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EARLY PUBLIC ARCHITECTURE IN SOUTHERN CHILE: ARCHAEOLOGICAL AND PEDOLOGICAL RESULTS FROM THE MOCHA ISLAND MOUNDS-AND-PLATFORM COMPLEX

Roberto Campbell and Marco Pfeiffer

Public architecture emerged in conjunction with the development of early complex societies and is therefore a key feature for understanding them. Anthropogenic mounds and platforms in southern Chile dated to the Late Ceramic Period (AD 1000–1550), and historic indigenous inhabitants (AD 1550–present) are the southernmost manifestation of public architecture in the Americas. We report the results from excavation of an architectural complex on Mocha Island that covers an area of ~9.2 ha and a volume of ~43,000 m^3. This paper describes its construction dynamics, placing its origin at around AD 1000, a moment of significant sociopolitical and economic changes in southern Chile. We then associate information obtained from this site with similar complexes on mainland southern Chile to locate this phenomenon within a more regional comparative context.

La arquitectura pública es un rasgo que surgió al mismo tiempo que se desarrollaron las sociedades complejas tempranas; por lo tanto, representa un aspecto clave para comprenderlas. Los montículos y plataformas antropogénicos del sur de Chile corresponden a las sociedades del período Alfarero tardío (1000–1550 dC) y a los grupos indígenas históricos (desde 1550 dC hasta el presente) y son la manifestación más meridional de la arquitectura pública en América. Este trabajo se centra en la excavación de un complejo arquitectónico ubicado en Isla Mocha. A partir de la investigación desarrollada se identificó la dinámica de construcción y se estableció su inicio alrededor del año 1000 dC, un momento caracterizado por significativos cambios sociopolíticos y económicos en el sur de Chile. El complejo tiene un área aproximado de 9,2 ha y un volumen de ca. 43.000 m^3. Se vincula esta información con complejos similares del área continental del sur de Chile con el objetivo de ubicar este fenómeno en una perspectiva regional comparativa.

Public architecture is one of the key features of early complex societies, as the massive mobilization of resources required for these projects prevented smaller-scale societies from undertaking them. In the Americas and elsewhere, public architecture took different forms such as mounds, platforms, ditches, palisades, and causeways (Dillehay 1992a; Iriarte 2006; Lesure and Blake 2002; Spencer and Redmond 1998). In this paper we discuss, from an archaeological and pedological perspective, a mound-and-platform complex discovered on Mocha Island (southern Chile) and compare it with similar sites on mainland southern Chile (Dillehay 1986, 2007, ed. 2014). Our aim is to shed light on the convergent and divergent characteristics of the indigenous communities in this region since ~AD 1000. This paper also endeavors to establish a methodological framework for studying the architectural features of public complexes. First we will introduce the geographical and social context of southern Chile and Mocha Island. We then describe Dillehay's groundbreaking work on mound building in the Purén-Lumaco area. This is followed by the results of our research, a discussion of these results, and our conclusions.

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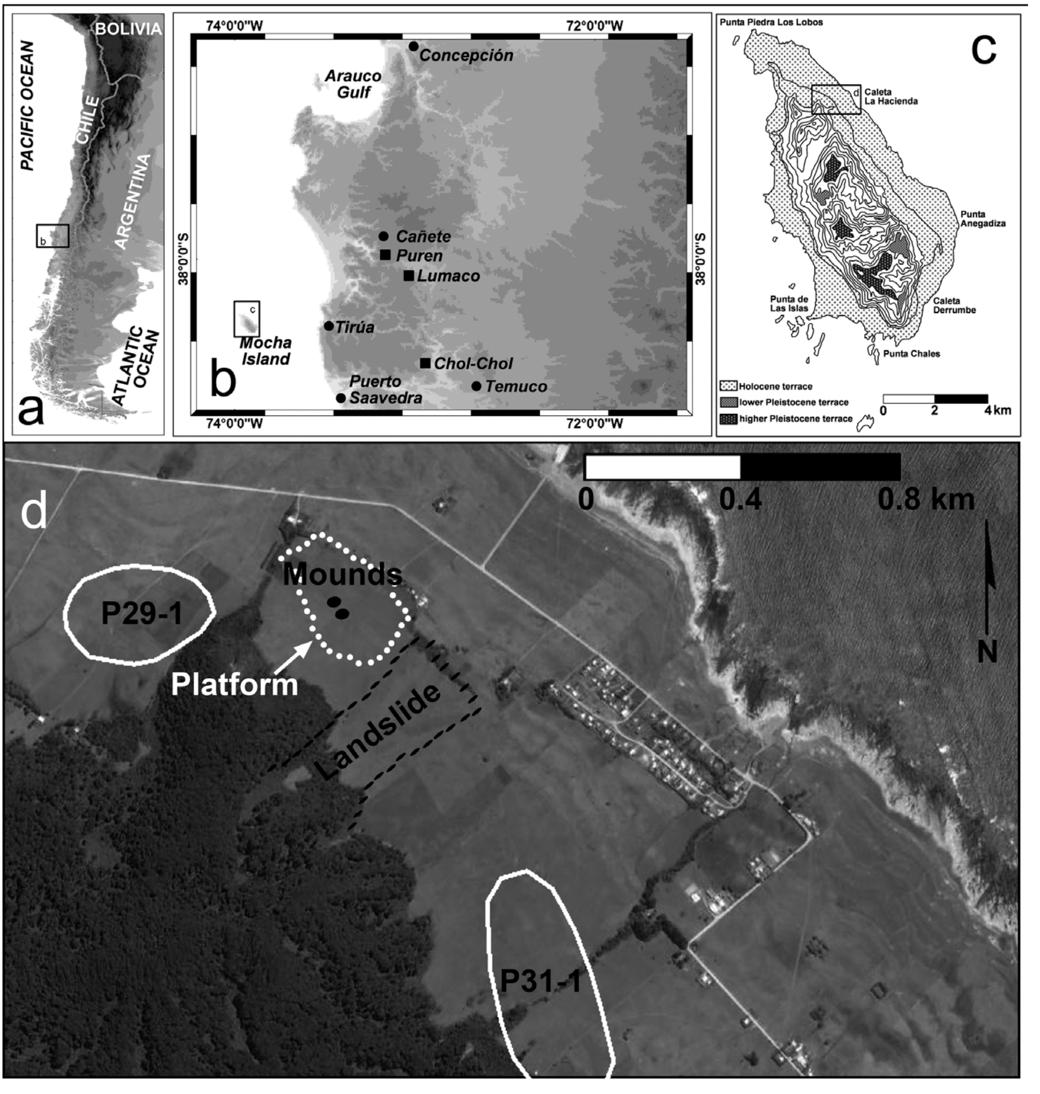

