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Archaeological Research in the Canary Islands: Island Archaeology off Africa's Atlantic Coast

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Abstract

Island archaeology is a well-established field within the wider discipline, but African contributions to it remain scarce. The Canary Islands are unusual in the broader African context for their relatively long history of occupation (~2000 years) and the intensity with which archaeological research has been, and is, undertaken there. Much of that research, however, has focused on specifically Canarian issues, including efforts to demonstrate connections between the islands' initial settlement and the Classical Mediterranean world. Relatively little of it has been conducted within the broader comparative framework that an island archaeology perspective provides. Additionally, much of the Canarian literature is not directly accessible to non-Hispanophones. In response, I synthesize what is currently known about the archaeology of the Canary Islands, focusing on determining when, how, and by whom they were first settled; the impacts of human settlement on their environments; inter-island variability in precolonial subsistence, social, and political trajectories; and the record left by European contact and subsequent colonization, which began in the 14th century AD. As well as pointing to further opportunities for research within the archipelago, I simultaneously map out several areas where archaeological work there could contribute to wider debates in island archaeology as a whole.

Keywords Canary Islands · Island archaeology · Colonization · Ecological transformation · Inter-island variability · European settlement

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Introduction

Archaeologists use material culture and other signals from the past to explore the full range of human experience across time and space. A key question involves understanding the adaptive strategies that allowed a species initially confined to sub-Saharan Africa to colonize virtually the entire planet (Gamble 2014; Roberts and Stewart 2018). Other researchers focus on the consequences of human actions for the broader ecosystem. Such consequences have always entailed modification, sometimes brought about the extinction of fellow species, and invariably been exacerbated where human numbers have grown and subsistence economies have shifted from hunting and gathering to dependence on a few domesticated plants and animals. This theme resonates particularly strongly in the face of the accelerating loss of biodiversity that we see around us today (Crabtree and Dunne 2022; Millhauser and Earle 2022). How the social relations between and within communities can shift from situations of relative equality to others of ever-growing inequality (and back again) and how this may be justified and normalized also attract interest (Bogaard et al. 2019; Kohler and Smith 2018). Inextricably linked to these questions archaeologists are likewise keen to grasp how past societies understood and made sense of the natural—and supernatural—worlds in which they lived (Insoll 2012). Colleagues whose work emphasizes the last several hundred years draw all these strands together as they seek to comprehend the evolution of a global capitalist economy that continues to depend on structural inequalities between (and within) different parts of the world. Their work highlights how those inequalities frequently emerge from a heritage of conquest and enslavement enacted by Europeans on those living elsewhere (Orser 1996; Orser et al. 2020). All these themes gain added relevance as archaeologists confront the challenges posed by a worldwide climate crisis and the demands for societal relevance that this brings (LeFebvre et al. 2022; Mitchell 2008).

Islands have often been singled out as particularly suitable contexts for pursuing these and other questions. In part, this is because of the Western world's deep-seated view of them as something quite different from the everyday experience of mainland life. Examples include their potential for encouraging cultural mixing and their liminal position between land and sea, different bodies of water, or different cultural and demographic components (Schnepel 2018). More particularly, the "island imaginaries" of which Schnepel (2018, p. 19) writes encourage a view of islands as being isolated, finite, and "virginal" (since, in every case, at some time no one had ever set foot on them). It is these three characteristics that underlie their frequent archaeological perception as laboratories within which processes of cultural change can be more readily grasped than in more "cluttered" and complex mainland settings (cf. Evans 1973; Vayda and Rappaport 1963). Within this framework, principles derived from island biogeography (MacArthur and Wilson 1967) have proven particularly helpful in understanding the spatiotemporal patterning of island settlement (e.g., Cherry 1981, 1990; Cherry and Leppard 2018; Keegan and Diamond 1987). Decades of debate have nevertheless shown that over-emphasizing such principles risks producing "a minimalist

vision of island life" (Broodbank 2000, p. 31), devoid of much of the cultural variation that makes human histories interesting. They have also confirmed that only rarely have islands formed tightly closed, fully bounded isolated systems (Eriksen 1993). Rather, they have, at different times, been more—or less—connected with each other and with societies elsewhere (Terrell 2020). An acceptance that island boundaries are permeable does not, however, preclude using them to understand processes of general relevance. Their smaller scale, distinctive ecological histories, and "heightened conceptuability" (Grydehøj 2018, p. 2) collectively render islands useful as model systems across a variety of research themes (Fitzpatrick 2007; Fitzpatrick and Erlandson 2018; Fitzpatrick et al. 2015). Working within relatively circumscribed areas with fewer external disturbances and a definite beginning (the date of human arrival) may, thus, deliver insights that not only add to our knowledge of specific islands but also prove useful in continental settings (DiNapoli and Leppard 2018; Kirch 1997).

With these ambitions in mind, over the last several decades, practitioners of island archaeology have established it as a distinct field within the wider discipline, complete with research agendas, dedicated journals, and conferences of its own. Major themes include establishing when and how individual islands were settled, the form that settlement took, and the impacts this had on ecologies that had, in many cases, evolved in relative isolation from other parts of the world and were, thus, prone to disruption following people's arrival. Others concern the ways in which island populations did, or did not, remain connected with each other or with the mainlands from which their ancestors hailed and the development of distinctive island identities. In the wake of European expansion overseas, the emergence of plantation economies powered by unfree labor, resistance to enslavement, and the formation of new creolized communities define additional research topics.

For reasons of geography and disciplinary history, much of island archaeology emphasizes the Mediterranean, the Caribbean, and the Pacific, with other seas and oceans under-investigated by comparison. Islands lying off the coasts of Africa are a particular case in point. Many have still to attract archaeological attention of more than a cursory kind (cf. Mitchell and Lunn-Rockliffe 2021), but even where a significant body of work has begun to accumulate it mostly addresses quite specific debates. For example, work on the islands that help define East Africa's Swahili Coast principally relates to the emergence of Swahili identity and the region's participation in trans-Indian Ocean trade networks (see Wynne-Jones and LaViolette 2018). Research focused on broader questions of relevance to island archaeology in general, such as faunal impoverishment following the insularization of Unguja, the main island of Zanzibar (Prendergast et al. 2016), or the particular challenges of successfully colonizing very small islands (Crowther et al. 2016), stands out for its rarity. With the partial exception of Madagascar, which has a well-known record of faunal extinctions, landscape transformation, and long-distance human colonization (Radimilahy and Crossland 2015), the result is that the African island experience features little, if at all, in most overviews and syntheses of island archaeology (e.g., Braje et al. 2017; Napolitano et al. 2021).

This omission is especially striking in the case of the Canary Islands, an archipelago situated off the northwest coast of Africa that has—uniquely in the African

Atlantic—a relatively long and archaeologically well-explored history of human settlement stretching back far beyond its conquest by Europeans in the 15th century AD. Although systematic fieldwork began over 150 years ago, after centuries of antiquarian speculation regarding the origin of the islands' Indigenous precolonial inhabitants, most publications regarding the archipelago's archaeology continue to address specifically Canarian themes and debates. More specifically, a significant proportion of archaeological resources has been devoted to debating when and by whom the islands were first settled, often using arguments heavily conditioned by, or reliant on, interpretations of Classical Greek and Latin authors and sometimes to the detriment of advancing broader understandings of their inhabitants' history (Owens 2005; and see further below). As a result, only rarely (e.g., Morales et al. 2009; Nogué et al. 2017) have the islands figured in broader conversations within island archaeology. Syntheses of their archaeological record are also few (see del Arco Aguilar et al. 1992; Farrujia de la Rosa 2015; Navarro Mederos 1997; and—with a focus on heritage management and the history of archaeological enquiry—Farrujia de la Rosa 2014). Moreover, most of the archaeological research relating to the islands is, understandably, published in Spanish (though frequently with English abstracts), often in journals or monographs of specifically Canarian provenance and interest. Issues of language competency and access, thus, compound the lack of interest in the archipelago's archaeology shown by island archaeologists working in other parts of the world where Spanish is little used (such as the West Indies and the Mediterranean) or completely absent (for example, Oceania).

This paper, therefore, has two interlinked goals. The first is to provide a synthesis for non-Spanish-reading archaeologists of the key findings of more than a century of sustained archaeological fieldwork in the Canarian archipelago, highlighting major debates and developments. The second is to focus on the contemporary relevance of those findings for wider discussions within island archaeology. In keeping with Canarian archaeology as a whole, my emphasis is mostly on the archipelago's precolonial record. However, because European colonization of the islands was, in many respects, a "trial run" for what happened subsequently in the Americas and elsewhere (Tejera Gaspar and Aznar Vallejo 1992), I also consider this dimension of their archaeology. I begin by introducing the Canarian archipelago, stressing the ecological diversity that exists within and between its component islands. Next, I review the history of research there, drawing on the work of several Canarian scholars to help situate this within broader currents in Canarian and Spanish history. I then highlight four topics, emphasizing as appropriate the importance of recent methodological advances: when, how, why, and from where the islands were first settled; the impacts that human settlement has had on their ecologies and indigenous flora and fauna; variability in precolonial cultural trajectories within the archipelago, particularly as this relates to questions about the organization of subsistence activities, technology, and social relations; and the islands' contribution to archaeological investigations of Crosby's (1972) Columbian Exchange. I conclude by identifying some of the ways in which the Canaries may bring new perspectives into archaeological studies of islands as well as possible issues for future research. Note that all the radiocarbon dates cited are calibrated using the most up-to-date calibration curve available, i.e., IntCal20 (Reimer et al. 2020) and OxCal 4.4.

The Canarian Archipelago: Geography and Ecology

The Canary Islands form one of four main groups of islands of volcanic origin in the northern part of the African Atlantic, the others being the Azores, Madeira and Porto Santo, and the Cape Verde archipelago. Collectively, they form a biogeographic region known as Macaronesia that is characterized by several distinct plant and animal communities, including remnant patches of laurel-leaved *laurisilva* forests on all save the Cape Verde Islands, which are too dry to sustain them. Never having been physically joined to an adjacent mainland, all the Macaronesian islands show a high degree of species endemism (Illera et al. 2012). Most also lack indigenous amphibians, freshwater fish, and nonvolant mammals, taxa that would have found it particularly challenging to travel over extensive bodies of salt water (Masseti 2010). Textual and paleontological evidence indicates that Madeira was known, if only briefly, by the Romans (Roller 2006, pp. 46–47) and later the Norse (Rando et al. 2014a). Paleoenvironmental proxies and house mouse (*Mus musculus*) genetics have also been cited (controversially) in support of a Norse presence in (or at least visits to) the Azores (Gabriel et al. 2015; Raposeiro et al. 2021; cf. Elias et al. 2022). The Canaries are nevertheless the only part of Macaronesia that was certainly settled by people before Europe's Middle Ages; sustained colonization of the other islands occurred during Portugal's 15th century "voyages of discovery." Since 1982 they have formed an autonomous community within Spain that is divided into two provinces, Las Palmas in the east and Santa Cruz de Tenerife in the west (Fig. 1).

The Canarian archipelago extends in a broadly east–west direction across some 450 km, from almost 13˚W to just beyond 18˚W. It lies roughly perpendicular to

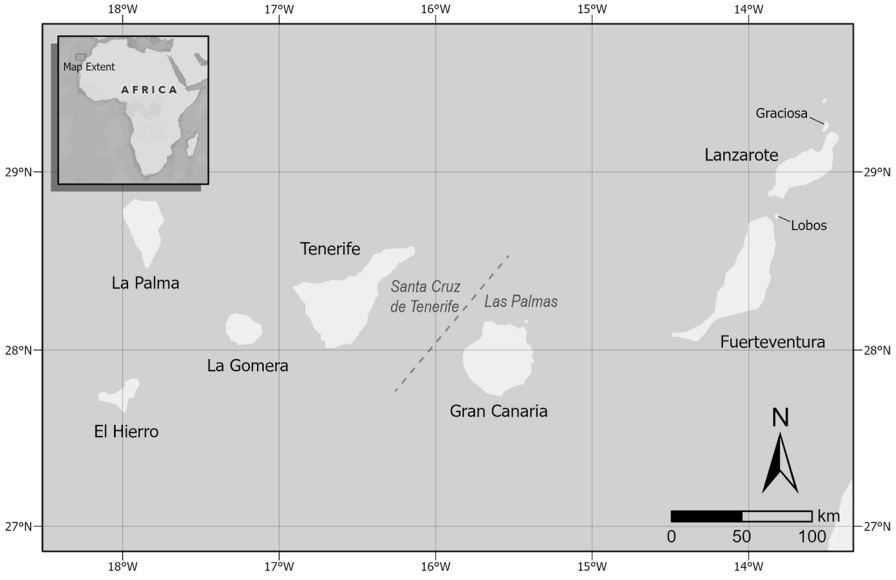

Fig. 1 Map of the Canary Islands showing modern provincial divisions and their position off Africa's northwest coast (inset)

the northwest coast of Africa, which is roughly 100 km from the eastern members of the group. Collectively, the islands have an area of 7493 km^2 and are sandwiched between approximately 27.5˚N and 29.5˚N, i.e., a little to the north of the Tropic of Cancer. They form three clusters, all of which originated as separate submarine volcanoes emerging from the floor of the Atlantic Ocean. The two most easterly islands—Fuerteventura and Lanzarote—appeared about 20.2 million years ago. However, the three middle islands—Gran Canaria, Tenerife, and La Gomera—date to much later in the Miocene (14.6–9.4 million years ago), while the two westerly islands—La Palma and El Hierro—are both of Pleistocene age (1.7 and 1.1 million years ago, respectively) (Carracedo and Troll 2016, 2021). Several smaller islands are also present, but only La Graciosa, off the northern tip of Lanzarote, and Lobos, between it and Fuerteventura, are relevant to the discussion here. The archipelago remains tectonically active. The most recent terrestrial eruption took place from the Cumbre Vieja volcano on La Palma in the second half of 2021, and all the other islands, except La Gomera, have witnessed volcanic activity during the Holocene. Global variations in sea level during the Quaternary had their greatest impact in the center and east of the archipelago, with Gran Canaria and La Gomera both now considerably reduced in size compared to their extent at the Last Glacial Maximum when Fuerteventura, Lanzarote, La Graciosa, and their associated islets joined together to form the much larger island of Mahan. The distributions of plant and insect species confirm that this subset of the overall Canarian group forms a single island from an evolutionary standpoint, one currently reduced to approximately half its typical Quaternary size (Rijsdijk et al. 2014). By global standards, none of the islands is particularly large, with even Tenerife (2034 km^2) failing to make the top 200. Table 1 summarizes basic geographical data for the archipelago's inhabited islands and—in anticipation of later discussion—also provides the oldest radiocarbon date for each of them (after Velasco Vásquez et al. 2020), plus the date of their conquest by Europeans.

