (e.g., coral or volcanic sand, grog) used to enhance the plasticity or thermal resistance of ceramic materials, which may also be culturally specific.

Finally, the recording of stylistic traits often takes place by means of coding systems. This may result in excavation documentation consisting almost exclusively of codes, which can be difficult for future researchers to decipher. Even when a specialist adds explanations about coding details to pottery analyses in publications, they may differ or lack all of the original content, with codebooks not always available for future consultation. Notwithstanding the numerous disadvantages that archaeologists may face, the careful analysis of stylistic similarities and dissimilarities in pottery assemblages has provided opportunities to study local, micro-regional, and regional interaction. As explained above, comparing stylistic and morphological pottery characteristics has led to the identification of stylistic areas, largely explained by the existence of ties between groups. These areas often span large parts of the eastern Caribbean, but the careful analysis of style characteristics, as well as morphological and technological pottery features, has also resulted in the identification of micro-style areas where (more) localized contact networks are presumed to have existed (e.g., De Waal 2006, 121–122, 128–129; C. L. Hofman and Hoogland 2004). Technological and compositional analyses focusing on the provenance of clays and temper materials have provided further data on mobility and pottery production and exchange within the eastern Caribbean (e.g., Descantes, Speakman, and Glascock 2008; C. L. Hofman, Isendoorn, and Booden 2005; Kracht, Bloch, and Keegan 2022; Lawrence, Fitzpatrick, and Giovas 2021).

The prevalence of pre-contact ceramics also allows the use of pottery for assessing site functions, which greatly contributes to the reconstruction and understanding of past settlement patterns and, as a result, past lifeways. In the Caribbean, this is relatively rare. Exceptions do exist, however. For example, Boomert (1996) estimated site functions largely based on relative quantities of pottery, while De Waal (2006, 22) did the same through analysis of the composition of archaeological assemblages, including the actual types of pottery present, site location, site dimensions, and duration of occupation. Pottery analysis can play an important role in helping to establish functions of locations of use and occupation in the past and can be particularly useful when studying complete social, political, economic, and ceremonial landscapes.

The Diversity of Animal Introductions

We now turn to the one of the more interesting and productive lines of inquiry pursued since the ca. 2010s, that of animal introductions into the Caribbean and their overall diversity and range as seen through detailed zooarchaeological analysis. A conservative estimate places the number of invasive, non-native animal species in the contemporary Caribbean at 171 (Witt, Picker, and Swinnerton 2024), although true numbers are likely much higher. Tourists to the region might immediately recognize some of these exotic species, such as goats and donkeys, as colonial-era Afro–Eurasian transplants. In other instances, they may be made aware of a species' invader status through public education campaigns and efforts to develop commercial markets as a control mechanism, as in the case of the lionfish (*Pterois* spp.). What fewer visitors may appreciate is that the region has a deep history of anthropogenic animal introductions that extends back at least 2000 years, when several South American animals were introduced (mostly in the ECA) by Ceramic Age horticulturalists as they settled the region. The Caribbean contrasts with Remote Oceania, a much larger island region, for its relatively large number of human-assisted faunal introductions in the pre-contact period and for the fact that the majority of these introductions involved non-domesticated species. On both accounts, however, the Caribbean falls short of the Mediterranean, comparable in size, where humans are implicated either directly or indirectly in the introduction of dozens of wild and domesticated animals over millennia (see review by C. A. Hofman and Rick 2018).