Figure 1. (a) Southern South America, with the location of southern Chile. (b) Southern Chile, with the location of Mocha Island, modern cities (black dots), and archaeological districts mentioned in the text (black squares). (c) Mocha Island's main geomorphological features and inset of mound location. (d) Mocha Island architectural complex (mounds and platform) and nearby archaeological domestic sites (Google Earth image).

Southern Chile and Mocha Island: Its Territory and People

Geographical Setting

Mocha Island is located in the South Pacific Ocean at 38°22' S, 30 km off the coast of southern Chile (Figure 1a). It is composed of abrupt escarpments that separate elevated Pleistocene marine abrasion platforms from a Holocene marine abrasion terrace (Figure 1c). The Holocene marine terrace surrounds the entire island and consists of a wave-cut platform directly abraded into the bedrock, which corresponds mainly to the Ranquil (Miocene) and Tubul (Pliocene) formations (Tavera and Veyl 1958), both of marine origin (Figure 2). A series of 18 strandlines formed by sand, gravel, and shell deposits have developed over the last 6,000 years due to tectonic uplift, causing a shoreline retreat of ~38 m during that period (Nelson and Manley 1992). Due to the steep terrain and dense forest of the central ridge, current human activity

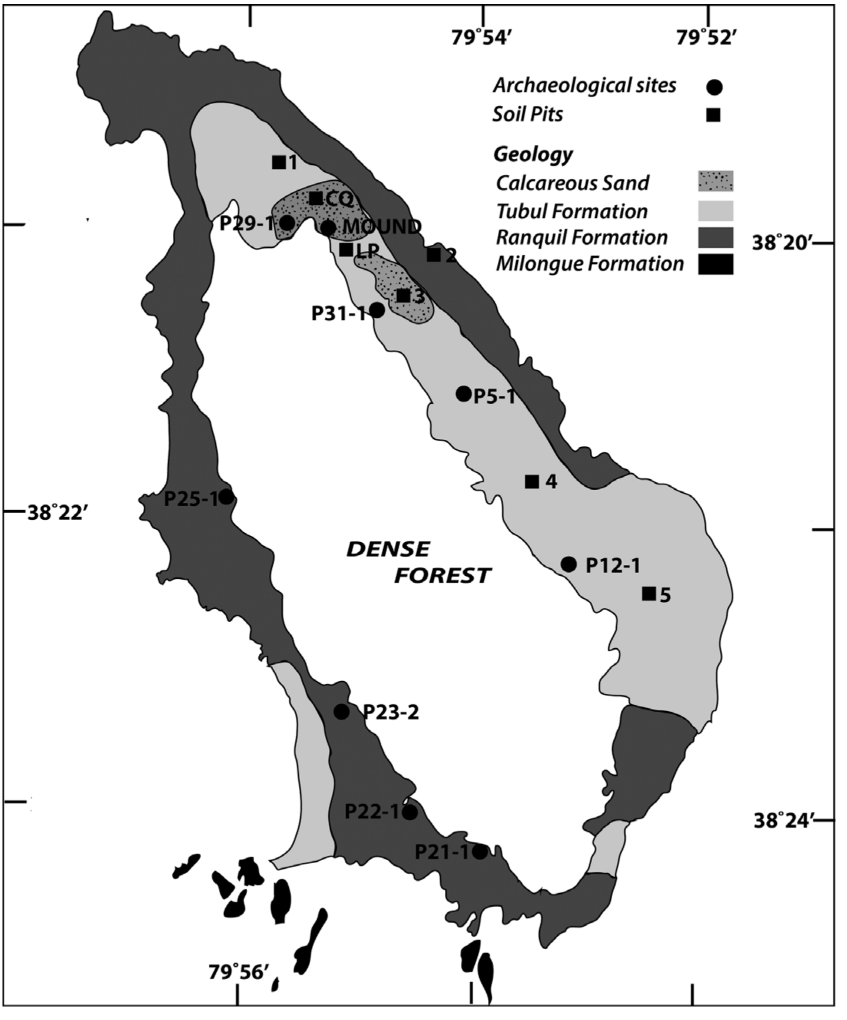

Figure 2. Mocha Island archaeological sites (black dots) and soil pit observations (black squares). Rocks that outcrop at the Holocene level terrace (after Gajardo 1973) and that served as parent material for the two main soil types present on the island are indicated.

and settlements are located on the Holocene terrace, as are all archeological sites found on the island to date.

Human Trajectories

Despite the fact that southern Chile has one of the longest records of human occupation in the Americas (Monte Verde, ~14500 cal BP [Dillehay 1997; Dillehay et al. 2008]), the first period of occupation on Mocha Island is dated to a brief span of time as recently as around 3400 cal BP (~1450 cal BC), after which the island appears to remain unoccupied for the next 1,500 years (Campbell 2015a; Quiroz et al. 2000).

By ~1850 cal BP (~100 cal AD), the first evidence of ceramics appears in southern Chile (Adán et al. 2016; Campbell and Quiroz 2015), although the first centuries of this phenomenon (~1850–1550 cal BP [~100–400 cal AD]) are still not fully defined. It is followed by the Early Ceramic Period (1550–950 cal BP [400–1000 cal AD]), during which the Pitrén Complex is the predominant culture-historical unit for all of southern Chile (Adán and Mera 2011; Aldunate 1989; Mera 2014). In the mainland, a remarkable shift occurs from the small early Pitrén cemeteries (no more than 10 graves) to larger ones in the late Pitrén (up to 50 graves), likely denoting larger, more sedentary, coresidential groups. These later graves, in contrast to the undifferentiated early burials, present varying quantities of ceramic vessels and have even yielded unusual artifacts such as metallic adornments and alpaca (*Vicugna pacos*) wool textiles. This evidence could indicate an emergent level of social differentiation occurring within this society (Adán and Mera 2011; Mera 2014; Mera et al. 2015; Ocampo et al. 2003).