Benefiting from the Gulf Stream and their subtropical latitude, the Canaries show few extremes of temperature, and climate is generally warm though moderated by the sea, the trade winds, and altitude. For the most part the islands fall within Köppen's (1936) hot semiarid or arid (BSh/BWh) climate categories (Fuerteventura, Lanzarote, and much of the coastal areas of Tenerife and Gran Canaria) or his subtropical Mediterranean (Csa/Csb) climate (the interior of Tenerife, the north and center of Gran Canaria, and most of the three western islands). There is, however, considerable microclimatic variation, partly because of the generally high, dissected relief of all the islands save Fuerteventura and Lanzarote. As a result, the western and central islands are much wetter than would be expected given their latitude. They are also more diverse in their climate and vegetation, with rain shadow effects causing southern areas to receive much lower precipitation than northern coasts. Annual precipitation, which is heavily concentrated in winter, varies from >1000 mm in the highest parts of La Palma to <100 mm on the south coasts of Gran Canaria and Tenerife. In contrast, Santa Cruz de Tenerife on Tenerife's northeast coast receives 214 mm *per annum*, Izaña in the island's center more than double this (440 mm), but Fuerteventura and Lanzarote in the east of the archipelago barely 110 mm (AEMET 2012). These variations in rainfall, elevation, and aspect translate into

Table 1. Summary geographical and historical data for the Canary Islands

	Lanzarote	Fuerteventura	Gran Canaria	Tenerife	La Gomera	La Palma	El Hierro
Area (km^2)	846	1633	1530	2034	370	708	269
Maximum elevation (m a.s.l.)	671	807	1956	3715	1487	2423	1501
Approximate minimum distance to nearest island (km)	11	11	60	30	30	60	60
Interpeak visibility distance to nearest neighbor (km) (after Benn 2020)	135	135	108	61	61	89	90
Earliest reliable occupation date (BP)	1840±30	980±30	1500±30	1540±40	1700±40	1660±40	1530±40
Earliest reliable occupation date (cal. AD 95.4%)	124–311	995–1158	484–644	428–601	247–425	258–537	430–633
Date of European conquest (AD)	1402	1405	1483	1496	1489	1493	1405

Radiocarbon dates for the earliest occupation of each island follow Velasco Vásquez et al. (2020) and are confined to short-lived materials with standard deviations of <100 years. Calibration uses IntCal 20 (Reimer et al. 2020) and OxCal 4.4

marked differences in vegetation (Fig. 2). Arid shrubland predominates along north-facing coasts and below 400 m a.s.l., with dry sclerophyllous forest featuring taxa such as Canarian wild olive (*Olea cerasiformis*), dragonwood (*Dracaena draco*), juniper (*Juniperus turbinata*), and the Mount Atlas mastic tree (*Pistachia atlantica*) above this. Humid, evergreen *laurisilva* forests are confined to the slopes of islands facing the northeast trade winds at 600–1200 m a.s.l. and do not occur at all on Fuerteventura or Lanzarote. Higher up, pine forests are dominated by the Canarian pine (*Pinus canariensis*). These forests are then capped by high-elevation dry

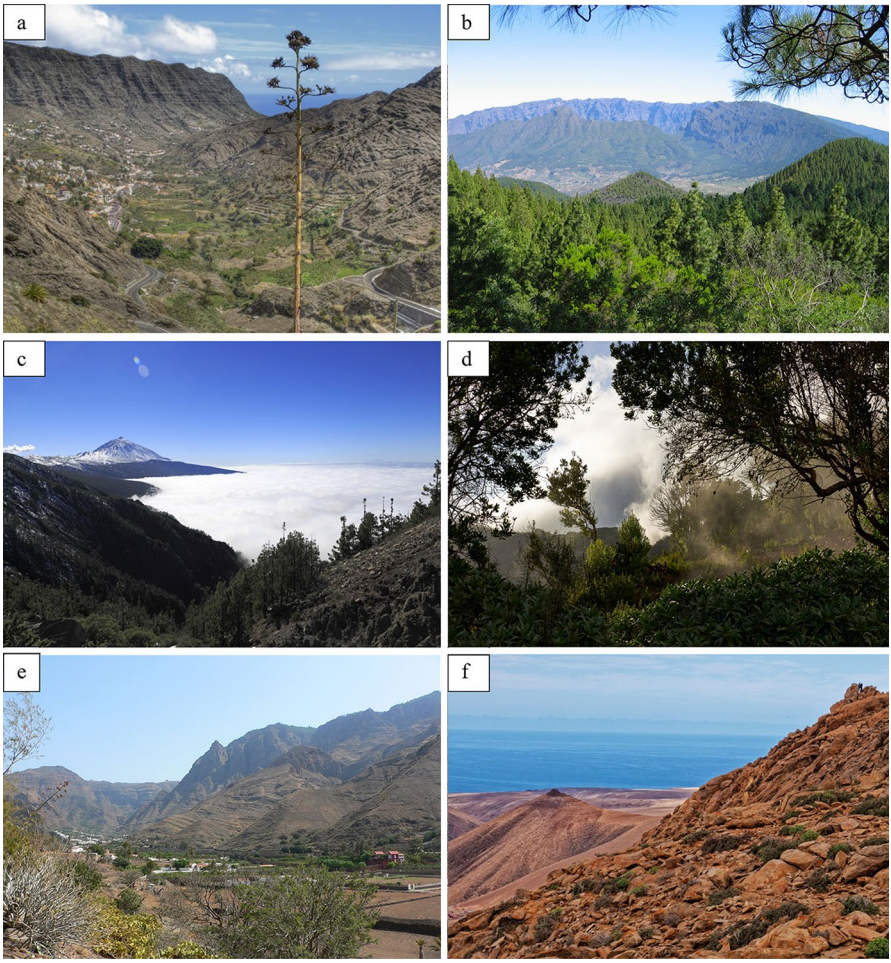

Fig. 2 The ecological diversity of the Canary Islands: **a** La Gomera with recent agricultural terracing in the distance; **b** pine forest in the Caldera de Taburiente, La Palma; **c** Mt. Teide, Tenerife, with snow on its peak and a cloud-covered caldera below; **d** indigenous laurel forest in the Garajonay National Park, La Gomera; **e** the Agaete Valley, Gran Canaria; **f** Betancuria Park, Fuerteventura. Courtesy Wikimedia Commons and **a** Fornax CC-SA-3.0, **b** Cor Lemmers CC-BY-3.0, **c** Falk2 CC-BY-SA-4.0, **d** Stefan Koehler CC-BY-SA-4.0, **e** Marianne Perdomo Machín CC-BY-SA-3.0, **f** Holger Uwe Schmitz CC-BY-SA-4.0

woodland on La Palma and Tenerife, the highest peaks of which reach to, respectively, 2423 and 3715 m a.s.l. (Francisco-Ortega et al. 2000).

Archaeological Research in the Canary Islands: History and Context

Historically, the term 'Guanche' has been widely used to refer to the aboriginal populations of all the Canary Islands. However, it was the Indigenous name only of those living on Tenerife. The inhabitants of the other islands each had their own names, for example Bimbapes (or Bimbaches) on El Hierro and Majos (or Mayos) on Lanzarote and Fuerteventura (Farrujia de la Rosa 2008, p. 6). The terms 'Indigenous' or 'Native Canarian' are, therefore, preferable when referring to the precolonial population of the whole archipelago. Early European commentators were in no doubt of its North African ancestry given the clear similarities between the various Canarian dialects and the Berber (Amazigh) languages of the Maghreb and Sahara (García García and Tejera Gaspar 2018, pp. 35–37; cf. Sabir 2008). Although their work produced valuable ethnohistoric material, efforts to move beyond cultural and linguistic parallels or documentary sources to understand the islands' early history only began in a systematic fashion in the mid-19th century, preceded by occasional comments on surviving instances of precolonial rock art (Farrujia de la Rosa 2009). Drawing on their acquaintance with how archaeology was developing in Europe, particularly France, local intellectuals collected artifacts and human remains that included many of the exceptionally well-preserved mummified ones for which the islands became famous. What we now know to have been unfounded similarities between some of these remains and those from the first Upper Paleolithic excavations in France further drove this early wave of research, which included the islands' first excavations (Ortiz García 2016). Local scientific societies, among them the still-surviving Canarian Museum on Gran Canaria, were established at this time (Farrujia de la Rosa 2014). However, this promising antiquarian phase then lapsed for much of the first half of the 1900s. Although further physical anthropological studies were undertaken, the only important excavations were of tumulus burials on Gran Canaria (del Arco Aguilar et al. 1992, pp. 21–25; Navarro Mederos 1997).

The aftermath of the Fascist victory in the Spanish Civil War saw the establishment in 1939 of a National Commission of Archaeological Excavations, with provincial subsidiaries created in the Canary Islands, directed by those faithful to the regime (Farrujia de la Rosa and del Arco Aguilar 2004). One consequence was a revival of fieldwork that helped lay the foundations of a cultural historical sequence on several of the islands, especially Tenerife. More intensive explorations continued during the 1960s, when Gran Canaria's hosting of the fifth conference of the Pan-African Association for Prehistory briefly drew wider attention to the archipelago's archaeological potential (Clark 1963). Excavations expanded beyond funerary sites (burial caves, tumuli) to include settlements (both cave complexes and open-air locations). Fieldwork methods also improved, but the focus remained on investigating the islands' initial colonization and island-specific developments thereafter (Navarro Mederos 1997). The general approach taken was a heavily cultural historical, diffusionist one in which bioanthropological (especially craniometric) studies of

precolonial Canarian human remains were used to sustain relatively tight connections between archaeological cultures and "race," notably by Schwidetsky (1963). These connections variously served to link the Canary Islands to the Iberian Peninsula and/or Spanish territories on the African mainland (Western Sahara and areas to its north that are now part of Morocco) in ways that served Francoist ideology and its emphasis on national unity and Spain's historic presence in North Africa (Farrujia de la Rosa 2003, 2014). Theoretically as well as in how it was structured, archaeology in the archipelago was, thus, subordinated to wider national (and nationalist) concerns. As part of this emphasis, initial human settlement of the Canaries by "Neolithic" groups from North Africa was placed as far back as the third millennium BC (Farrujia de la Rosa and del Arco Aguilar 2004).

Canarian archaeology shifted gears as Spain returned to democracy following General Franco's death in 1975 and the dismantling of his dictatorship. Within a political context favorable to ideas of regional autonomy and Canarian identity, the Department of Archaeology and Prehistory at the University of La Laguna on Tenerife (established in 1969) and its more recent counterpart at the University of Las Palmas de Gran Canaria became key centers in training archaeologists and conducting archaeological investigations. Together, they have established a much more robust, stratigraphically grounded basis for understanding the archipelago's past (Farrujia de la Rosa 2009). One result of the consequent explosion of fieldwork was to encourage many archaeologists to shift from a broadly pan-Canarian perspective toward more island-specific research programs. Influenced by North American processual archaeology, these programs stressed the role of environmental and socioeconomic processes, especially those relating to technology and subsistence, along with the adaptive responses of the populations of individual islands to local ecological conditions (Hernández Gómez et al. 2004/2005). An emphasis on the distinctive ethnic identities of those populations, coupled with the significant role played in supporting and funding archaeological fieldwork by provincial or subprovincial (i.e., island-specific) local governments (*cabildos*), further encouraged this trend away from archipelago-wide questions toward more atomized studies of the Canarian past (Farrujia de la Rosa 2008, 2019).

Broadly in parallel with this trend, and contemporary with the increasing prominence of more conservative forces in island politics in the 1980s and 1990s, other archaeologists began to pursue links between the archipelago's early settlement and the presumed activity there of the Classical civilizations of the Mediterranean (Phoenician, Carthaginian, Roman). I discuss the evidence for such connections below but note here that one consequence has sometimes been to deemphasize the agency of precolonial Canarian populations, asserting instead "the most deterministic version" of continuity between ethnohistorically recorded practices and the deeper past in ways that suggest little changed on the islands or in the lives of their inhabitants between their initial settlement and medieval European arrival (Hernández Gómez et al. 2004/2005, p. 179). The discovery in 1992 of the so-called Zanata Stone, a monolith of supposedly fishlike form bearing an apparently Libyco-Berber inscription (*ZNTN*), gave added impetus to this search for connections with the Classical (specifically Phoenician/Punic) world. The stone was, thus, quickly put on public display by the Archaeological Museum of Tenerife (González Antón et al. 1995),

notwithstanding the doubts about its authenticity entertained by many archaeologists given its lack of any clear stratigraphic provenance and serious concerns over the accuracy of the transliteration of the signs engraved on it (Galand 1994).