Because it is often unclear whether dispersal was anthropogenic or natural, the exact number of non-native animals that Indigenous peoples introduced to the islands is arguable. Similar challenges arise when the permanence of a species' presence on an island is ambiguous (see Giovas 2018 for a case study involving deer). For clarity, we use the term "translocation" to refer to the intentional or unintentional human transport of a species to a location outside its existing range and the term "introduction" to mean their establishment in a new environment. It seems likely that at least the agouti (*Dasyprocta* sp.), common opossum (*Didelphis marsupialis*), dog (*Canis lupus familiaris*), guinea pig (*Cavia porcellus*), and armadillo (*Dasypus* sp.) were introduced from the continental Americas to the Caribbean islands (Giovas 2019a; Giovas et al. 2016; LeFebvre and deFrance 2014; Lord et al. 2020; Newsom and Wing 2004; Wing 2012) (Figure 4). Of these, the agouti, opossum, and dog are the most common archaeologically (based on number of specimens/site ubiquity) and most widely dispersed (based on number of islands recorded), although their geographic distributions across the islands overlap each other only partially. In addition to these mammals, evidence indicates that several Caribbean endemics were moved among islands, including the Puerto Rican hutia (*Isolobodon portoricensis*) (Morgan et al. 2019), Bahamian hutia (*Geocapromys ingrahami*) (LeFebvre et al. 2019b), and several native parrots (Oswald et al. 2023; see also Williams and Steadman 2001). Although requiring further verification, other possible human-mediated animal introductions prior to European colonization include the short-tailed cane rat (*Zygodontomys brevicauda*) (Mistretta et al. 2021) and the green iguana (*Iguana iguana*) (Bochaton 2022)—both may represent accidental translocations by humans—as well as the Curaçaoan cottontail (*Sylvilagus floridanus nigronuchalis*) and the Curaçao deer (*Odocoileus virginianus curassavicus*) (van Buurt 2010, 240). Among all the species noted above, only the dog and guinea pig were domesticated, although isotopic and metric evidence supports the possible management of the Bahamian hutia (Lefebvre et al. 2019a, 2019b) (Figure 3). In most instances, the timing of Caribbean introduction for many of the above-mentioned species can be assigned generally to the ECA or LCA, but more precise dates are unavailable due to lack of direct dating of specimens and the simultaneous need to demonstrate that the specimen in question represents the introduction of a live individual rather than an exchange object (Giovas 2019a). The nature of these methodological challenges, which Caribbean zooarchaeology has contributed significantly to untangling, are discussed in more detail in LeFebvre et al. (this volume).

Figure 4. Animals introduced from the continental Americas to the Caribbean islands by Indigenous peoples or moved between islands during the Ceramic Age: (A) agouti (*Dasyprocta* sp.; Credit: Thomaz de Carvalho Callado, Creative Commons Attribution 4.0 International license, https://www.inaturalist.org/photos/227715464); (B) common opossum (*Didelphis marsupialis*; Credit: Flickr as Rabipelao, Juan Tello, Creative Commons Attribution 2.0 Generic license, https://en.wikipedia.org/wiki/Common_opossum#/media/File:Rabipelao2.jpg); (C) armadillo (*Dasypus* sp.; Credit: gailhampshire from Cradley, Malvern, U.K Creative Commons Attribution 2.0 Generic license, https://commons.wikimedia.org/w/index.php?curid=73445113); (D) a taxidermy specimen of Bahamian hutia (*Geocapromys ingrahami*) at the Natural History Museum (National Museum of Ireland), Dublin (Credit: Illustratedjc, Creative Commons Attribution-Share Alike 4.0 International license, https://commons.wikimedia.org/wiki/File:Hutia_-_Geocapromys_ingrahami_-_NHMI.jpg); (E) and guinea pig (*Cavia porcellus*; Credit: MarcelaSanzo, Creative Commons Attribution 4.0 International license, https://commons.wikimedia.org/wiki/File:CobayoColorado1.JPG);