In the case of Mocha Island, ceramics also appear around 1850 cal BP (~100 cal AD), marking the starting point of its second human occupation. Here the Pitrén Complex is represented by isolated findings and a few archaeological stratigraphic components. An effective and permanent colonization of Mocha Island can be identified dating to around 950 cal BP (~1000 cal AD; Campbell 2015a), which lasted into the ethnohistorical period.

The Pitrén Complex was followed, in the northern section of southern Chile (Mocha Island included), by the El Vergel Complex which is the prevailing culture-historical unit for this region during the Late Ceramic Period (950–400 cal BP [1000–1550 cal AD]). It is important to note that the Pitrén-El Vergel transition does not seem to imply a population replacement, but rather a significant change in the material assemblages that characterize each complex – primarily, ceramic decoration and funerary practices (Adán et al. 2005; Aldunate 2005; Bahamondes 2010; Dillehay 1990a; Massone 2005). Additionally, there is a diversification of burial patterns (direct burial, dugout trunks, stone slab cists, urns, and mounds; Aldunate 1989; Bullock 1970; Dillehay 1986), the development of a widespread metal-working tradition (Campbell 2005; Campbell et al. 2015), and the earliest manifestations of public architecture (earthen mounds and platforms; Dillehay 2007).

In terms of subsistence, there is a clear and greater reliance on cultivated resources such as quinoa (*Chenopodium quinoa*), maize (*Zea mays*), beans (*Phaseolus vulgaris*), squash (*Cucurbita* sp.), and cheatgrass (*Bromus* sp.), combined with wild ones such as strawberry (*Fragaria chiloensis*), maqui (*Aristotelia chilensis*), and berries (*Rubus* sp.), among others (Bonzani 2014; Delgado 2016; Dillehay et al. 2007; Godoy 2016; Iriarte 2014; Massone et al. 2012; Roa 2016; Roa et al. 2015; Sánchez et al. 2004; Silva 2010, 2014). In addition, there is evidence of hunting and fishing practices and likely raising of camelids (*Lama* sp.). Also, the El Vergel Complex residential sites are the most ubiquitous and discernible in all of southern Chile. On Mocha Island, in particular, these domestic areas range from 4 to 15 ha in size and present deep (80 to 150 cm) and rich deposits (Campbell 2011, 2015b; Quiroz and Sánchez 2005; Sánchez 1997).

Taken together, all of the above evidence is indicative of a much more sedentary lifestyle, and a very probable increase in population. In sociopolitical terms, the El Vergel Complex seems to correspond to several small political units or polities, whose descriptions plausibly fit somewhere between transegalitarian societies and simple chiefdoms (Bogucki 1999), marking a significant increase in social complexity from its Pitrén predecessor. The slight evidence of wealth differentiation vis-à-vis the ethnohistorical record helps propose a phenomenon of social differentiation based more on ideological aspects, rather than direct economic control (Campbell 2011; Dillehay 2007).

The southern Chile Late Ceramic Period groups faced the arrival of Europeans around AD 1550; the collective but vague name they used to refer to themselves was "*reche*": "the authentic people" (Adán 2014; Boccara 2007; Sauer 2015). After 50 years of occupation of this area, Europeans were permanently driven out to the north of the Biobio-Laja rivers. An independent indigenous country emerged in 1604 and lasted until 1882, when it was conquered by the Chilean state. The society during the ethnohistorical period, in contrast to the prehistoric one, is marked by livestock raising, raiding, and a trading economy, as well as the consolidation or reinforcement of a chiefdom structure in certain sectors of southern Chile (Bengoa 2003; Boccara 2007; Dillehay 2007; Zavala 2008). By the mid-eighteenth century, a new ethnic identity had emerged from "*reche*" and was clearly consolidated as "Mapuche." Finally, the integration of the Mapuche people into Chile during the late nineteenth century, although resulting in the dissolution of their political autonomy and most of their social structure, did not lead to the disappearance of their traditions and ideological world.

In contrast to the mainland, Mocha Island during the sixteenth and seventeenth centuries was never occupied by Europeans. Still, its indigenous population was intermittently visited by European explorers who traded with the islanders and/or raided them (Quiroz and Olivares 1997). This situation continued until Spanish authorities forcibly transferred the island's population to the mainland in AD 1685–1687, bringing its second human occupation to an abrupt end (Goicovich and Quiroz 2008; Quiroz 1994). After this, Mocha Island remained unoccupied for the next 160 years. In the 1840s, a third human occupation began by Chilean farmers (Pizarro 1990) who are the forebears of most of the current population. They implemented an economy based on livestock and low-scale nonmechanized agriculture.

Mounds in Southern Chile: The Case of Purén-Lumaco

In southern Chile, anthropogenic mounds and platforms have been very recently recognized as a feature of the Late Ceramic Period (AD 1000–1550) and Reche-Mapuche groups (AD 1550–present). This has mostly been due to the efforts of Dillehay (1986, 1990b, 1992b, 1992c, 1995a, 1995b, 1999, 2002, 2006, 2007, ed. 2014; Dillehay and Saavedra 2003, 2010; Seguel et al. 2005), although previous indications can be found in ethnohistorical sources (Molina 1795:90; Nuñẽz de Pineda 2001[1673]:498–502) and archaeological works (Gordon et al. 1972–1973). In addition, there are also small burial tumuli in southern Chile (Dillehay 2007:91–92, 2014:16; Latcham 1916:138–140, 1924:524–525, 1928:207) that should be distinguished from the abovementioned features; these tumuli did not reach the spatial scale or convey the same ritual and political importance as the mounds and platforms did for prehistoric, ethnohistorical, and ethnographic indigenous groups.