The past 30 years have seen a further intensification in the scale and frequency of archaeological research, sometimes ahead of infrastructural developments such as road construction (e.g., Mederos Martín and Escribano Cobo 2008). Research has been increasingly enriched by the deployment of state-of-the-art scientific techniques, notably stable isotope analysis (e.g., Sánchez-Cañadillas et al. 2021), DNA analyses of human remains and living populations (e.g., Fregel et al. 2019), and more sophisticated modeling of a growing body of radiocarbon dates to which appropriate chronometric hygiene protocols are applied (e.g., Pardo-Gordó et al. 2022; Velasco Vásquez et al. 2020). Detailed studies of plant remains and archaeozoological evidence have also taken place, along with investigations of the Canary Islands' rich bioanthropological record (e.g., Castellano-Alonso et al. 2018; Morales et al. 2017; Owens 2007). While some authors (e.g., Farrujia de la Rosa 2014, p. 56) find that the theoretical framework within which Canarian archaeology has been researched has not shifted greatly over past decades, one important change concerns the use of broadly historical materialist approaches to explore past social formations beyond questions of contact with areas outside the archipelago (Hernández Gómez et al. 2004/2005).

More striking perhaps has been the emergence of historical archaeology as a key component of the Canarian past (Arnay de la Rosa 2009; Rodríguez 2015), something prefigured by preliminary explorations of Norman settlements on Lanzarote (Serra Ràfols 1960; Tejera Gaspar and Aznar Vallejo 1989). Conceptually, efforts have been made to differentiate between a more "colonial," "contact," or "medieval" phase in the 14th to early 16th centuries and a "modern" phase thereafter (Onrubia Pintado and González Marrero 2018; Ramos Pérez and Gámez Mendoza 2014; Trujillo Yánez 2004). Projects emphasizing the former include excavations at Cueva Pintada de Gáldar on Gran Canaria (González Marrero and Tejera Gaspar 2011; Onrubia Pintado et al. 2004), and Fiquinineo (de León Hernández et al. 2014) and Zonzamas (Santana Cabrera et al. 2017) on Lanzarote. All three sites show evidence of continuity in occupation across the contact era. Research stressing the period following the completion of the islands' conquest—and, thus, the history of European settlement rather than Indigenous reaction to its imposition—has frequently been impelled by the need to salvage archaeological resources threatened by redevelopment of the urban centers of Las Palmas de Gran Canaria and Santa Cruz de Tenerife. In both cities, as well as in other locations like La Gomera where such work had its origins (Navarro Mederos 1987), archaeologists have also seized opportunities presented by the need to restore buildings of colonial date. Major themes have included the bioanthropological and funerary dimensions of religious sites, especially those from which large numbers of skeletons have been recovered, and the investigation of their civil and military counterparts. Notable among these are the many fortifications constructed across the archipelago during its 15th century conquest (Onrubia Pintado and González Marrero 2018). Slightly later in date, excavations at the fort of Las Isletas (Castillo de La Luz), part of the defenses of Las Palmas,

the capital of Gran Canaria, produced substantial ceramic and faunal assemblages dating to the first century of Spanish colonization (Cuenca Sanabria et al. 2005). Other projects have explored some of the archipelago's first sugar plantations (Rodríguez 2022) and other instances of landscape modification (e.g., Díaz-Serra 2022) (Fig. 3).

Fig. 3 Selected archaeological sites in the Canarian archipelago mentioned in the text: **a** Libyco-Berber inscription from Balos, Gran Canaria; **b** Cenobio de Valerón granary, Gran Canaria; **c** stone tumuli, Arteara, Gran Canaria; **d** El Alto de Garajonay, La Gomera; **e** Zonzamas, Lanzarote; **f** Church of the Conception, Santa Cruz de Tenerife, Tenerife. Courtesy Wikimedia Commons and **a** Victor Ruíz CC-BY-SA-4.0, **b** Felix König CC-BY-3.0, **c** Victor Ruíz CC-BY-SA-2.0, **d** Cardenasg CC-BY-SA-3.0, **e** Ruth Medina Hernández CC-BY-SA 3.0, **f** Koppchen CC-BY-3.0

Arriving: Settling the Canary Islands

For all islands human arrival reset their long-term history, dividing it into "before" and "after." Experience shows, however, that determining when and in what form that moment of change took place is far from simple, for two reasons. First, the act of discovery does not always lead to settlement, which itself may be more—or less—enduring. Historical records of the colonization of islands in the Atlantic and Indian Oceans (e.g., Cheke and Hume 2008) show how islands may have been visited, used to extract resources, "stocked" with familiar plants and animals, inhabited for shorter or longer periods of time, and temporarily abandoned before being sustainably and permanently settled. The challenges posed by an island's ecology, the advantages of living there rather than elsewhere, and its position vis-à-vis larger networks of commerce and imperialism have all affected the decisions on how—and for how long—to remain. The second reason is methodological: distinguishing between the various kinds of human presence just described may not always be straightforward (Cherry and Leppard 2018). Ephemeral visits or particularly small-scale, short-lived episodes of colonization may prove particularly difficult to detect in the archaeological record (Leppard 2014a). Claims for human presence, of whatever kind, nevertheless need to meet the following widely acknowledged criteria: the recovery of undeniable traces of human activity from undisturbed geological deposits and primary stratigraphic contexts that are unambiguously associated with indisputable (preferably radiometric) dates (cf. Cherry and Leppard 2018; Meltzer 2021). Determining with certainty when people first reached and settled the Canary Islands requires meeting all these conditions (Fig. 4).

That the Canaries' aboriginal inhabitants were of North African origin was, as noted above, already evident to early European chroniclers. Ancient DNA analyses of human remains predating Spanish conquest amply confirm this (Calderón Ordóñez et al. 2017; Fregel et al. 2009, 2021; Maca-Meyer et al. 2004; Rodríguez-Varela et al. 2017). While the confidence limits associated with coalescence ages obtained from DNA sequences are too wide to be meaningful for addressing a colonization event as recent as that of the Canaries, it is nevertheless possible that four mitochondrial lineages specific to the archipelago diverged from each other in the first millennium AD (Fregel et al. 2019). Additionally, one of the Y-chromosome lineages present among Indigenous Canarians (E-M81) appears only to have evolved in mainland North Africa 2000–3000 years ago, evidence that suggests an upper limit for when people colonized the islands (Solé-Morata et al. 2017). The presence across the archipelago of inscriptions in scripts known as Libyco-Berber and (on Lanzarote and Fuerteventura alone) Latin-Canarian or Libyco-Canarian that have North African parallels likewise points to the Maghreb as the source of the islands' human population (Springer Bunk 2015–2016). More specifically, Mora Aguiar (2021) identifies Western Sahara and southern Morocco's Sous and Drâa-Tafilalet regions as having the most similar inscriptions, at least to those found on El Hierro; their likely date suggests that the Libyco-Berber script was introduced to the Canary Islands early in the Christian era.

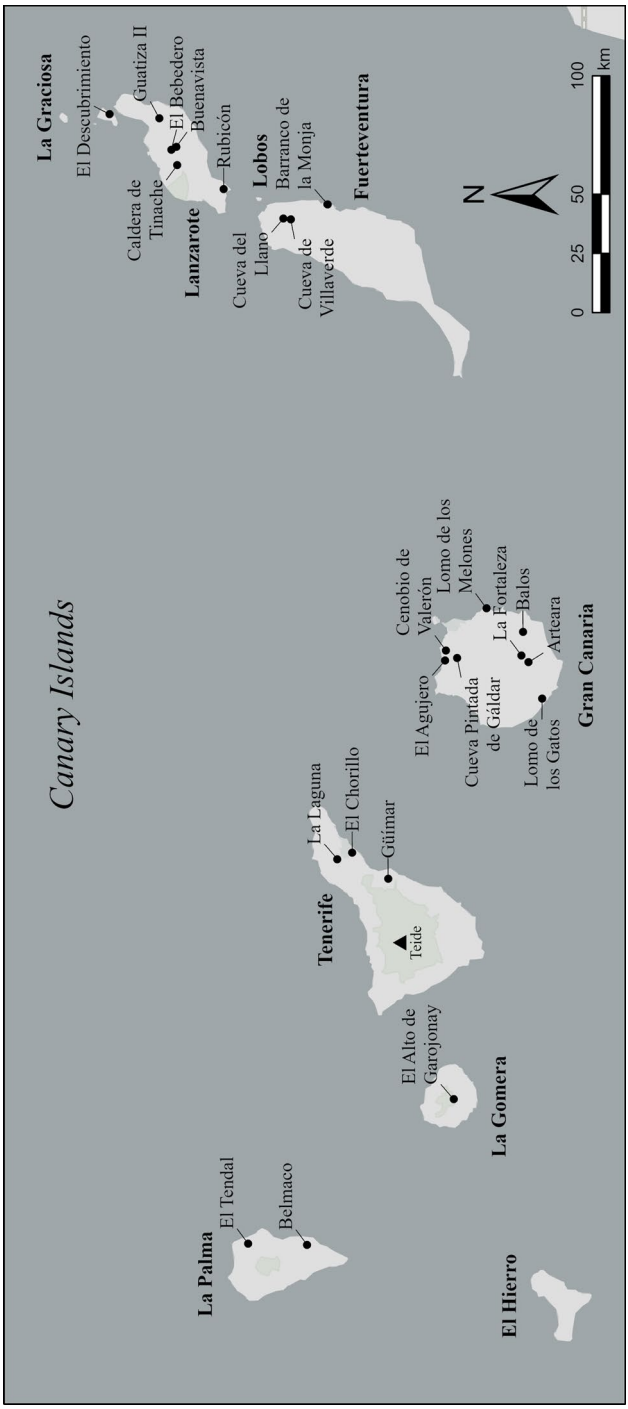

Fig. 4 Map of the Canary Islands and adjacent parts of North Africa showing key archaeological sites of precolonial date mentioned in the text

Mitochondrial (Santos et al. 2010) and Y-chromosome (Flores et al. 2003) studies of the archipelago's present-day inhabitants suggest at least two movements of people from North Africa, the first affecting all the islands, the second concentrated at its eastern end in Fuerteventura and Lanzarote. Dialectical differences between the islands support this interpretation (Reyes-García 2000, p. 1768). So, too, does the absence from the archipelago of crops introduced to North Africa in the early centuries AD (hulled wheat, pearl millet, sorghum; Morales Mateos 2006, p. 352) and the genetics of the barley grown on the islands prior to Spanish conquest (Hagenblad et al. 2017). Aspects of funerary practices on Gran Canaria that I discuss further below (Alberto Barroso et al. 2021, 2022b) also suggest a second arrival of people from the North African mainland. The mitochondrial DNA of Canarian goats, on the other hand, points to a single founding caprine population that spread across the archipelago from east to west (Ferrando et al. 2015).

Archaeological claims for human presence in the Canaries reaching back significantly beyond 1000 BC can now be readily dismissed. Both the caprine bones from Guatiza II on the island of Lanzarote (Zöller et al. 2003) and those from Barranco de la Monja on its southern neighbor Fuerteventura (Onrubia Pintado et al. 1997) come from patently mixed and/or poorly dated stratigraphic contexts that are certainly not 3000–5000 years old as previously claimed (Criado Hernández 2006). Likewise, house mouse remains from Cueva del Llano, also on Fuerteventura, are now directly radiocarbon-dated to the second millennium AD (Alcover et al. 2009) instead of having the early Holocene age initially argued by Castillo et al. (2001). This underlines the importance of establishing human presence from evidence that is both directly linkable to people (house mice could not have reached the Canaries other than by hitch-hiking on boats) *and* directly dated.

Consideration of paleoenvironmental proxies that have been advanced to establish when people arrived on the islands and began modifying the ecologies they encountered reinforces this point, since neither human agency nor tightly controlled dating is readily or reliably demonstrable (de Nascimento et al. 2020, p. 13). For example, while charcoal frequency increases in pollen cores on Tenerife and Gran Canaria from roughly 2300 years ago, and in the latter a decline in arboreal taxa is also apparent (de Nascimento et al. 2009, 2016), the dating of both sequences depends on interpolation from a tiny number of radiocarbon dates run on bulk sediment samples, a less than ideal material for such analyses. The possibility that subtle shifts in climate associated with the globally cooler Neoglacial period influenced vegetation composition on these islands and on La Gomera, where charcoal frequencies show peaks c. 3100 and 1800 years ago (Nogué et al. 2013), also requires consideration. Significantly, no paleoenvironmental sequence has yet produced evidence of cultivation predating cereal remains or house mice from archaeological sites that are directly dated to the second to fourth centuries AD (Alcover et al. 2009; Morales et al. 2017).