From the 1960s onward, Elizabeth Wing (2008, 2012; Newsom and Wing 2004) was the first zooarchaeologist to systematically document the incidence and distribution of exotic continental animals in Caribbean archaeological sites. Wing (2008) suggested that the dispersal of introduced species aligned with island biogeographic expectations for declining richness with distance from source. Subsequent investigations have not upheld this observation, with more recent reviews of archaeological distributions suggesting that, for at least some non-native animals, this reflects the human interaction and exchange networks that facilitated dispersal (Giovas 2018, 2019a; LeFebvre and deFrance 2014; Rabinow and Giovas 2021). Nonetheless, Wing's pioneering work paved the way for expanded investigations of pre-contact species introductions that have addressed geographic distributions, mobility, ethnohistory, chronology, isotopic ecology, biomolecular characterization and relationships, ritual use, and management by Indigenous islanders (Giovas 2018, 2019a; Giovas et al. 2012; Grouard, Perdikaris, and Debue 2013; Kimura et al. 2016; Lafoon et al. 2019; LeFebvre and deFrance 2014, 2018; LeFebvre et al. 2019a, 2019b; Oswald et al. 2020; Rabinow 2021; Rabinow and Giovas 2021; Shev et al. 2020). Ancient DNA (aDNA) analyses of Ceramic Age guinea pig specimens from the Greater and Lesser Antilles, for example, demonstrate two distinct ancient introduction events from South America (possibly Colombia) (Lord et al. 2020), highlighting the potential of such methods to illuminate the spatiotemporal patterning of introduction in ways that morphological analysis cannot. Rabinow's (2021) comprehensive ethnohistorical review of agouti cultural treatment also reveals how integrating ethnohistoric records into archaeological investigations of animal introductions can help refine hypotheses and deepen understanding of introduction histories.

Introduced animals were used for a variety of cultural purposes but seem to have been most consistently utilized for food. Dogs, for instance, were apparently kept during the Ceramic Age to fulfill multiple human needs. On the basis of size, two types have been identified; the zooarchaeological remains of each have been discretely associated with either human burials or archaeological middens, suggesting distinct roles for each type as human companions, possible hunting aids, and food (Grouard, Perdikaris, and Debue 2013). Exotic parrots (Psittacidae) may have been exploited for feathers or kept as pets as well as consumed (Oswald et al.

2023). In general, though, most introduced mammals were used principally for food and raw materials, with limited evidence for ritual or other non-dietary, non-utilitarian uses (see deFrance et al. 2010). Agouti, hutias, and opossum are frequently found as butchered, disarticulated, and burned remains within Ceramic Age archaeological refuse deposits (Giovas 2019b; Giovas et al. 2012; LeFebvre et al. 2019b; Newsom and Wing 2004; Shev et al. 2023). Here too, the Caribbean is somewhat at odds with other island regions, such as Oceania and the Mediterranean, where unequivocal evidence indicates domestic and wild animals were incorporated into systems of status-mediated consumption and ritual sacrifice (e.g., Kirch and O'Day 2003; Ekroth 2014).

As some researchers have highlighted (e.g., Bochaton 2022; Giovas 2019a; Rabinow and Giovas 2021), gaps exist in our knowledge of Indigenous animal introductions stemming from practical (e.g., preservation) and methodological (e.g., lack of suitable comparative specimens, underpublication of records, incomplete archaeological survey) challenges and the need for systematic application of rigorous evidentiary criteria to substantiate introductions. As alluded to above, the last of these can be advanced by direct dating of specimens, distinguishing introduced animals from items of exchange, and biochemical analyses that can establish an animal's geographical origin (e.g., Lord et al. 2020). Curaçaoan deer illustrate some of the complexities involved for such studies. The species is considered to have been introduced during the Ceramic Age by Dabajuroid peoples from South America to Curaçao (van Buurt 2010), where it currently persists as an endemic subspecies of white-tailed deer. However, its very limited archaeological presence in the pre-contact period suggests that those remains may derive from trade with the mainland in animal parts rather than live animals; present-day deer populations on Curaçao may instead be a Spanish introduction during the colonial era (Giovas 2018; Van Heekeren 1963).

In this respect, the Caribbean is little different from other island regions where archaeologists must also grapple with issues of methodological rigor as it relates to the spatiotemporal dynamics of animal introductions and their cultural and ecological significance (e.g., Valenzuela and Alcover 2013; Valenzuela et al. 2022). Thus, insights gained from Caribbean investigations of ancient species introductions and bioinvasions stand to advance knowledge of these processes on islands globally.