According to Dillehay (2007:37), mounds are present in different areas of southern Chile. Purén-Lumaco has the largest number of mounds at over 300; it is also where they are still used, constructed, and incorporated in Mapuche life. These mounds range between 5 and 50 m in diameter and 1 and 18 m in height, and most are clustered in 9- to 12-mound complexes or *rehuekuel* (Dillehay 2007:17, 94, 279–281). Purén-Lumaco has an area of about 250 km^2, and based on Dillehay's calculations (2007:305–306, 311), it could hold a population of 10,000 to 30,000 in the late prehistoric period (AD 1000–1550) and into AD 1800.

Dillehay's ethnographic research has recovered a variety of concepts related to the mounds (2007:16–22, 159). First, the name for *mound* in the Mapudungun language is *kuel*, which means "a socially built mound where ancestral spirits reside, important people are occasionally buried, and public rituals are performed," while *ñichi* is "the culturally leveled surface, or hilltop platform, on which mounds are erected." An associated term is *rehuekuel*, which refers to "sacred knolls and hilltops that are artificially leveled, where one or several *kuel* are located and where large scale *nguillatun* (fertility) and other public ceremonies are sponsored by multiple patrilineages." These *rehuekuel* then are "associated with old *nguillatun* and *palín* (ballgame) fields and sacred altars (*llangi-llangi*)." Finally, *reñinmapu* are "the artificially prepared soil layers that make up the mounds," and *kueltun* refers to "the ritual act of capping the *kuel* with individual soil layers that are offerings to the ancestors and deities."

Dillehay proposes that mound building in Purén-Lumaco and elsewhere in southern Chile "was related to population growth, social emulation, competitive feasting, and differential power relations between lineages in highly fertile, circumscribed valleys" (Dillehay 2007:34). In turn, "the absence of archaeological *kuel* in some areas suggests that local societies never activated a necessary and sufficient level of social stratification and complexity to develop mound building" (Dillehay 2007:312). For the same reason, "those populations in the region not having built and worshipped mounds, generally did and do not exhibit the same kinds of social organization and military success [than mound-building populations]" (Dillehay 2007:22).

The areas where mounds are built correspond to "spurs, crests, or promontories, usually at their highest point or at a unique angle that visually sets them apart and visibly contrasts them on the horizon in multiple directions (…). Mounds also are cleared of vegetation so they can be seen from various angles and distances." (Dillehay 2007:322). Also, informants (Dillehay 2007:267) indicate that the soil used for a mound is carried from different areas in the valley, which is reflected in the different colors observable in the mound's stratigraphy, and represents the participation of different lineages in its construction.

According to Dillehay, mounds and mound-building activities are intimately integrated with ritual and political aspects of the prehistoric and historical indigenous communities in southern Chile, virtually becoming their ideological axis. As such, the functions of mounds were diverse (Dillehay 2007:224). One of these was "to serve as burial plots for important leaders," although not all mounds fulfilled this role (Dillehay 2007:298). Also, Mapuche communities today hold *nguillatun* ceremonies at some *rehuekuel*. In these fields, "participants cook, eat, and reside for several days" (Dillehay 2007:61). The field is "a semicircle or rectangular U-form with the opening to the east" and it is "sacred, never plowed, and always located in a flat area adjacent to or overlooking a body of water (creek, river, or lagoon)" (Dillehay 2007:183–184).

The Mocha Island Mounds and Platform

Our research case study is focused on a recently discovered mound-and-platform complex on Mocha Island (Campbell 2011). Given the small scale of this island (50 km^2) and its native population (estimated at about 1,500; Supplemental Text 4), as well as its marginal geographical position within southern Chile, it serves as an excellent case study to contrast and complement the views already advanced by Dillehay (2007, ed. 2014) in relation to the historical, sociopolitical, and technical processes behind mound-building in southern Chile and elsewhere.

This architectural complex (*rehuekuel* in Mapuche terminology) is located on the northeastern part of Mocha Island on a Holocene marine terrace (Figure 1d). It is in a flat area at 43 msl and about 650 m from the current shoreline, on a level that is above the highest strandline of the Holocene terrace (Nelson and Manley 1992). This area is bracketed by an arm of the central range to the north and an ancient landslide to the south, while to the east it is open, facing the ocean and, across that, the mainland. This positioning creates quite an amphitheatric setting for the complex itself (Figure 3 and Supplemental Figures 1 and 2). The area is covered with grass and is used for animal husbandry rather than agriculture, which has helped preserve the entire complex and protect its soil integrity.

The complex consists of a platform or extensive leveled surface (*ñichi* in Mapuche terminology), which has an elliptical shape and covers ~9.2 ha. Above this there are two side-by-side mounds, or *kuel*. Although there is no clear-cut distinction between the platform and the mound bases, because they constitute a single anthropogenic continuity, the mounds rise from the present surrounding ground level by about 2.8 m for the North Mound and 3.1 m for the South Mound.

Materials and Methods

The mounds-and-platform complex was investigated using two complementary strategies. The first was a trench oriented from the top of the North Mound into the space between the two mounds. The goal of the trench was to access the mound's stratigraphy and to reach the original paleosol. The second strategy involved a set of 49 auger cores distributed all over the platform, as well as beyond it (Figure 4a). The goal was to estimate the extension and depth of the platform and its stratigraphy at different points, in order to better understand the construction efforts entailed.

A topographic survey was undertaken using a differential GPS and a total station over 45 ha, centered at the mounds. Auger core data were used to create topographic maps of the current surface and the paleosurface before mounds-and-platform construction (Figure 4b and 4c). Auger cores that reached a point beyond the platform without paleosol are located on the north-south and east-west axes. The paleosurface grid was created by subtracting the depth of paleosol surface from the current surface altitude (Supplemental Figure 3).

To understand the architectural complex's stages of construction and the potential materials

Figure 3. Northward view (from above the ancient landslide) of the architectural complex.