When, then, did people arrive in the Canaries? Answering this question from the archaeological evidence has long been bedeviled by a reliance on radiocarbon dates run on frankly untrustworthy materials—unidentified organic sediment, ash or charcoal of unknown origin—that may well include carbon older than the phenomenon for which a date is sought. For example, the discrepancy between the dates for a

wooden plank (1935±65 BP, GX-15959, 52 cal. BC–cal. AD 242) and associated human remains (693±81 BP, GX-18748, cal. AD 1180–1420) at El Chorillo, Tenerife, is at least 900 years (Velasco Vásquez et al. 2020). Applying the chronometric hygiene protocols that are now widely used elsewhere in island archaeology (e.g., Fitzpatrick 2006; Wilmshurst et al. 2011), Velasco Vásquez et al. (2020) recently analyzed over 400 radiocarbon dates from across the archipelago. Ignoring samples that might display old wood effects (wood, charcoal), require marine reservoir corrections (shellfish), or come from unreliable laboratories (Gakushuin, Japan) and focusing only on high-quality short-lived materials such as seeds and bones, they show that there is *no* secure evidence of human presence anywhere before the second–third centuries AD. The very few potentially contrary instances (caprine bones from El Bebedero and Caldera Tinache 05 on Lanzarote) have such large ranges once calibrated that they could just as easily concur with the rest of the dataset. In other words, they do not provide a sound basis from which to argue for earlier settlement (Alberto-Barroso et al. 2022a). Colonization, thus, appears to have taken place early in the first millennium AD, with the oldest evidence coming from the eastern end of the archipelago (i.e., Lanzarote, Lobos), closest to Africa (Velasco Vásquez et al. 2020) (Table 1).

Scrutinizing the available radiocarbon dates also enhances our understanding of *how* settlement took place. As already indicated, arguments implicating the Classical civilizations of the Mediterranean in the initial settlement of the Canarian archipelago are longstanding. One possibility has centered on the Phoenicians or Carthaginians and postulates that colonization began by at least the mid-first millennium BC to develop an infrastructure for exploiting the islands' rich tuna fisheries and extracting valuable purple dye from locally available shellfish (Atoche Peña 2006; González Antón et al. 1998; Mederos Martín and Escribano Cobo 2015). However, radiocarbon dates on unreliable materials from Lanzarote (Atoche Peña and Ramírez Rodríguez 2017) and TL dates with very large standard errors on two typologically unidentifiable sherds from a nonprimary context in fossil beach deposits at El Descubrimiento on La Graciosa (González Antón and del Arco Aguilar 2009) fail to offer firm support for this scenario. Other evidence is comparably weak, including the previously mentioned Zanata Stone, the vague parallels adduced by Atoche Peña and Ramírez Rodríguez (2011) between infant pot burials on Tenerife and Gran Canaria and those from Punic/Phoenician North Africa, and a supposedly Punic/Phoenician stone well at El Rubicón, Lanzarote, that is generally thought to be of 15th century Norman origin (Martín Ruíz 2015). Arguments that the Canaries were strategically important for Phoenician/Carthaginian trade along the West African coast (e.g., Santana Santana and Arcos Pereira 2006) are also unlikely, given the lack of hard evidence in the first place (Roller 2006) and the improbability that, even if it did take place, it would have justified more than ephemeral visits to the archipelago (Medas 2008). For all these reasons, Punic/Phoenician-mediated settlement of the islands should be excluded (Alberto-Borraso et al. 2022a; Martín Ruíz 2015).

In contrast, the Canary Islands were certainly known to Classical Rome. Plutarch's *Life of Sertorius* (8) may refer to Fuerteventura and Lanzarote in a context dating c. 75 BC, but Pliny's *Natural History* (VI, 37) provides the first definite account. Pliny reports an expedition sent into the African Atlantic by Juba II of Mauretania

(modern northern Morocco; reign 25 BC–AD 23) in the decades immediately aside the birth of Christ. He describes seven islands, one with "perpetual snows" (a reference presumably to Mount Teide on Tenerife), and mentions the presence of giant lizards, birds, and "dogs" (possibly seals). However, despite noting "a small temple" on an island he calls Junonia Major (El Hierro? La Palma?) and traces of buildings on a second (Canaria = Gran Canaria?), Pliny gives no indication that the archipelago was inhabited, emphasizing instead that it lay *beyond* the dye factories Juba had previously established on other islands along the African coast. Despite this—and the lack of any further mention by Classical authors (other than in Ptolemy's early second century *Geography*; Marx 2016)—there is now clear archaeological proof of Roman activity in the archipelago at broadly the time of Juba's explorations.

The evidence comes from Lobos, a small islet just off the coast of Fuerteventura in the east of the Canaries. Here, on the island's more sheltered side, a late first century BC/early first century AD site, Lobos 1, has yielded hundreds of Roman potsherds (mostly Dressel 7/11 and Haltern 70 transport amphorae from southern Spain) as well as several hundred fragments of metalwork (in copper, iron, and lead). Activity appears to have been principally directed at extracting purple dye from *Stramonita haemastoma* shells on a scale that easily matches the evidence from Morocco's Atlantic coast (del Arco Aguilar et al. 2017). Deep-sea fishing using hooks, nets, and harpoons (Rodríguez Fidel and del Arco Aguilar 2020), and possible whaling (Bernal Casasola 2018), are also attested. Rare examples of Roman amphorae recovered off the coast of Tenerife and some of the other islands are at least partly of comparable age (Escribano Cobo et al. 2014), although none come from archaeologically secure provenances or known shipwrecks (Chávez Álvarez and Tejera Gaspar 2010).

The Lobos 1 evidence is amplified by finds from Lanzarote, immediately to its north, where two sites in sheltered inland (~8 km) locations had commanding views and at least seasonally good water supplies on this arid island. El Bebedero has produced a few copper and bronze items of Mediterranean origin and wheel-turned ceramics made in Spain, Italy, and Tunisia. Pig, caprine, and fish bones are also present. The age at death of the sheep/goat remains suggests that the site was occupied seasonally (February to April) to produce meat for Roman sailors engaged in catching and salting tuna over the summer months (Atoche Peña 2006). Finds similar to those from El Bebedero come at comparably low density from a multiroomed quadrangular basalt structure at Buenavista, just a few kilometers away, although here the ceramics are not stylistically diagnostic. Significantly, given the lithic base of Indigenous Canarian technologies, flaked stone is extremely scarce, but one flint flake must come from beyond the archipelago (Atoche Peña et al. 2010). Multiple dates exist for both sites (Atoche Peña and Ramírez Rodríguez 2017). Those on short-lived materials with acceptably small standard errors restrict occupation to between the early second and fourth centuries AD (Velasco Vásquez et al. 2020), consistent with Lanzarote's oldest known human burials (Alberto-Barroso et al. 2022a).

Who was responsible for the El Bebedero and Buenavista sites is uncertain—Roman sailors or settlers of North African origin? However, the material culture from both clearly confirms contact with the Roman world, if not intermittent occupation by people originating there. Nothing, on the other hand, points directly to the North African

mainland, 100 km to the archipelago's east, although the situation is complicated by the limited state of archaeological knowledge of southern Morocco and Western Sahara. Neolithic groups who exploited shellfish, fish, and marine mammals along that coastline into the first millennium BC (Close 1984) constitute a potential source population (Serra Ràfols 1971), one whose lithic technologies might be usefully compared with those employed in the Canary Islands. However, we continue to lack evidence that would explain how, or why, people from northwest Africa would choose to settle an oceanic archipelago that was barely, if at all, visible from the mainland—and to do so in what must have been deliberate acts of colonization involving the transportation of people, animals, and crops. A hypothetical Roman decision to deport whole communities to the Canaries (Atoche Peña 2013; García García and Tejera Gaspar 2018) is strikingly at odds with the general imperial practice of enslaving or killing other troublesome groups and lacks historical parallels (Woolf 2016). Instead, might it be that awareness of the Canaries attracted people there who were keen to avoid conflicts stimulated by greater aridity in the western Sahara and Sahel in the first centuries AD (Bouimetarhan et al. 2009) and Rome's push south of the Atlas Mountains during the reign of Claudius (AD 43–54) (Sterry et al. 2020)?

Raising points such as these, and intensifying research in those parts of the African mainland from which the ancestors of the Indigenous Canarians presumably came, would encourage acknowledgment of the latter's agency in the archipelago's settlement rather than denying it, which is what privileging the Classical Mediterranean has hitherto tended to convey (cf. Atoche Peña 2008). Combined with further efforts at chronometric hygiene within the Canaries, it might also facilitate progress in unraveling the circumstances in which individual islands were settled. Biogeographical considerations clearly influenced, though they did not always determine, the order in which people colonized other archipelagos (e.g., Cherry and Leppard 2018; Dawson 2013). For the Canaries relevant factors include closeness to Africa, relative aridity (which decreases from east to west, i.e., further from the mainland), size (Tenerife and Fuerteventura together make up almost half of the total land mass), ecological diversity (Tenerife and Gran Canaria score highest here), and intervisibility (comparatively short distances between the islands and high-elevation peaks on all but Fuerteventura and Lanzarote mean that the entire chain is intervisible, if only in stages; Benn 2020; Table 1). Further modeling could address how target-to-distance ratios, winds, and currents might have affected people's ability to reach each island, exploring this against an increasingly large and robust radiocarbon dataset and the kinds of boats that early settlers might have had. Where dates and surveys are sufficiently comprehensive, expansion of settlement within individual islands could also be modeled (cf. Hernández Marrero and Navarro Mederos 2011/2012; Moreno Benítez 2014; Pérez Caamaño et al. 2005).

Altering: Subsistence and Transformation

Whenever and however, people established themselves on the islands of the Canarian archipelago, their settlement of the islands forms a classic example of Leppard's (2017) "Neolithic colonizations." These instances of island colonization by

food-producing societies depended on the introduction of domesticated plants, animals, and agricultural practices to recreate a familiar subsistence basis, what Kirch (1984) has termed "transported landscapes." Such introductions tended to bring about significant transformation of the environments encountered. As seen most notably in Polynesia, oceanic islands are particularly susceptible to this kind of disruption because their relative isolation resulted in their ecosystems following distinctive evolutionary trajectories marked by high levels of species endemism, considerable specialization of taxa into specific ecological niches, less complex trophic structures, and a frequent absence of terrestrial predators. Once such predators or competing taxa arrived, native species were at high risk of extinction (Steadman 2006; Weigelt et al. 2013).

In the case of the Canary Islands, a distance of barely more than 100 km from mainland Africa and a maximum geological history of 20 million years sufficed to permit the evolution of a considerable number of endemic taxa, including >600 plant species that represent about two-fifths of their native flora (Francisco-Ortega et al. 2000). Endemic vertebrates were fewer but included the archipelago's only nonflying native mammals: two species of giant (>1 kg) rat that were found, respectively, on Gran Canaria (*Canariomys tamarani*) and Tenerife (*C. bravoi*), plus the smaller lava mouse (*Malpaisomys insularis*) and the Canary shrew (*Crocidura canariensis*), both of which were restricted to the easterly islands of Fuerteventura, La Graciosa, Lanzarote, and Lobos. Only the shrew survives. At least 12 bird taxa, seven of them endemic also became extinct during the Holocene (Illera et al. 2012, 2016). So, too, did the endemic giant lizard (*Gallotia goliath*) of Tenerife and El Hierro (Palacios-García et al. 2021). Two of its smaller relatives, both now critically endangered, survive, *G. intermedia* on Tenerife and *G. simonyi* on El Hierro. The latter, as well as two further taxa (*G. bravoana* on La Gomera and *G. stehlini* on Gran Canaria), nevertheless, shows reductions in body size that may result from predation pressure (de Nascimento et al. 2020).

How far humans were complicit in these losses is uncertain, not least because their timing is, in many cases, still unknown (Crowley et al. 2019). Archaeozoological assemblages show that people did sometimes eat Tenerife's giant lizards and rats (Alberto Barroso 1998), as well as at least two now-extinct birds, the lava shearwater (*Puffinus olsoni*), and the Canary Island quail (*Coturnix gomerae*) (de Nascimento et al. 2020; Rando and Perera 1994). However, both the lizards and the shearwaters persisted into at least the 15th century, suggesting that they had previously found it possible to coexist with Indigenous Canarians. The lava mouse likewise survived on Fuerteventura until at least 500–700 years ago, when European settlers introduced black rats to the island (Rando et al. 2008). By then, however, it had already disappeared from Lanzarote, where *R. rattus* arrived c. AD 650 (Rando et al. 2011). On the much smaller islands of La Graciosa and Lobos, on the other hand, house mouse arrival may have spurred massive growth in the numbers of predatory barn owls (*Tyto alba*) against which *Malpaisomys*' smaller size and possibly slower rate of reproduction would have left it particularly vulnerable (Rando et al. 2011). Lacking evidence of human consumption, other taxa may have disappeared because of predation by the domestic and commensal animals that people introduced. Dogs are known to have been present on all the islands except possibly El Hierro, with cats on

La Palma and Tenerife as well (Morales et al. 2009), while house mice were everywhere, save on El Hierro, La Gomera, and Gran Canaria before contact with medieval Europe got underway (Rando et al. 2014b). All three species are well known as predators of rodents and birds on oceanic islands, and endemic taxa that evolved in their absence are likely to have been highly exposed to the threat they posed (de Nascimento et al. 2020, p. 11). That those predators arrived when the islands were at their most minimal size (measured on a geological timescale) can only have increased the vulnerability of native species (Rijsdijk et al. 2014).

Direct hunting and predation by introduced mammals are, however, just a part of the story. The first Canarians brought with them from North Africa much of the classic Neolithic package found across the Mediterranean basin (Broodbank and Lucarini 2019). Of its four principal domestic animals, only cattle, the largest, were omitted (along with the later additions of donkeys, horses, and camels). Goats (*Capra hircus*), sheep (*Ovis aries*), and pigs (*Sus scrofa*) were instead taken to all seven of the main islands. The balance between livestock and cultivation and the precise form taken by each varied across the archipelago, but archaeology and historical sources show that cereals (and in several cases legumes as well) were grown on all the islands (Table 2). Wherever they lived, people also collected firewood for fuel and building materials, but clearance of land for farming and the direct impact of livestock carried greater consequences for Canarian ecologies, producing extensive landscape change even before late medieval European settlement began (Atoche Peña 2003).