Isotopic Analysis

Next, we highlight how one of the most important techniques for examining animals and human diet—isotopic analysis, with some of its earliest applications in the Caribbean—has helped to revolutionize what we know about ancient lifeways in the islands. Despite a relative paucity of scholarly archaeological research compared to some other island regions, isotopic research, in particular paleodietary investigation using stable isotopes of C, N, and O, was notably precocious and innovative. Within a decade of the publication of the first isotopic study of paleodiet in archaeology (Vogel and Van der Merwe 1977), several studies had applied stable isotope analysis of carbon and nitrogen to Caribbean (Bahamian and Puerto Rican) samples and contexts (Keegan 1985; Keegan and DeNiro 1988; Schoeninger, DeNiro, and Tauber 1983). Pan-archipelagic studies focused on the biogeographical effects on human diet, which included hundreds of samples from dozens of islands and the surrounding continents, also appeared at a relatively early date (Stokes 1998; van Klinken 1991). The early onset of such studies is especially noteworthy given the problems that poor preservation creates for such methods in tropical/Neotropical settings (Pestle and Colvard 2012) and the mind-boggling complexity of regional food webs (Pestle 2013a; Pestle and Laffoon 2018). The latest wave of interpretive techniques to include multisource and Bayesian modeling of isotopic paleodietary data also began appearing in Caribbean studies ahead of their incorporation in other "core" regions (Chinique de Armas and Pestle 2018; Pestle 2010; Pestle and Laffoon 2018).

Isotopic paleomobility and trade studies, most typically using radiogenic (Sr) isotope analysis, had a somewhat later start in the region, with the first studies employing these isotopes systems appearing only late in the first

decade of the 2000s (e.g., Booden et al. 2008; Laffoon and Hoogland 2009; Schroeder et al. 2009). Despite the later date, this area of study has been noteworthy for its broad timescale of application, spanning the temporal range of archipelagic settlement, from the earliest inhabitants to the historic period; the variety of materials (humans, animals, artifacts) studied; and the interdisciplinary nature of the work performed (Fricke, Laffoon, and Espersen 2021; Laffoon 2012; Laffoon et al. 2014, 2015, 2020; Price et al. 2020; Schroeder, Haviser, and Price 2014). As with the complications of paleodietary studies noted for the region, the execution and success of these reconstructions of paleomobility are more remarkable given the geological and hydrological complexity of the region (Pestle, Simonetti, and Curet 2013), which must be overcome by methodological and/or model-based means (Bataille, Laffoon, and Bowen 2012; Laffoon et al. 2012).

Here, we highlight just a few applications of isotopic toolkits to Caribbean contexts and research questions that reflect the sophistication of the methods being employed and the crucial archaeological and anthropological problems being addressed. Beginning with paleodietary studies, the work of Schulting and colleagues (2021) employed stable isotope analysis to understand the adaptive strategies and behavioral resilience of Bahamian Indigenous groups over a period of six centuries (AD 1000–1600), finding that even small-scale Indigenous societies were capable of overexploitation of marine resources in the fragile ecosystems of the Bahamas (see Pestle 2013b for a similar example from eastern Puerto Rico or Fitzpatrick and Keegan 2007 or Newsom and Wing 2004 for region-wide analyses). The potential for Indigenous overfishing has been intensely investigated in the insular Caribbean, and zooarchaeological studies have identified its occurrence in numerous (but not all) prehistoric Caribbean contexts (Carder and Crock 2012; Grouard et al. 2019; Wing 2001; see also Baisre 2010 for a contrarian view). The use of isotopic data to test or validate the conclusions of faunal analysis adds further detail to discussions of this important and contested topic.

Chinique de Armas and Pestle (2018) used Bayesian modeling of six prehistoric Caribbean groups with differing subsistence economies to determine if and how differences in subsistence practices may have affected the groups' breastfeeding and weaning practices. They found that supplementary foods seem to have been introduced into children's diets at earlier ages than observed in ethnographic populations of the region, but there was no direct correlation between the start of weaning and the availability of cultigens. Thus, while agricultural reliance (and the potential correlates thereof) did not appear to influence the timing of supplementation or weaning, those groups that had access to cultigens likely used domesticated plants as weaning foods. Only through the rigorous use of isotopic analysis can these fundamental aspects of ancient Caribbean human cultural practice be untangled.