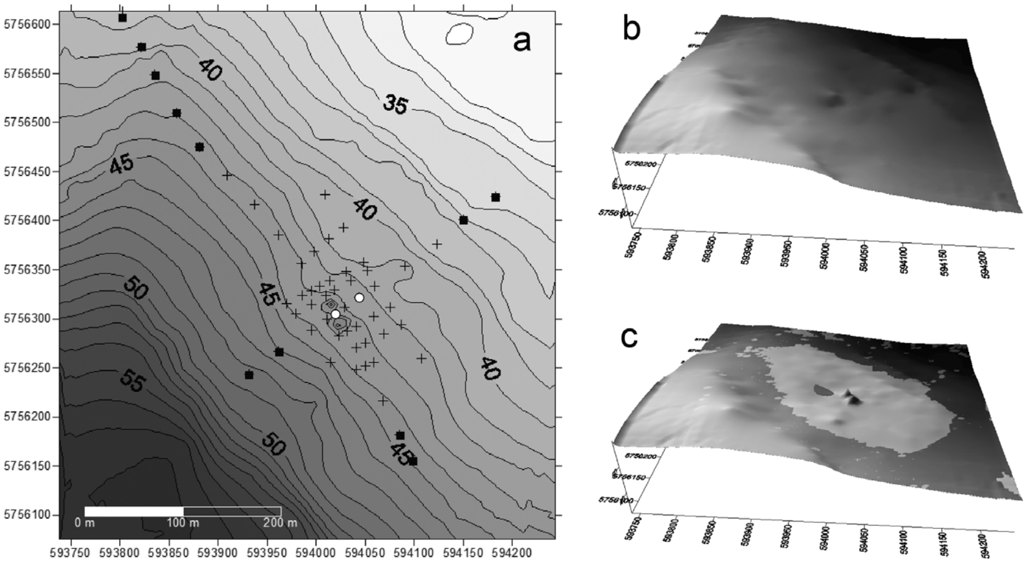

Figure 4. (a) Topographic map of the research area, with elevations relative to sea level; auger cores with a buried paleosol (black crosses), auger cores without a buried paleosol (black squares), auger cores with a buried paleosol and artifacts in it (white circles) are all indicated. (b) Digital elevation model of the paleosurface. (c) Digital elevation model of the current surface, showing the maximum refill area occupied by the platform and the mounds (in light gray).

used to build the complex, we performed a general survey of the soils on the eastern part of the island, in addition to studying the trench and two soil profiles located at opposite ends of the mound trench (Figure 5 and Supplemental Figure 4). The profiles in the trench are named mound top profile (MP) and mound base profile (MB). In our soil survey, we observed that there were generally two types of soil that could be differentiated by their parent material: those that

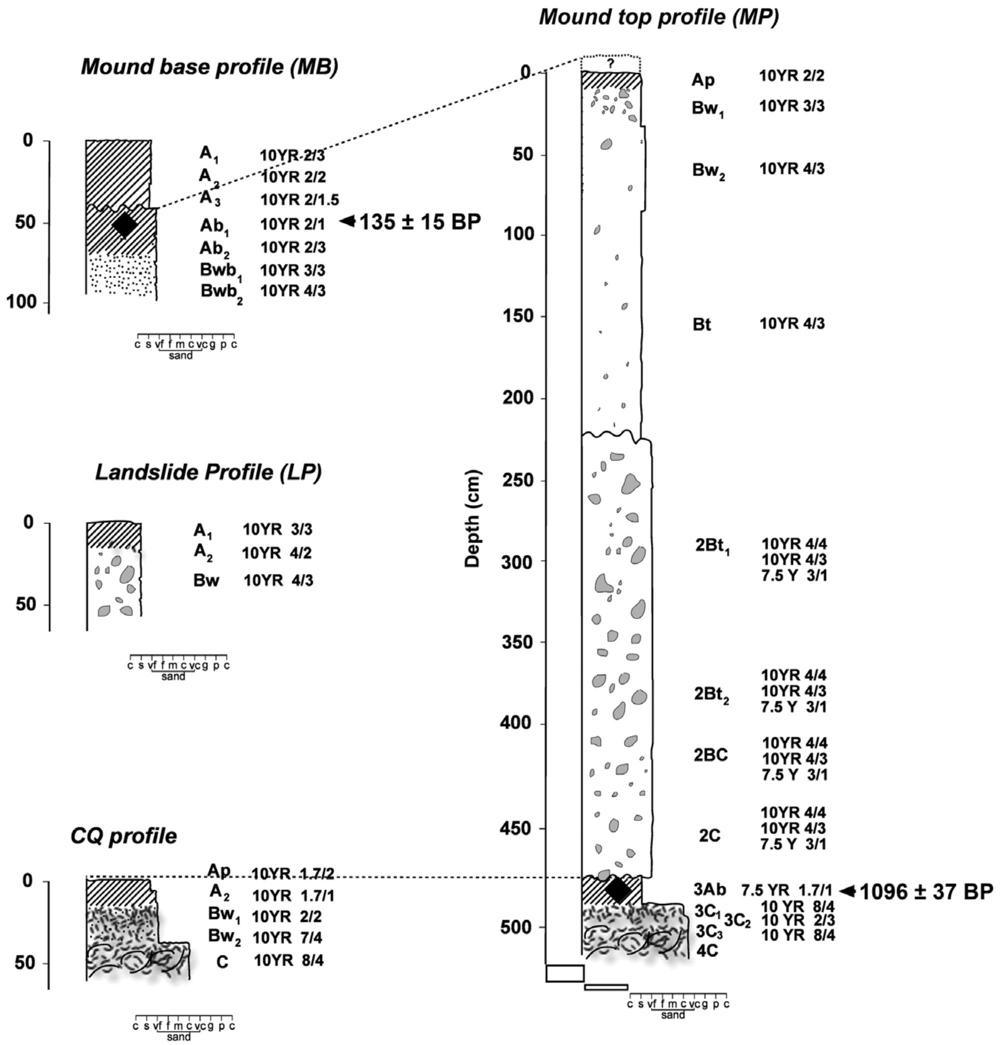

Figure 5. Stratigraphy of profiles mentioned in the text. Soil diagnostic horizons, Munsell soil color, and AMS radiocarbon dates of buried soils are all indicated.