Relevant paleoenvironmental data come principally from pollen sequences in a few favorable lake deposits and from the analysis of charcoal assemblages from archaeological sites. Together, they suggest that some effects were probably quite rapid. For example, cores from the La Laguna lakebed on Tenerife show a decline of both oak (*Quercus* sp.) and hornbeam (*Carpinus* sp.) over the last 2000 years relative to the period before human settlement, with the latter species disappearing totally by 700 years ago and the former persisting only at low levels. Increased frequencies of microcharcoal suggest that burning was one among several likely causes that also included removal for fuel, wood, and fodder. In addition, livestock likely suppressed tree regeneration. Neither oak nor hornbeam is currently recognized as native to the Canaries, underlining the extent to which Indigenous Canarians may have altered the islands' vegetation (de Nascimento et al. 2009). Further evidence comes from two charcoal records. At El Tendal Cave near the northeast coast of La Palma, where the oldest high-quality radiocarbon date—on barley—is 1660±40 BP (Beta-206154, cal. AD 258–537), people were already exhausting locally available firewood sources by the seventh century, replacing them with fuel from higher elevations that must have required greater effort to acquire (Morales et al. 2009). More compellingly, the Cueva Villaverde sequence on Fuerteventura charts the almost complete disappearance of that island's indigenous laurel (*laurisilva*) and dry leeward forests, including taxa such as the strawberry tree (*Arbustus canariensis*), vinhático (*Persea indica*), and Macaronesian laurel (*Laurus novocanariensis* [formerly *L. azorica*]), and their replacement by chenopod shrubs (Machado 2007). Laurel forest and woodland were also considerably reduced on several of the other islands (de Nascimento et al. 2009; Machado Yanes 1999; Machado Yanes and Galván 1998).

Table 2 Inter-island variation in Indigenous subsistence in the Canary Islands according to archaeological and ethnohistoric sources

	Lanzarote	Fuerteventura	Gran Canaria	Tenerife	La Gomera	La Palma	El Hierro
Subsistence strategy							
Cultivation	Yes	Yes	Important	Yes	Yes (rare)	Yes	Yes
Livestock	Yes	Yes	Less important	Important	Important	Yes	Important
Marine resources	Yes	Yes	Mostly fish	Rare	Yes	Yes	Yes
Wild plants	?	?	Yes	Yes	Important	Yes	Yes
Cultivated plants							
Barley (*Hordeum vulgare*)	*Present*	Present	Abundant	Abundant	Present	Abundant	*Rare*
Wheat (*Triticum aestivum*)	–	Present	Present	Present	?	Abundant	–
Beans (*Vica faba*)	–	–	Present	–	–	Present	*Rare*
Lentils (*Lens culinaris*)	–	Present	Common	–	–	Present	–
Peas (*Pisum sativum*)	–	–	Present	Rare	–	–	–
Figs (*Ficus carica*)	–	–	Common	?	–	–	–

Archaeobotanical data follow Morales et al. (2017) and Morales Mateos and López (2020). Information in italics draws on ethnohistoric evidence. At European arrival cultivation was no longer practiced on La Palma or Fuerteventura

Pigs and goats probably had even greater impacts than deliberate deforestation. The former trample soils, modify vegetation structure, reduce litter cover and soil arthropod numbers, and eat roots, facilitating soil erosion and weed establishment (Atoche Peña et al. 2018). Goats can be even more transformational, especially where, as in the Canaries, they were kept in large numbers and were free from non-human predators. Being both grazers and browsers, they drive habitat fragmentation and destruction, especially in indigenous woodland, favoring grasses over indigenous flora, reducing soil stability and integrity, changing nutrient pathways in soils, placing pressure on endemic animals, and facilitating erosion (Leppard and Pilaar Birch 2016). Although transhumance between upland and lowland areas would have mitigated some of these effects (Machado Yanes 1999), their overall impact was probably considerable, impoverishing native ecologies and contributing, on Lanzarote and Fuerteventura in particular, to widespread loss of woodland.

Subsistence has been a principal theme in Canarian archaeology over recent decades, tackled using the "hard" evidence of plant and animal remains in archaeological sites as well as insights obtained from stable isotope analyses of Indigenous human remains. Native Canarians were, as I have noted, heirs to the ultimately Near Eastern Neolithic economy that first entered the Maghreb in the middle Holocene. Of its cereal components, barley (*Hordeum vulgare*) was the most widely cultivated crop, attested archaeologically on every island, including Fuerteventura (Morales Mateos and López 2020). Wheat (*Triticum durum*) seems to have been much scarcer and has yet to be identified on El Hierro (Morales et al. 2017). Legumes are less evident, though preservation biases may partly explain this. Lentils (*Lens culinaris*), broad beans (*Vicia faba*), and peas (*Pisum sativum*) were all grown on Gran Canaria, with the first two taxa most common, but evidence is scarcer on Tenerife and La Palma and—so far at least—largely absent elsewhere. Cultivated figs (*Ficus carica*) are only known for certainty from Gran Canaria where they, along with cereals and legumes, were stored in the island's distinctive communal granaries (Morales et al. 2014a). Wild plants also featured in aboriginal Canarian diets, particularly the fruits of the mocán tree (*Visnea mocanera*) and the Canarian date palm (*Phoenix canariensis*), the range of which may have expanded, perhaps even by deliberate propagation, as woodland was lost and vegetation became more open (Morales Mateos and Rodríguez Rodríguez 2007). Wild plant resources may have been particularly important in central Tenerife, where high-elevation areas were occupied, if only seasonally, as part of transhumance routines or to extract and produce the rotary querns used in agricultural settings downslope (Arnay de la Rosa and González Reimers 2007/08; Morales et al. 2021). Other taxa eaten included pine seeds, juniper and wild olive fruits, and fern rhizomes (*Pteridium aquilinum*) (Morales 2003; Morales et al. 2014b).

Transhumance was widely practiced, not only between higher and lower elevations, but also to exploit other seasonal opportunities, such as the contrasts between the better-watered northerly and more arid southerly sides of the island of Tenerife (Pérez Caamaño et al. 2005). Regrettably, pioneering attempts to explore such movements on Lanzarote using strontium analysis of caprine remains proved inconclusive (Cuella del Pozo 2016) and have not yet been followed up elsewhere. Livestock rearing was, however, more than simply a matter of coordinating animal movements

across the landscape. Excavations on La Gomera, for instance, suggest that some animals were kept in pens at settlement sites, provisioned in part by the collection of fodder and bedding materials. Shorter, even daily, movements are also conceivable, including perhaps maintaining some animals in a semi-feral state to be periodically rounded up and slaughtered (Hernández-Marrero et al. 2016). Certainly, different species were exploited in different ways, although caprines were always more common than pigs, and goats were kept in larger numbers than sheep. Data from La Gomera indicate that both sheep and goats were mostly killed as adults, suggesting that milk was the primary reason for keeping them, whereas pigs were typically killed when young for their meat (Hernández-Marrero et al. 2016). Similar conclusions hold widely on Gran Canaria, but pigs were emphasized there more than on the other islands, consistent with a greater importance for both sedentism and cultivation (Alberto Barroso et al. 2017).

Being surrounded by highly productive seas, Indigenous Canarian populations also had access to marine and littoral resources. Shell middens occur throughout the archipelago, typically dominated by limpets (*Patella* spp.), but also featuring other taxa such as *Phorcus* spp. and *S. haemastoma*. Some middens may have been habitation sites, but many were likely used to collect shellfish and extract and dry the meat for consumption elsewhere (Alberto Barroso 2002a; González-Ruíz et al. 2021; Mesa Hernández 2006; Parker et al. 2020). Analysis of the $\delta^{18}O$ signatures of black limpet (*Patella candei*) shells from middens on La Gomera, La Palma, and Tenerife indicates that collection of this endemic species was avoided in the coldest months of the year, while the absence of changes in shellfish size suggests that collecting intensity remained relatively constant (and sustainable) throughout precolonial times (Parker et al. 2020). Shellfish were collected from the intertidal zone or just below it, and sites were frequently near submerged rocky platforms immediately offshore that would have been rich in limpets. Fishing also seems to have favored shallower areas closer to the shoreline rather than deeper waters. Taxa represented include Mediterranean parrotfish (*Sparisoma cretense*), moray eels (Muraenidae), sea bass and grouper (Serranidae), and sea bream (*Diplodus* sp.), while techniques included the capture of sardines (*Sardina pilchardus*) using nets made from plant fibers (Martín Oval 1985; Rodríguez-Santana 1996).

Evidence from the analysis of plant and animal remains is complemented by the rich opportunities for exploring diet and other aspects of lifestyle that arise because a longstanding research emphasis on cemetery excavation has provided Canarian archaeologists with large samples of human remains. Stable isotope studies focused on variation in $\delta^{15}N$ and $\delta^{13}C$ values show, for example, that on El Hierro in the west of the archipelago diet largely comprised fish, shellfish, and meat/milk from terrestrial mammals (overwhelmingly goats; Alberto Barroso 2002b). However, it included only a limited intake of plants (Arnay de la Rosa et al. 2010), matching the island's restricted archaeobotanical evidence for cultivation (Morales et al. 2017). In contrast, seafoods were eaten less on Tenerife, where meat and milk from livestock played a larger role (Arnay de la Rosa et al. 2011). La Gomera shows a similar signature, but intense dental attrition suggests that difficult-to-process wild roots and palm fruits compensated for the low profile there of cultivated foods; marine resources may have been more important early on before food production was well

established (Arnay de la Rosa et al. 2009a; Sánchez-Cañadillas et al. 2021). Finally, results from Gran Canaria show that grain was significantly more important there than on the other islands, again in keeping with the archaeobotanical evidence (Arnay de la Rosa et al. 2010).

In the absence of metal ores or flint anywhere in the archipelago, rocks of volcanic origin were central to the technologies used in agriculture, fishing, and herding, as well as to many other tasks. Basalt, phonolite, and trachyte were the most common materials employed for making knapped tools, along with obsidian, the use of which was particularly intensive on Tenerife (Hernández Gómez and Galván Santos 2008). Use-wear studies from across the archipelago document their collective employment in animal butchery and in working soft vegetable fibers, hide, bone, and wood. Ground stone tools (i.e., picks), on the other hand, occur only on Gran Canaria, while pebbles helped shape handmade pottery, and rotary querns and other grindstones were used to grind grain (Rodríguez Rodríguez 2009; Rodríguez Rodríguez et al. 2017). The excellent preservation conditions characterizing many cave sites in the Canary Islands have also favored the survival of organic technologies. Digging sticks, shepherds' staffs, baskets, rope, matting, the funerary boards used to transport and bury the dead, and even wooden doors have all survived, particularly in caves and granaries on Gran Canaria (Morales 2003). Analysis of woodworking marks and debris identified several *chaînes opératoires* and a preference for using pine and fig as raw materials (Vidal-Matutano et al. 2021).

Diversity: Variation in Island Trajectories

Shifting the focus of archaeological research away from poorly substantiated claims that link human settlement of the Canary Islands with Phoenician colonies in the Mediterranean and their Carthaginian successors or overemphasize their connections to imperial Rome allows us to appreciate more clearly the varied and dynamic history of Indigenous Canarians in the millennium and more preceding the arrival of medieval European traders and settlers. This does not mean that the islands were completely isolated from the wider world: a reference to the mid-12th century geographer al-Idrisi hints at one Muslim expedition from Lisbon, Portugal (Levtzion and Hopkins 2000, pp. 130–131), while funerary monuments on Gran Canaria indicate links to North Africa in the late first millennium AD (see below). However, a refocusing on the islanders' own history, rather than the islands' connections with elsewhere, usefully highlights how the historical trajectories taken by aboriginal Canarians varied across the archipelago in spheres other than subsistence.

One crucial element here is to determine how far individual islands remained in contact with each other after initial settlement. Early European chronicles describe two kinds of watercraft: inflated skins that allowed movement between Fuerteventura and Lanzarote (~11 km), as well as perhaps some of the islands to their west, and wooden boats with palm leaf sails said to have linked Gran Canaria to Tenerife (~60 km) and Fuerteventura (~125 km) (Mederos Martín and Escribano Cobo 2005). However, there is no suggestion that such contacts were frequent or that the vessels used could move substantial numbers of people, animals, or goods.

Consistent with this, archaeological evidence for inter-island contact is ephemeral, a few flakes of obsidian from Tenerife on La Gomera, for example (Navarro Mederos 1997, p. 492). The archaeobotanical picture of a general decline in crop diversity across the islands with time supports this. It suggests that Fuerteventura and Lanzarote quickly became isolated from the rest of the group, but that seed exchange may have persisted longer between Gran Canaria and Tenerife in the archipelago's center (Hagenblad and Morales 2020). Analyses of human aDNA from La Gomera and El Hierro further suggest that the populations of individual islands experienced long-term isolation, compounded genetically by strong founder effects in small colonizing groups (Calderón Ordóñez et al. 2017; Fregel et al. 2015).