Finally, Pestle (2013c) used stable isotope approximation of diet, combined with mortuary analysis, to test for the presence of status differences among the people of LCA societies of Puerto Rico, which have typically been assumed to possess at least some degree of institutionalized social inequality. Based on the analysis of 135 individuals from two sites, the study found no evidence to support such an assumption. The lack of clear differentiation in either mortuary treatment or diet for these ancestors, who together represent a period between roughly 1300 and 600 cal. BP, calls into question the existence of institutionalized social inequality in this period and raises new questions about the nature of the internal organization of LCA societies in Puerto Rico.

Turning to studies of paleomobility and trade, Knaf and colleagues (2021) used an elemental and multi-isotope approach (Sr–Nd–Pb) to establish the geochemical "fingerprints" of jade/jadeite sources in Cuba, Hispaniola, and Guatemala. Using these baseline data, the point of origin and pattern(s) of trade of jade artifacts from an LCA site in the Dominican Republic found that some 16% of such artifacts, rather than originating in the most proximate Dominican source, instead could be traced to Guatemalan points of formation/origin. As such, a prehistoric Indigenous trade, and presumable social network, stretching more than 2000 km was explicitly attested to through the application of isotopic techniques, though the ways in which these resources or finished products were acquired are unknown.

Further evidence of patterns of movement and exchange are demonstrated in the work of Laffoon et al. (2019), in which the strontium and carbon isotope composition of human and dog remains from prehistoric sites in Guadeloupe and the Dominican Republic was analyzed and compared. The results of the strontium isotope analysis indicated that patterns of mobility for humans and dogs were largely similar at each of the four sites (i.e., sites with more non-local humans also had more non-local dogs and vice versa) and that the one early site (Morel on Guadeloupe) was home to a far higher proportion of non-local individuals than the three later sites. The isotopic approach permits, in this case, the delineation of temporal trends in inter-island mobility of humans and their canine companions.

Though in this chapter we have focused on the pre-contact era, it is worth noting that these types of analysis have also proven useful for events that happened after European arrival. For example, Laffoon, Espersen, and Mickleburgh (2018) used strontium isotope analysis, along with bioarchaeology and stable isotope analyses, to elucidate the osteobiography of a single seventeenth/eighteenth century enslaved individual from the Spring Bay Flat Plantation on the island of Saba. Despite being represented by only five teeth, the results of the Sr analysis indicated that this individual was a first-generation migrant from Africa, whose forced migration possibly took place during the time of formation of their adult third molar (generally, late teens to early 20s). The application of biogeochemical analysis in this case attested to the life of this individual from enslavement to transport across the Atlantic and eventual adaptation to life on a colonial-era plantation in the Antilles.

Earlier reviews of the reconstruction of paleodiet and paleomobility by isotopic means can be found in Pestle (2013a, 2013b, 2013c) and Laffoon (2013), respectively. Overall, it is clear that stable isotope analysis has emerged as one of the most important tools archaeologists have for examining questions related to the health, diet, nutrition, and mobility of Caribbean peoples who lived in the past.

Summary and Conclusions

The Caribbean islands have garnered the attention of antiquarians and archaeologists for more than a century. Ever since the turn of the twenty-first century, however, we have seen a tremendous increase in the scholarly investigation of sites and assemblages that have broadened our understanding of who these first island inhabitants were and the complex ways in which they dispersed, interacted, and developed varied modes of cultural behavior. In this chapter, we hope to have provided readers with a basic understanding of the region's culture history while highlighting the material record and some of the analytical techniques that have been historically important or critical to these endeavors. While the categories we have emphasized are not mutually exclusive—and recognizing that there are many more tools at our disposal to examine Caribbean Indigenous lifeways (e.g., aDNA)—we hope to have demonstrated the region's importance to the subfield of island and coastal archaeology, its unique status in archaeology generally, and why more can be done to explore the island Neotropics.

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Note

1 As Antczak and Hofman (2019, 33) have correctly outlined, the unambiguous distinctions between Archaic Age and Ceramic Age groups that archaeologists presented until recently may have to be revised, but this is beyond the scope of this contribution.