formed in Tertiary deposits from the Tubul and Ranquil formations, and those that developed in Quaternary calcareous sand (Figure 2). These two types of soil are very different in color and texture and are therefore very easy to distinguish from each other. We thoroughly described a profile for each of these soil types near the architectural complex, one located at the ancient landslide (LP profile), corresponding to the Tertiary parent material, and one located toward the north at the same level as the complex (CQ profile), that developed over the Quaternary calcareous sand (Supplemental Figure 5). Soils that developed in the Tertiary parent material tend to be loamy textured (LP profile), while soils developed in the Quaternary parent material have sandy loam or loamy sand soil textures (CQ profile). For each soil horizon, color (Munsell Color chart), texture, and friability were analyzed, while additional samples were taken for micromorphological analysis. Our micromorphological descriptions were based on the terminology proposed by Bullock and colleagues (1985). Soil texture was examined for paleosol under the mound at the MP and for the CQ profile. Bulk density was measured using the clod method.

Charcoal samples for ^{14}C dating were collected from the Ab paleosol at the MP and MB profiles. The dates were calibrated using the software Calib 7.0 (Stuiver et al. 2005) and the calibration curve SHCal13 (Hogg et al. 2013). Samples for carpological analysis were taken from the paleosol material of the MP. Soil material was processed with a machine-assisted flotation system. Recovered cultural archaeological remains were also analyzed.

Results

The Mocha Island architectural complex is structured around two mounds located atop a platform that covers an area of about 400 by 300 m, and that has a thickness of ~2.4 m below where the mounds are located (i.e., excluding the thickness of the mounds themselves). The fill materials in the mounds and platform consist of soil from unconsolidated parent material related to sedimentary deposits of fossiliferous clay with mollusk molds and sandstone, which correspond to the Tubul and Ranquil formations. This material is different from the underlying material (paleosol), which is composed of sands, gravels, and shell fragment deposits of Quaternary age. As a result, it is easy to separate these two materials in the stratigraphic column. Given the record of the island's rapid uplift in the last 6,000 years (Nelson and Manley 1992), it is possible to estimate that at the moment of the mound's construction, the seashore was less than 200 m away.

Macromorphological Soil Features. For the mound, two profiles were described at each end of the trench (Supplemental Text 1 and 2). One (MP) extended from the top of the mound summit down to a depth of 514 cm, and the other profile (MB) extended from the mound base down to a depth of 97 cm.

The MP consisted of two main sections (Figure 5 and Supplemental Figure 4): from 0 to 474 cm, corresponding to anthropogenic deposited soil material, and from 474 to 524 cm, corresponding to paleosol buried after the construction of the complex. The first section of MP comprises eight horizons with one discontinuity at a depth of 225 cm, which clearly segregates two construction phases. The underlying paleosol comprises five horizons.

The MB has three horizons, covering a buried sequence of five horizons (Figure 5 and Supplemental Figure 4); at a depth of 45 cm, the Ab_1 horizon was found to contain charcoal. The last sequence corresponds to soil development over the mound and platform filling material, whereas the upper A horizons correspond to eroded material, mostly from the mound, that was deposited over the original sequence.

The discontinuity inside the MP consists of an abrupt boundary separating two layers that differ in color, the amount of coarse fragments they contain, and their consistencies. Both construction phases used similar materials, removed from Ranquil and Tubul formation deposits, which are at different stages of weathering and consistency (Supplemental Figure 6 and Supplemental Text 3). The clay and sand fragments of sedimentary origin are clearly separated from the weathered soil fill material. These materials suffered pedogenic processes indicated by the presence of color and structure development, as well as clay illuviation features and a dark-colored upper horizon, which reflects the accumulation of organic matter. This pedogenic development of the profile could be clearly seen at a depth of at least 437 cm. The degree of material mixing, features of pedogenic development prior to the material's transfer, and the similarity to the profile described at the nearby landslide (LP [Figures 1c and 5 and Supplemental Figure 2]) all indicate that a material of similar origin to that observed at LP was used to construct the mound.

The differences between the upper filling material and the underlying paleosol are clear (Figure 6). There is an abrupt boundary and a clear change in material content, as well as the presence of a dark horizon, reflecting a formerly exposed A horizon that accumulated a significant amount of organic matter, giving it a characteristic dark color. The contact between the two materials appears as a smooth, continuous gray layer with ash and a high amount of charcoal. The parent material of the paleosol corresponds to sand composed of seashell fragments of Holocene age (Nelson and Manley 1992).

The exposed CQ profile at the same level as the paleosol displays a sequence with

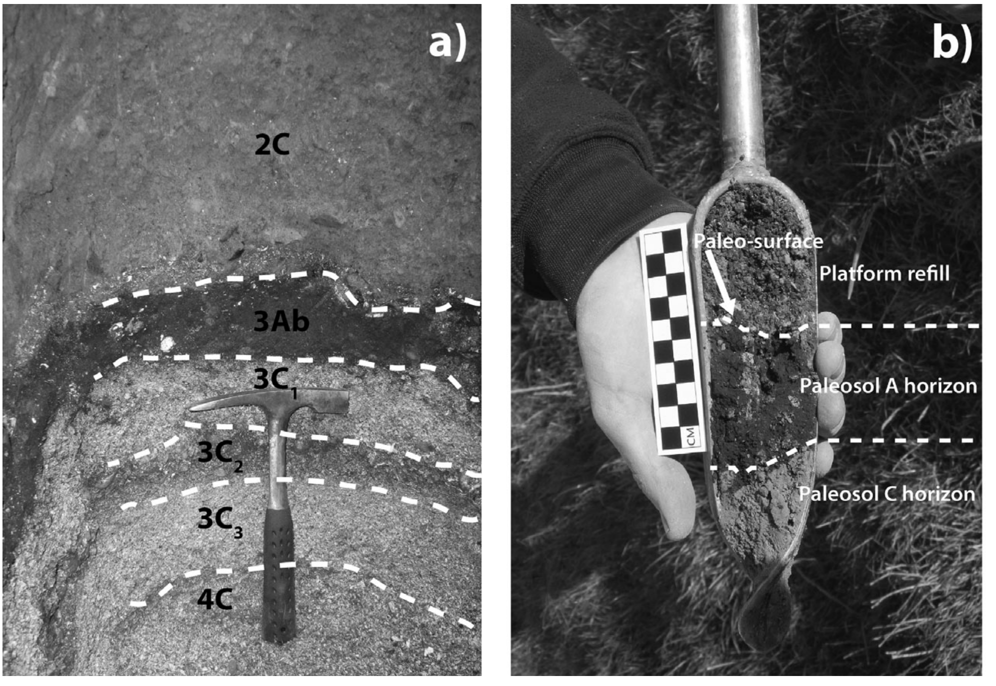

Figure 6. (a) Contact between mound fill (horizon 2C) and paleosol (3Ab), which shows the contrast between the fill material and the beach sands and shells that overlie it. (b) Auger core showing the contact between both materials.