Individual island histories, therefore, seem to have developed largely on their own, as potential variants on a common theme. As already discussed, no single pattern of subsistence is evident across the entire Canarian archipelago. Nor, indeed, should we expect one, given the variation in the size, topography, and environments of its individual islands (Table 2). However, there is also evidence for important changes in diet over time. That La Gomera's inhabitants may have consumed more marine foods early in the island's history is one example (Arnay de la Rosa et al. 2009a) that fits well with a general pattern found in many other instances of insular colonization (e.g., Anderson 1991). The abandonment of cultivation on La Palma, one of the best-watered islands, is more puzzling and more striking. European accounts indicate that crops were not grown there (or on Fuerteventura) in the 15th century, and archaeology shows them to be absent from post-11th century deposits at the cave site of Belmaco. However, the older site of El Tendal (and the deeper levels at Belmaco) demonstrate that La Palma's inhabitants had, in fact, previously grown not only barley but also wheat, lentils, and beans (Morales et al. 2017). The first three of these crops are also now attested archaeologically on Fuerteventura (at Cueva Villaverde; Morales Mateos and López 2020). Genetic comparisons of modern barley grains from La Palma with those from prehispanic contexts confirm that barley was reintroduced there after Spanish colonization in the 1400s (Hagenblad et al. 2017). Why cultivation would have been abandoned on La Palma remains unknown, though it may have been part of a broader transformation in settlement pattern (Morales et al. 2014b). So, too, is the extent to which it was practiced across the island in the first millennium AD. Further fieldwork is called for, work that should also tackle previously identified hints at inter-site differences in marine food consumption (Pérez González et al. 2001). In any event, explaining subsistence changes on La Palma or elsewhere requires us to consider the social context in which they took place. For that I discuss three interrelated topics: sociopolitical organization, funerary practices, and bioanthropological evidence for patterns of violence. Data are fullest for Gran Canaria.

At the time of initial European contact in the 14th century Gran Canaria, the third largest island in the Canaries, may have had as many as 50,000 inhabitants living in open-air stone-built villages (such as Lomo de los Gatos) and modified caves (e.g., Cueva Pintada de Gáldar). Archaeological plant remains and the communal granaries carved into volcanic tuff that are found only on this island show that cultivation was both more diverse and more important here than elsewhere in the archipelago, with several strategies used to minimize potential loss to pests (Morales

et al. 2014a). Gran Canaria was also the most hierarchically organized of the islands. Velasco Vásquez (1999) argues for distinct endogamous classes, marked by differences in clothing and diet, with one controlling land and distributing the produce from it, the other supplying labor, although less differentiated interpretations are also possible (Rodríguez Rodríguez et al. 2011/2012). Tenerifean society was likewise marked by strong social distinctions. Additionally, the unique, stonewalled structural complex at Zonzamas has sometimes been considered a chiefly base on Lanzarote (Santana Cabrera et al. 2017, p. 3), but looser kinship-based structures operated elsewhere in the archipelago (Morales et al. 2009). All the islands were nevertheless divided into multiple chiefdoms with variable degrees of internal cohesion (Adhikari 2017). Known as *menceyatos* on Tenerife, buffer zones between them were used for transhumant pastoralism or the extraction of other resources, such as obsidian (Hernández Gómez and Galván Santos 2008). Archaeological surveys have sought to identify the territorial limits implied by documentary sources, some of them marked by concentrations of burials in caves that may have asserted and legitimized claims to land ownership (Jiménez Gómez et al. 2006; Mederos Martín and Escribano Cobo 2008, 2017).

On Gran Canaria the construction and maintenance of communal granaries such as those at Cenobio de Valerón and La Fortaleza first appeared in the 11th–12th centuries (Alberto Borraso et al. 2022b). Such installations presumably offered aspiring leaders one means of manipulating social relations to their own benefit. That production and distribution of key resources may have been controlled to such ends is hinted at archaeologically. For example, the open-air settlement of Lomo los Melones was very different from Cueva Pintada de Gáldar, a complex of around 60 stone-built structures around a cave well known for its rock art that was an important precolonial political center (Onrubia Pintado et al. 1996). In both cases fig and barley seeds show no sign of being processed on-site, implying that here, at least, access to these crops was in some measure indirect (Rodríguez Rodríguez et al. 2011/2012). On Gran Canaria, as well as on Tenerife, lithic technologies also imply a degree of specialization, both in the extraction and manufacture of obsidian tools (Rodríguez Rodríguez and Hernández Gómez 2006) and in those of grindstones and rotary querns made from basalt and volcanic tuff (Arnay de la Rosa et al. 2019; Naranjo-Mayor et al. 2016, 2019). Ceramics on Gran Canaria (e.g., at the site of La Cerera) also became more standardized over time, including the manufacture of elaborately decorated vessels that may have been primarily used in serving/eating food (at feasts?) rather than in preparing it and that perhaps denoted the identities of the groups involved (del Pino Curbelo et al. 2016; del Pino Curbelo and Rodríguez Rodríguez 2017). In sum, multiple signals suggest that during the last few centuries before Castile's 15th century conquest of the island the production and distribution of food and artifacts on Gran Canaria were becoming more centrally controlled (Morales et al. 2014a).

A variety of ritual practices and burial evidence from caves as well as open-air tumuli and stone cists (e.g., Bernal Santana and Atoche Peña 2008; Lecuona Viera and Atoche Peña 2008) support this and document significant changes in ritual and social arrangements over time, further illustrating the dynamism of precolonial Canarian societies. Alberto Barroso et al. (2019, 2021, 2022b) demonstrate via

Bayesian modeling of over 100 radiocarbon dates that Gran Canaria's inhabitants initially used funerary caves as burial places. By the seventh century, however, and probably corresponding with settlement of the entire island, there was a marked shift to cemeteries of stone tumuli that were almost invariably used for individual burials and were less closely linked to contemporary settlements. This emphasis on the individual along with the physical prominence accorded tumuli within the landscape imply a "materialization of asymmetry and hierarchization of interpersonal relations" (Alberto Barroso et al. 2019, p. 156). At the site of El Agujero this was reinforced by a pattern in which a few male graves were centrally positioned, with others arranged around them, and by a strong bias toward male burials overall (Santana Cabrera 2009/2010). Bioanthropological studies confirm that men and women engaged in significantly different daily activities, with men undertaking more movement, load carrying, and heavy work, and women more repetitive labor likely linked to craft production and agriculture. Such differences were more marked at El Agujero than at the nearby cemetery of Juan Primo (Santana Cabrera 2009/2010). Women also ate more plants and shellfish (gathered/cultivated foods) than men, whose diets were instead richer in meat and fish. Similar differences are evident on Tenerife and El Hierro as well (Arnay de la Rosa et al. 2010; Delgado Darias 2009).

Although sharp differences that might speak to class distinctions are not obvious, on Gran Canaria both sexes (if more particularly men) experienced high levels of physical aggression, judging from the frequency with which their remains show evidence of skeletal trauma (Delgado Darias et al. 2018). In at least one, late sixth/early seventh century instance from the Guayadeque Ravine this probably involved multiple individuals at the same time. Delgado Darias et al. (2022) suggest that this may indicate increased violence (raiding or other forms of confrontation using slings or wooden clubs?) that preceded and was associated with the emergence of a novel cemetery and settlement pattern and new forms of social relations broadly coincidental with the island's comprehensive agricultural occupation (Moreno Benítez 2014). Tellingly, although it is far from unknown, interpersonal violence is less evident in skeletal samples from the rest of the archipelago, with Tenerife showing the highest levels (Atoche Peña et al. 2008; Owens 2007).

An additional impetus to the competition implied by the Guayadeque Ravine remains may have come from a further—though not necessarily large—pulse of settlement from North Africa, where tumulus burial was practiced until the end of the first millennium AD, and the introduction of Islam and expansion of trans-Saharan trade from the late seventh century may have encouraged some communities to seek refuge beyond the horizon (Alberto Barroso et al. 2021, 2022b). Regrettably, Gran Canaria's tumulus burials are not sufficiently well preserved to permit paleogenetic studies, but analysis of human remains from funerary caves does point to a second movement of people into at least the east of the archipelago sometime after its initial colonization (Fregel et al. 2019). Regardless, however, of the circumstances in which tumulus burials arose, they did not persist; only at Arteara is there an (early) second millennium date, and the important settlement complex at Gáldar was also abandoned in the 11th to 13th centuries (Onrubia Pintado et al. 2004). Social relations, thus, probably underwent further change in the centuries immediately preceding the Spanish conquest of Gran Canaria, when burials in open-air graves or stone

cists were most frequent, along with some continuing use of caves (Alberto Borraso et al. 2022b). The tendency to locate pit graves and cist burials close to settlements is especially evident near the coast, which appears to have become significantly more densely populated from the 1200s onward in parallel with a growing contribution of marine foods to Gran Canarian diets (Lécuyer et al. 2021). Unsurprisingly, this nutritional signal is less obvious in the island's central highlands where higher frequencies of dental caries imply consumption of greater amounts of carbohydrate- and sugar-rich foods (dates, figs). Coastal burials also have much a higher incidence of abnormal bone growth in the ear from repeated exposure to cold water, consistent with their enhanced marine isotopic signal. European chroniclers report that at the time of contact community leaders were well known for their fishing and diving skills (Delgado Darias et al. 2005), suggesting a further tie between diet, activity, burial, and social standing.

Beyond Gran Canaria some of the most extensive investigations of Indigenous Canarian social organization have focused on the island of La Gomera, where community ritual rather than hierarchical relations seems to have been key in integrating what was a much smaller population. Over 60 drystone altar sites are found across the island, all in elevated locations commanding excellent views. The most significant, El Alto de Garajonay, dates to the seventh to 12th centuries and is sited at the island' center and on its highest peak. It and three similar sites, all falling within the territory of La Gomera's most senior 15th century lineage, also have large cemeteries and rock art associated with them. Excavations at El Alto produced over 500,000 faunal remains, almost exclusively of caprines, plus the island's only known instances of pigs. Only heads and feet are present, implying systematic butchery and disposal elsewhere (via ritual feasting?) of other body parts with higher meat yields. The firewood used, Canarian pine, must have been introduced from lower altitudes, reinforcing the effort to which people went to conduct ceremonies there. The repetition of these activities over several centuries further emphasizes El Alto's importance to La Gomera's inhabitants (Alberto Barroso et al. 2015). Other stone-built altars are known on El Hierro and La Palma, although with differences in location and associations, suggesting that communal feasting and ceremony may have been important beyond La Gomera in binding communities together. In contrast, they are extremely unusual on Gran Canaria and completely unknown on Tenerife, the two islands where social relations assumed their most hierarchical form (Navarro Mederos 2001). Across the archipelago, rock art (in the form of both paintings and engravings) was probably also involved in acts that drew people together and reaffirmed ties between them, creating symbolically rich landscapes, for example, in upland areas of Tenerife, La Palma, El Hierro, and Fuerteventura (Farrujia de la Rosa 2014, pp. 80–94; Hernández Pérez 2016).

Contact, Colonization, and Resistance

The Canary Islands were the first Macaronesian archipelago that medieval Europeans encountered, their inhabitants the first of many more in Africa and beyond to be subjected to invasion, conquest, enslavement, and acculturation. In many

respects, the history of these events parallels later developments farther south along the African seaboard as well as across the Atlantic in the Caribbean and the wider Americas (Tejera Gaspar and Aznar Vallejo 1992). As a result, Canarian archaeology is well placed to contribute to those wider discussions of cultural encounter, expansion, dispossession, colonization, and resistance often subsumed under the rubric of Crosby's (1972) "Columbian Exchange" (Fig. 5). The first known medieval European visitors reached the Canarian archipelago in the early 14th century. Raiding for slaves and trading metal tools and other trinkets for orchil lichen (*Roccella* spp.) and the sap of the dragonwood tree—both valued as sources of textile dyes—intensified after a Portuguese expedition in 1341. Missionaries were also sent to convert the Canarians to Christianity, although with little immediate effect (Aznar Vallejo 2008). The islands attracted attention from both Iberian and Italian merchants and settlers, but their outright conquest was initiated by Normans, who, acting on their own initiative, albeit in the name of the Spanish kingdom of Castile, seized control of Lanzarote in 1402. Nearby Fuerteventura along with El Hierro at the other end of the island chain were also quickly targeted, likely because Indigenous populations were small and comparatively unorganized on all three. Archaeologists have explored some of the sites established by these early Norman settlers, notably San Marcial del Rubicón on Lanzarote (Tejera Gaspar and Aznar Vallejo 1989) and Rico Roque on Fuerteventura (Tejera Gaspar et al. 1998). Norman interests were succeeded by those of Castilian nobles and then by the more direct involvement of the Castilian monarchy itself. This provided the impetus, manpower, and resources to assault the remaining islands, especially those with the largest populations—Gran Canaria and Tenerife. Invoking a tactic of *divide et impera* that saw the Castilians ally themselves with some Indigenous *menceyatos* against others, the conquest of Tenerife was eventually completed in 1496, four years after Columbus reached the New World (Crosby 1984).

The conquest of the Canaries was marked by warfare and the widespread deportation and enslavement of the Indigenous population, compounded by the effects of famine and diseases to which the Canarians—more-or-less isolated in their archipelago for over a millennium—appear to have had little immunity (Crosby 1984). Its completion saw the islands divided between European settlers and those few Indigenous communities that had collaborated with the conquerors (Fernández-Armesto 1987). Use of the relatively neutral term 'contact' to describe the period's archaeology or the processes involved does not, however, do justice to the violence involved (Onrubia Pintado et al. 1996, pp. 659–660). Direct evidence of that violence is traceable archaeologically, for example on the body of a young man from a cemetery at Los Acarreaderos in Gran Canaria's Agaete Valley. His skeleton shows multiple lesions most likely inflicted from above by one or more sword-wielding horsemen. A radiocarbon date (280±30 BP, Beta-370948) that yields a most likely calibrated age of cal. AD 1505–1596 (55.0%) nevertheless suggests that he was perhaps a victim not of the conquest itself but of resistance to Castilian rule some decades later (Santana Cabrera et al. 2016). Even so, the injuries he sustained underline the limited capacity of Canarian slingshots and wooden weapons against European crossbows, steel, horses, and (at the end) primitive firearms (Crosby 1984).

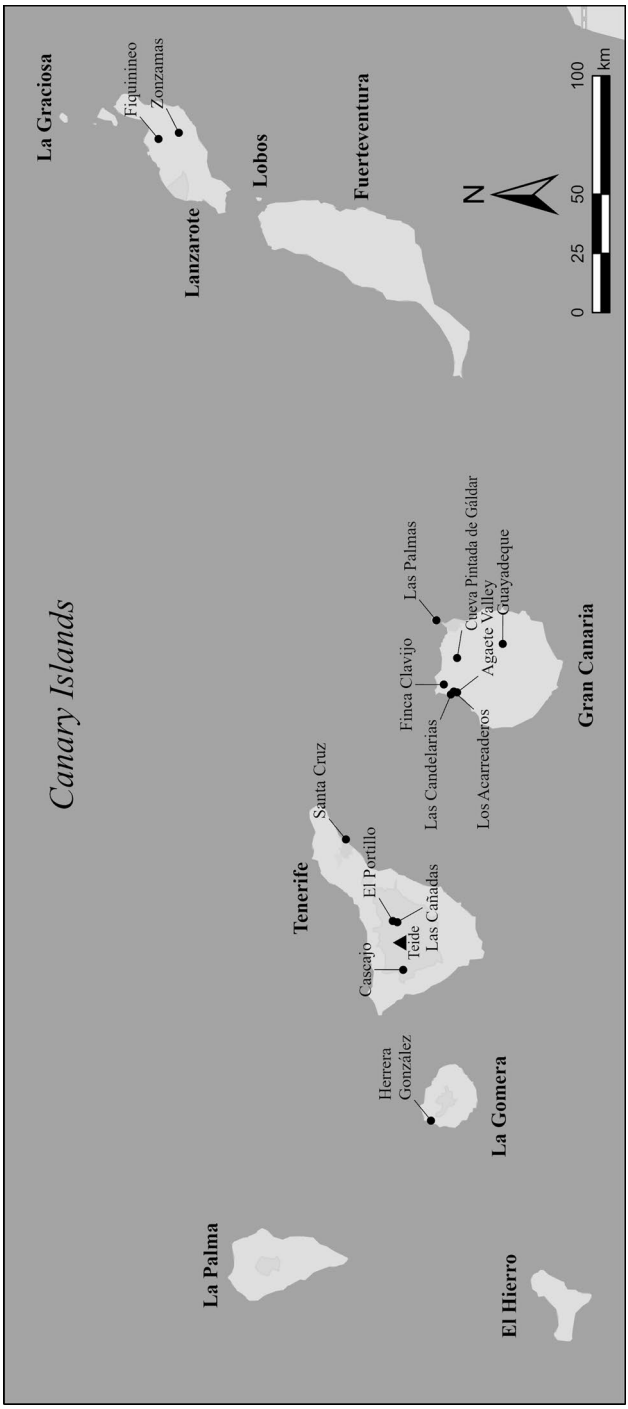

Fig. 5 Map of the Canarian Archipelago showing key archaeological sites dating to the 14th to 19th centuries mentioned in the text

The impact of European invasion is also traceable in the genetic make-up of the archipelago's present inhabitants, which, relative to the ancient DNA of preconquest individuals, shows a marked asymmetry by sex of precisely the kind seen in post-16th century Latin America. This is explicable by the widespread killing of Indigenous men and the interbreeding of surviving Indigenous women with incoming European settlers (Fregel et al. 2009, 2021). In some estimates, no more than 7% of the Y-chromosome ancestry of today's Canarian population has an Indigenous source compared to 33% of their mitochondrial DNA (Maca-Meyer et al. 2005; Rodríguez-Varela et al. 2017); El Hierro, indeed, may have witnessed almost total replacement of its original Bimbape population, albeit with subsequent arrival of people of (partially) Indigenous descent from elsewhere in the archipelago (Fregel et al. 2019). Removal of (mostly male) Indigenous Canarians from the islands as slaves compounded processes happening within the archipelago. Documentary sources confirm their use as shepherds and, more extensively, as laborers on developing sugar plantations on Madeira, which the Portuguese began settling in the 1420s (Fernández-Armesto 1987, p. 20). Others, from the 14th century onward, were seized and taken to Spain (Crosby 1984).

As the Los Acarreaderos individual shows, Canarians resisted colonization. The ferocity of their resistance in military terms is well documented in historical sources (Crosby 1984), but archaeology shows that it also took other forms. The rugged, mountainous interiors of many of the Canary Islands provided people with opportunities, however, fleeting, to seek refuge from invasion or the systems of control imposed in its aftermath. In this they bear comparison to many other African—and non-African—islands where such settings provided similar havens (e.g., Chowdhury 2015). In the Canaries, for example, the Las Cañadas plateau extending around the El Teide volcano at the heart of the island of Tenerife provided refuge for Indigenous Canarians and escaped slaves alike (Arnay de la Rosa and González Reimers 2007/2008). Burials of post-Conquest age at El Portillo and Cascajo were undertaken in ways consistent with precontact, rather than Christian, practice, while stable isotope values suggest a shift toward a more plant-based diet, perhaps because of problems in accessing livestock in large numbers (Arnay de la Rosa et al. 2011). Continued Indigenous settlement well into the 16th, if not 17th, centuries is also evident at Chasogo, located almost 2000 m a.s.l. (Morales et al. 2021). Other signatures are difficult to assign to aboriginal groups rather than other categories of the oppressed within colonial society. Charcoal production, for instance, was tightly regulated and, therefore, often carried out clandestinely. The circular stone structures in which it took place were, thus, frequently hidden away, although located with good views and access to key materials: stands of *retama* (*Spartocystis supranubius*) for making the charcoal itself and the presence of volcanic sand to help create the necessary reducing atmosphere (Baucells Mesa et al. 2008).

Castile's conquest of the Canary Islands was a drawn-out affair, taking almost 200 years from initial contact to the final takeover of Tenerife. In that time, and afterwards, multiple forms of cultural borrowing occurred. Well-known examples include the production of exact skeuomorphs of Castilian metal weapons and fishhooks on Gran Canaria in the second half of the 15th century and the veneration on Tenerife of a washed-up image of the Virgin and Child that had its origins in the

1390s (Owens 2005). More prosaically, there is archaeological evidence for Canarian adoption of new subsistence resources. These included the breadwheat (*Triticum aestivum*) of late 15th–16th century date recovered from traditional granaries at Guayadeque on Gran Canaria, although this may still have been processed and consumed like the durum wheat with which the islanders had long been familiar (Oliveira et al. 2012). Cave sites at Herrera González on La Gomera suggest that while 15th century Native Canarians continued to emphasize caprine herding, they also now kept chickens and rabbits, as well as acquiring a taste for imported Portuguese glazed pottery (Hernández-Marrero et al. 2016). Other sites, too, show a continuity of occupation across the imposition of Castilian rule, but with shifts in material culture or group composition. For example, at Fiquinineo—a sand-covered open-air site on Lanzarote—the Native population was joined by individuals brought as slaves from North Africa (de León Hernández et al. 2014). In another instance, from the late 1400s at Cueva Pintada de Gáldar on Gran Canaria, hearths came to be placed inside dwellings rather than outside them, and the inhabitants gained access to imported metal tools, glassware, and pottery (Onrubia Pintado et al. 1996). Colonization also saw at least some of them shift their previous highly unusual preference for consuming pigs to emphasizing caprines, although the reasons for this and its extent remain unclear (Castellano-Alonso et al. 2018). More generally, the archipelago's Indigenous cultural heritage survived in multiple ways, including crop strains (Hagenblad et al. 2017), foodstuffs (such as *gofio*, a flour made from toasted grains; de Saja Alonso 2001), and place names (Vidal-Luengo et al. 2019). Archaeologically, probably the best indicator is the handmade pottery (water storage jars; perfume jars etc.) that was exported on a substantial scale to Spain, Spanish colonies in the Americas, and the West African mainland in the 17th to 19th centuries (Jiménez Medina et al. 2010; Rodríguez Rodríguez et al. 2017).

The Canarian archipelago's geographical position as a fulcrum in late 15th–16th century voyages between Europe, Africa, and the Americas meant that it played a crucial role in the trans-Atlantic movement of precious metals from Spain's New World colonies as well as in the translocation of plants and animals between all three continents. Santa Cruz de Tenerife, in particular, became a major commercial port. Unless introduced from North Africa or Iberia, where they were known in the Middle Ages (Grimaldi et al. 2018; Watson 1983), the bananas/plantains (*Musa* sp.) and taro (*Colocasia esculenta*) already being grown in the islands by 1500 had probably been sourced from West Africa (Santana Pérez et al. 2004). Donkeys, as well as other livestock, on the other hand, were shipped from the Canaries to Spanish colonies in the Americas (Yanes García 2005). Like horses, cattle, camels, and the chickens and rabbits mentioned previously, donkeys were introduced to the archipelago by European settlers in the aftermath of Castile's conquest. Most remained under close human control, but on Fuerteventura feral herds quickly assumed plague proportions, leading to efforts to bring about their wholesale eradication as overgrazing exacerbated the island's aridity (Mann 2011, p. 292).

The impact of larger grazing animals on fragile native floras was not alone in accelerating deforestation and increasing pressure on the archipelago's endemic taxa. Other contributors were intensified agriculture, construction, charcoal production, enhanced hunting, and the introduction of black rats (*Rattus rattus*), which

had been unknown except on Lanzarote before the 14th–15th centuries (López et al. 2013). Consequences included the extinction of Tenerife's goliath lizard and the last surviving lava shearwaters and lava mice, as well as all of the islands' red kites (*Milvus milvus*) and Mediterranean monk seals (*Monachus monachus*) (Illera et al. 2016; Mariano González 2015). Almost certainly several plants, some of them endemic, were also lost, with American-sourced competitors like prickly pear (*Opuntia* spp.) and agave (*Agave* spp.) aggressively invading many lowland areas while spiderworts (*Tradescantia fluminensis*) and sunflowers (*Ageratina* spp.) proliferated in higher elevation forests (Francisco-Ortega et al. 2009). Nor were shellfish populations unaffected: the mean sizes of black limpets, which had remained fairly constant in aboriginal times, declined significantly after the 15th century in the west of the archipelago, probably because of intensified collection (Parker et al. 2020). The species is now effectively restricted to Fuerteventura (González-Lorenzo et al. 2015).

Cultivation of sugarcane (*Saccharum officinarum*) was introduced to southern Spain in the 10th century (Jiménez-Brobeil et al. 2022) and by the 1300s plantations (often powered by enslaved labor) had been established in several areas of the Mediterranean (Curtin 1998). Along with the Portuguese islands of Madeira and, a little later, the Cape Verde group, the Canary Islands were one of the first places to which sugar was introduced in the Atlantic, a prequel to Iberian practice later in the Americas. The Canary Islands remained a significant producer until they lost out to New World competition from the later 16th century (Rodríguez 2022, p. 12), and they are the only part of Macaronesia where the industry has been tackled archaeologically. Cultivation concentrated where rainfall, soils, and topography were most propitious, namely on Gran Canaria, Tenerife, La Gomera, and La Palma (Rodríguez 2022). Near Cueva Pintada de Gáldar on the first of these islands, an Indigenous site that continued to be occupied into the 16th century, locally made ceramic sugar molds and in situ mortars suggest either small-scale production or perhaps breaking up of poor-quality sugar for personal use. Copper cauldrons and cooking pots (*ollas*), on the other hand, were used to reduce the juice and purge the resulting molasses so that the sugar could dry out (Onrubia Pintado et al. 1996). Just a few kilometers away, more substantive traces survive at Las Candelarias near Agaete, where a plantation was established as early as 1494. They comprise a mill, the aqueduct that brought water to it, and other structures whose excavation yielded sugar molds (mostly of Portuguese manufacture), local handmade and imported wheel-turned ceramics, and coins of Ferdinand II and Isabella I of Spain (1479–1504) (Marrero Quevedo et al. 2014; Quintana Andrés et al. 2018). Other projects have explored sugar factories on La Gomera (Navarro Mederos and Hernández Marrero 2006) and Tenerife (Pou Hernández et al. 2020).

In some cases, rather than undertaking the work of creating the infrastructure needed to grow crops completely *de novo*, Gran Canaria's new Spanish landowners repurposed existing Indigenous fields and irrigation channels to grow not only vines but also woad (a flowering plant in the mustard family) for use as a dye (Díaz-Serra 2022). Comparable reuse of Indigenous experience in farming in dryland contexts is also discernible on Lanzarote, where a series of agricultural innovations (terracing, water-capture basins, tephra-mulched fields, pits for planting crops, and walled field systems) were successively used to cultivate cereals, wine, fruits, and sweet potatoes

as well as to harvest cochineal beetles. Collectively, these innovations proactively brought about ever greater transformation of the island's landscape in efforts to render a commercial profit (Stevenson et al. 2021).