well-developed Ap and A_2 horizons, with pedogenic development down to at least 37 cm (Supplemental Figures 4 and 5). This profile corresponds to a soil with a similar initial exposure age as the paleosol, but with continuous exposure (Figure 4 and Supplemental Figure 3). The buried paleosol at the MP has an A horizon that is 11 cm thick, revealing that the surface over which the mound was built corresponded to a young and poor soil.

Platform and Mounds Dimensions. Two topographic surfaces were generated. The first surface (Figure 4b) corresponds to the paleosurface that existed before the mounds and platform were constructed. Its stratigraphic ceiling was the contact between the fill of the platform and mounds complex and a buried A horizon (equivalent to horizon 3Ab in Figures 5 and 6). For the auger cores where no paleosol was found, and for those points beyond the auger core survey, the paleosurface was assumed to be equivalent to the present surface. The second surface (Figure 4c) corresponds to the current surface.

The calculated area of the complex is between 5.5 and 12.8 ha, with an average of 9.2 ± 3.7 ha. The difference between these values results from calculating the area of the platform surveyed with the auger cores (5.5 ha) and the value obtained after interpolating all points beyond that survey (12.8 ha; Figure 4). Using these values, an average volume of 42,996 ± 2,900 m^3 was obtained for the material used to construct the platform and mounds. For simplicity's sake, we will take the averages as the most suitable values. The bulk density of the platform and mound fill is an average 1.35 mg/m^3, which corresponds to 58,045 tons of filling material.

Absolute Dates. The first sample was taken from the buried Ab paleosol horizon in the MP, and it provided a date of 1096 ± 37 BP (AA 89415). The second sample was taken from the Ab horizon in the MB, yielding a date of 135 ± 15 BP (KCCAMS 109404; Table 1). The oldest date provides the maximum time since when the paleosol was buried under the architectural complex's fill. It implies that construction of the complex started around the Early Ceramic to Late Ceramic

Table 1. Absolute Dates from Mocha Island Mounds-and-Platform Complex

Laboratory code	Material	^{14}C Age BP	Cal Age AD Range (2σ)	Cal Age BP Range (2σ)	p	Δ^{13}C	Reference
KCCAMS 109404	Charcoal	135 ± 15	1698–1724	226–252	0.162	−25.0	Campbell and Quiroz 2015
			1808–1869	81–142	0.366		
			1876–1952	0 - 74	0.472		
AA 89415	Charcoal	1096 ± 37	890–1043	907–1060	1	−25.4	Campbell 2011

Note: Dates were calibrated using the software Calib 7.0 (Stuiver et al. 2005) and the calibration curve SHCal13 (Hogg et al. 2013).

transition. Nonetheless, the existence of at least two discernible construction events at the North Mound suggests that much of its construction can be attributed to the Late Ceramic El Vergel Complex period.

The later date likely corresponds to the 1840s Mocha Island recolonization. This occupation included clearing the forest with fire to open up areas for agriculture (Cañas Pinochet 1902). In this case, the sediments that eroded from the mound helped to preserve this thin charcoal layer, and this allows us to assume that a thicker A horizon covered the mound until it eroded during recolonization.

Archaeological Remains. Excavation of the mound trench and the auger cores revealed that the filling material used to build both the mound and the platform was completely devoid of any cultural material. Instead, the only archaeological remains were recovered from the paleosol, and more specifically from the Ab horizon (Figure 7).

At the mound trench, the paleosol provided nine undecorated nondiagnostic ceramic sherds, seven bone fragments (two of *Spheniscus* sp. and five indeterminate), and two lithics (a small sandstone net-sinker and a schist flake). Auger cores #12 and #24, directly adjacent to the North Mound, yielded a single undecorated ceramic sherd and four indeterminate bone fragments, respectively. Finally, a survey of the entire architectural complex area found two ceramic sherds and six lithics; these were neither chronological nor functionally informative.

The sediments from the paleosol material of the MP trench revealed the presence of a sample of botanical taxa (Supplemental Table 2); these remains have to predate the construction of the architectural complex. Both the *Chenopodium* sp. and Poaceae are part of the Mocha Island archaeobotanical assemblages. The former could be a variety of wild chenopodium or quinoa (*Chenopodium quinoa*), while the latter probably corresponds to a collected and/or cultivated cheatgrass.

Discussion

The construction of architectural complexes such as the one described here is one of the features of some late prehistoric and historic indigenous communities in southern Chile. Dillehay (1986, 2007, 2014) has reported extensively on these complexes, mostly through his research on Purén-Lumaco. Our discussion then, will take a comparative approach, contrasting the Purén-Lumaco sites with the Mocha Island complex described above.

Dillehay indicates that some of these architectural complexes or *rehuekuel* consist of a platform or *ñichi*, and mound(s) on top of it, called *kuel*. That is the case on Mocha Island as well. However, what is different and surprising is the size and volume of the Mocha Island complex. Using the Purén-Lumaco data (Dillehay 2007; Dillehay and Saavedra 2010, 2014), we have estimated that the mainland platforms measure from 0.04 ha (Ñachekuel [Dillehay and Saavedra 2010:201]) up to 3.2 ha (Rehueñichikuel [Dillehay and Saavedra 2010:226]), although most are no more than 0.2 ha. It should, nevertheless, be noted that the Purén-Lumaco area has been subject to forestry, agricultural activities, and public works (e.g., road construction), which have certainly resulted in the loss of fill material at some of these complexes.