Excavations at the cemetery of Finca Clavijo on Gran Canaria tie together several aspects of the colonial economy. Fourteen burials dating from the late 15th to early 17th centuries are probably those of men and women working on nearby sugar farms, where African slaves are known to have served as both field laborers and domestic servants (Ronquillo 2008). The Finca Clavijo cemetery constitutes a distinct spatial unit, implying that those interred there held a different status from other members of the community, even if a Catholic medallion in one grave suggests links to a nearby Franciscan convent and all the burials were oriented east–west, largely without grave goods of any kind. Stable isotope and paleogenetic analyses cast further light on the individuals concerned. First, all had engaged in intense physical activity throughout their lives; significant spinal stress, high rates of osteoarthritis, and other signals are consistent with those found on sugarcane workers in the Americas. Second, mitochondrial DNA indicates that one person was certainly of Indigenous Canarian ancestry. Two more may have been as well, although in these cases—plus those of two additional individuals—their haplotypes are also consistent with a broader North African/Eurasian origin. The remaining four skeletons analyzed, however, all had mtDNA traceable to south of the Sahara. Based on their oxygen isotope signatures, one, possibly two, of these individuals, plus one other, had also likely been born and had grown up outside the Canarian archipelago. Some evidence also points to a retention of non-Christian religious beliefs. Two people were buried with glass beads, a detail that may reflect African beliefs and can be paralleled in both North America (e.g., LaRoche 1994) and the Caribbean (e.g., Handler 1997). The DNA of one of them indicates that she may have been of North African origin. Both she and a second individual, a teenager of sub-Saharan descent, were buried in lateral position with the head turned east or southeast. Their orientation and burial position suggest that these two individuals may have been Muslim. Summing up, Santana et al. (2016, p. 309) conclude that the "syncretism of various backgrounds" evident at Finca Clavijo suggests that the people buried there retained the means to signal and recall their identities, even if they may have had little autonomy in many aspects of their daily lives. Documentary sources confirm that, across the islands, slaves drawn from sub-Saharan Africa and the Maghreb, as well as Indigenous Canarian backgrounds, provided the manual labor to cultivate and process sugar (Lobo Cabrera 1996; Viña Brito 2006).

Interdisciplinary bioanthropological studies of those buried in some of the Canary Islands' major churches deliver insights into other sections of colonial society (see Pérez Álvarez 2006, pp. 286–287). The most notable has involved analysis of almost 800 18th century individuals from across the social spectrum recovered during restoration of the Church of the Conception in Tenerife's capital, Santa Cruz, which was founded on the site of the island's first (1494) chapel. Genetic analysis of a sample of these remains confirms that most were of European or Indigenous Canarian descent. However, a notable frequency (15.6%) of mitochondrial haplotypes traceable to the Sahel (Mauritania, Niger, Senegal) and Angola supports Tenerife's role in the onward trade of slaves from sub-Saharan Africa as well as the use of enslaved

but baptized Africans in domestic service (Calderón Ordóñez et al. 2014). The same analyses also established the presence of Native American mitochondrial lineages (1.5%), underlining the importance of the Canary Islands in Spanish colonization of the Americas and attesting to the trans-Atlantic movement of individuals of Native American heritage. Canarian-specific haplotypes from the Caribbean mirror this in the opposite direction (Fregel et al. 2009; Maca-Meyer et al. 2005).

Although skeletal preservation at the Church of the Conception was poor, study of surviving dentitions indicates a cereal-rich diet (Afonso Vargas 2006), something supported by analysis of coprolites (Gijón Botella et al. 2010). Barium/strontium analysis of bones further confirms this, while also indicating the importance of marine foods and increased access to both fish and meat on the part of older children and adults relative to infants, a pattern likely linked to a high incidence of infant mortality (Arnay de la Rosa et al. 2009b; Ramos Pérez and Gámez Mendoza 2014). Associated with the burials was a rich assemblage of jewelry, clothing, and other objects of quotidian or specifically religious use (e.g., crucifixes and rosaries). Details of burial practice were also identifiable, including a tendency for individuals of European maternal descent to be buried away from those of sub-Saharan or Canarian ancestry (Arnay de la Rosa and Pérez Álvarez 2002, pp. 149–156; Gámez Mendoza et al. 2013). As with other historical era excavations in the archipelago, this material finds ready comparisons not only in metropolitan Spain but also colonial Spanish America (Arnay de la Rosa 2009). They include the take-up of the practice of smoking tobacco as attested by numerous pipe fragments and instances of the distinctive dental wear produced by their use. The American origins of tobacco and the Dutch provenance of many of the pipes, like the genetic results obtained from those buried in the church, underline the Canaries' enmeshment in the wider Atlantic economy (Pérez Álvarez et al. 2008).

Discussion

Island archaeology encompasses many different fields of enquiry, from the antiquity of seafaring and maritime dispersals to the conservation and management of island heritage sites (Fitzpatrick et al. 2015, 2016). The rich archaeological record of the Canary Islands, which I have attempted to review here, contributes to many of these. One of the most obvious areas is island colonization. A focus on requiring rigorous demonstration of unambiguous evidence of human activity in securely dated contexts shows that the Canary Islands, like the remainder of Africa's offshore and oceanic islands (Mitchell 2020, 2022), were settled late in human history (≤2000 years ago), notwithstanding their relative proximity to the continent. Issues of maritime technology to one side, some general features are worth emphasizing, particularly the limited degree to which most African islands may have offered wild plant foods or terrestrial vertebrate prey to attract or sustain settlers. The apparent abandonment of the Tanzanian island of Unguja when insularization overtook it and large mammals declined sharply in abundance and diversity at the Pleistocene/Holocene transition illustrates this well (Prendergast et al. 2016). In contrast to many of the islands of the Mediterranean (Dawson 2013), the Caribbean (Wilson 2007), and Melanesia

(Carson 2018), food production may have been a prerequisite of the successful settlement of African islands. Canarian dependence on domestic livestock across the archipelago and evidence of cultivation (at least at one time) on all its islands clearly fit this pattern, reinforced by the paucity of native land animals (birds, reptiles, mammals) and edible plants that could have substituted for these humanly introduced resources (Morales et al. 2009, p. 35).

Across the world human settlement of islands has often been associated with the widespread extinction of animal species that had evolved in the absence of terrestrial predators. In the Canaries, however, although a minimum of 17 vertebrate taxa became extinct during the Holocene, 11 of them endemics, in many cases we still lack firm evidence of when this happened (Crowley et al. 2019). Of those certainly eaten by Indigenous Canarians—Canary Island quails, lava shearwaters, and Tenerife's giant rats and lizards—the last two at least survived into the 15th century, and in all four cases instances of human consumption are rare. Does this apparent lack of interest imply that, with domesticated animals available from the start and native animals relatively unobtrusive and small, hunting was neither nutritionally necessary nor culturally attractive? Recalling Madagascar, where losses were certainly much more profound, but evidence of hunting is also meager (Anderson et al. 2018), what may have been more important in accounting for faunal extinctions are the indirect consequences of human settlement: the habitat transformations wrought by land clearance, the actions of domestic livestock, and the effects of introducing carnivores and novel rodents. In this respect, the Canary Islands, which were renowned at European contact for the large size of their caprine populations, fit comfortably the model of Mediterranean Neolithic landscape change described by Leppard and Pilaar Birch (2016). Intensified efforts to recover and directly date the bones of extinct taxa, and to determine precisely when pigs, goats, dogs, cats, and house mice were introduced to specific islands, will help clarify this picture, as will further detailed paleoenvironmental studies. Sufficient evidence already exists, however, in the form of soil erosion, altered fire regimes, and dramatic changes to vegetation (particularly tree cover) to confirm that Indigenous Canarians affected their islands' environments on a scale "similar to the impacts arising from other first settlers of oceanic archipelagos" elsewhere in the world (de Nascimento et al. 2020, p. 12).

Establishing when and how people (and their domesticates) reached the Canary Islands has been fiercely debated but is now receiving clarification via critical analysis of existing dates and their archaeological contexts, as well as new excavations boosted by a major European Research Council project (IsoCAN; https://cordis.europa.eu/project/id/851733). Chronometric hygiene protocols require us to reject arguments that people were present in the archipelago before the early centuries AD (Alberto Barroso et al. 2022a; Velasco Vásquez et al. 2020), except in the form of the highly specific Roman activity at the Lobos 1 site c. AD 1 (del Arco Aguilar et al. 2017). Earlier claims for Republican Roman, Carthaginian, or Phoenician presence are circumstantial or depend on selective interpretation of a few poor-quality radiometric dates and potentially unreliable Classical texts (e.g., Atoche Peña 2013; Mederos Martín and Escribano Cobo 2015). Their repetition subordinates the archipelago's early history to the civilizations of the Classical, "European" Mediterranean world at the expense of unraveling the processes by which North African

Amazigh-speaking communities crossed the sea to settle in the islands, processes for which claims of deportation by Roman armies or recruitment of tame workers by Punic traders remain unsubstantiated. Such subordination is nowhere more apparent than in the proposition that the cessation of contact with the Mediterranean world brought about a prolonged period of cultural and technological stasis, a "forced Neolithic" (Atoche Peña 2009, p. 129) that was ended only by the arrival of medieval European ships in the 1300s. Describing the millennium before this as a "phenomenon of collapse" that left the archipelago's inhabitants "trapped without possibility of escape" (Atoche Peña 2008, p. 339) merely reinforces how far emphasizing supposed connections with the Mediterranean directs attention away from understanding the history of Canarian populations themselves (Hernández Gómez et al. 2004/2005, p. 179).

The necessity of reorienting the Canarian past within the broader Northwest African context that the Amazigh linguistic and cultural origins of its Indigenous inhabitants demand (Farrujia de la Rosa 2014) could not be clearer. Recent and ongoing work in the Maghreb synthesized by Sterry and Mattingly (2020) provides an initial step along this path. It should be reinforced by further work along and immediately inland of the coasts of Western Sahara and southern Morocco. More generally, decades of research, some of it summarized above, affirm the diversity and dynamism of Indigenous Canarian societies. Change, not stasis, variety, not uniformity, are what that research shows, not least in the evidence for social, political, and ideological change emerging on Gran Canaria, perhaps the most intensively investigated of the islands. Synthetic studies of the kind recently accomplished there by Alberto Barroso et al. (2021, 2022b) should be extended to the other islands, reinforced by new field research where appropriate and by an emphasis on building sound chronologies (cf. Pardo-Gordó et al. 2022). Inter-island comparisons of subsistence strategies, ecological change, and diet already exist (e.g., Arnay de la Rosa et al. 2010; de Nascimento et al. 2020; Morales et al. 2017). They could be usefully amplified by similar studies in other fields, for example the organization of ceramic and lithic technologies (cf. del Pino Curbelo and Rodríguez-Rodríguez 2017; Rodríguez Rodríguez 2009).

Focusing on the agency of insular populations within the Canarian archipelago will not only confirm the dynamism of their history prior to contact with medieval European voyagers, but also open up comparisons beyond the Canary Islands themselves. Three examples suffice. First, the complete absence of metal ores meant, as we have seen, that Indigenous Canarian technology was lithic based. Bioko in the Gulf of Guinea off the west coast of central Africa presents precisely the same situation, settlement of an island by a population that was certainly using metal in the first instance, but that subsequently eschewed contact with the mainland and used only stone at European contact (Clist and de Maret 2021). Such rare instances of technological "devolution" merit focused attention from archaeologists, not least in understanding the choices made and solutions adopted as new contingencies took hold. Moreover, the trajectories followed in the Canaries may well have differed from one island to another across the archipelago. Second, and notwithstanding the temporal discrepancies involved, the archipelago should be brought into broader comparative discussions of island colonizations

during the Mediterranean Neolithic, with which it shared a common, Near Eastern-derived resource package of cultigens and livestock and broadly similar technologies (cf. Dawson 2013; Plekhov et al. 2021). Third, the Canary Islands differ from other African islands (except for the Cape Verde group and the Comores of the western Indian Ocean) precisely in that they are clearly an archipelago that was settled at broadly the same time. Along with the apparent paucity of contact between individual islands after colonization was complete, this creates an exciting opportunity to explore patterned differences in cultural trajectories and how these might map on to demographic and ecological variables, both of which varied substantially from island to island (Fernández-Armesto 1987). Here, too, situating the Canary Islands more strongly within broader research in island archaeology would be a positive move, drawing in part on the expertise of those working in areas where such studies are already well developed (e.g., Kirch 2000, 2010; Leppard 2014b). As one example, with its extensive opportunities for paleogenetic and stable isotope analyses of human remains and its well-understood material culture sequences, the archipelago provides an excellent opportunity for testing Leppard's (2015) model of the relationship between inter-island connectivity and demographic growth and resilience.

A final focus for comparative study turns on the Canary Islands as a focus of contact with—and subsequently colonization by—Europeans in and from the 14th–15th centuries. Many of the key themes here were set out decades ago (Crosby 1984; Tejera Gaspar and Aznar Vallejo 1992) and were discussed above. It is nevertheless worth highlighting others. Uniquely within Macaronesia, the Canarian archipelago was settled by people before Spanish/Portuguese colonization in the Age of Discovery. Within this biologically distinctive region, it, therefore, provides the only chance of ascertaining how populations equipped with very different technologies, social systems, and subsistence regimes impacted broadly similar ecologies to bring about what Halikowski Smith (2010) has, with justification, described as widespread "ecocide." Additionally, as recent papers show (Díaz-Serra 2022; Stevenson et al. 2021), the Canary Islands are special in allowing us to see how the implantation of European systems of land use drew on Native ways of doing things and how far those new systems of resource extraction intensified or redirected changes to insular environments and the species that had evolved within them. And finally, because much of the historical archaeology undertaken in the archipelago, thus, far has focused on religious sites and bioanthropological studies (Rodríguez 2015), unlike the situation on Madeira (Sousa 2011) and the Azores (Gerrard et al. 2021), the quotidian life of ordinary people as revealed by their houses, material culture, and foodways is currently much less in evidence. Here, then, is another exciting challenge for future research, one that should allow the archipelago's archaeology to speak as loudly in wider discussions of Spanish colonization across the globe (cf. Van Buren 2010) as it deserves to in island archaeology as a whole.

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