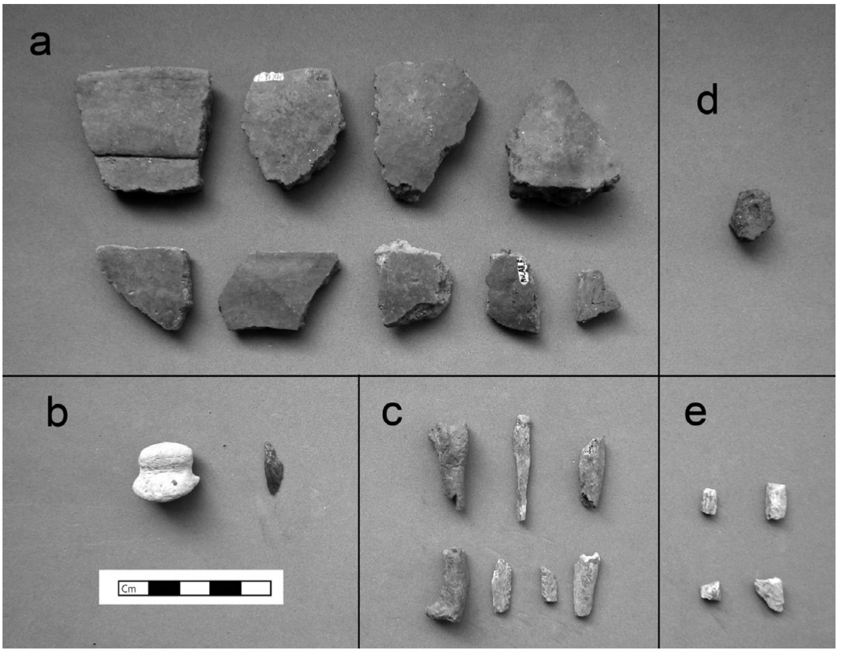

Figure 7. Archaeological materials recovered from the paleosol. In the mound trench: (a) ceramics sherds, (b) lithics, (c) bone fragments; in auger core #12, (d) ceramics; in auger core #24, (e) bone fragments.

In contrast, the platform at Mocha Island covers ~9.2 ha. This aspect is even more striking when one considers that native population estimates for Mocha Island reach only up to about 1,500, while population estimates for Purén-Lumaco are in the range of 10,000 to 30,000. In terms of per-capita labor, this single construction project may have been much more demanding for the people on Mocha Island than at Purén-Lumaco, if not for the many more *rehuekuel* that were built at Purén-Lumaco. Therefore, in the long run, the demand on mainland inhabitants might have been much greater than on Mocha Island.

In fact, in the case of Mocha Island, the nature of the filling sediments allows them to be more easily and clearly isolated from the paleosol. The parent material of the paleosol is a Quaternary seashell-rich material, while soils of unconsolidated sediments from the Ranquil and Tubul formations were used for the fill material, giving it a texture, color, and consistency that are distinct from the paleosol.

Another point of comparison is the mounds themselves. On Mocha Island, the filling sediment was completely devoid of cultural material, and the most likely explanation for this is that the sediment came from the nearby landslide formed over the Ranquil and Tubul formations, which is the closest source of material with these characteristics. On the other hand, for Purén-Lumaco, Dillehay (2007, ed. 2014) reports the presence of archaeological features such as different color layers and burning events, and cultural materials such as ceramics and faunal remains. Also absent on Mocha Island are differentiated "artificially prepared soil layers" or *reñinmapu* like those found at the Purén-Lumaco mounds, added as part of the *kueltun* rituals. These characteristics imply the following for the latter area: a) the use of sediments that already contained cultural remains from, for example, domestic middens; b) the addition of cultural remains, as well as soil layers, to the filling sediments as, for instance, offerings; or c) both. In fact, Dillehay and Saavedra (2014) described mounds formed by hundreds of different pockets of *poncho-loads*—woven blankets used to carry dirt—which correspond to individual loads of soils of different texture and color. The various soils at Purén-Lumaco have been linked with soil series located in different parts of the valley (Seguel et al. 2005, 2014). The diversity of soils used for mound construction was particularly pronounced during the prehispanic period in Purén-Lumaco, while more homogeneous soil materials were used for the Hispanic levels (Dillehay and Saavedra 2014:217–220). The use of diverse soils was interpreted as representing the relationships among the lineages of the mound builders, with different soils sourced from each lineage's homeland (Dillehay and Saavedra 2014:218).

In contrast, at Mocha Island the homogeneity of the fill material made it extremely difficult to isolate different construction events. It was possible to identify only one boundary between stages, which does not present a buried A horizon. The absence of buried soil inside the mound fill might reflect a process of rapid construction, perhaps with a short break between the two construction events. Young soils of known age on the island show high soil production rates: Bahlburg and Spiske (2012) described 5 to 10 cm thick soils in the shore uplifted after the 1835 earthquake. Because soil production declines exponentially as depth increases (Heimsath et al. 1997), we expect high initial rates of soil formation for the beginning decades (as shown by the 5 to 10 cm thick soils after 175 years). The absence of even a very thin soil inside the mound allows us to think in terms of a unique break period that might not have exceeded the duration of a century.

This means that the construction of the mounds was very probably a rapid and continuous process. The absence of any datable or chronologically diagnostic material inside the mound fill prevents us from estimating the precise timing of construction. Nevertheless, the degree of pedogenic development of the soil in the platform and mounds after their construction allows us to interpret a long period of soil formation based on the following facts: thickness and pedogenic development of the MB soil (52 cm), the amount of eroded material that constitutes the three upper A horizons (55 cm), and the average thickness of 24 cm for the A horizon of the platform. Considering soil production values on Mocha Island, a 24 cm thick soil (considering the thickness of the MB's A horizon) should have been exposed for ~560 years at least. This implies that the mounds and platform had already been there for at least five centuries before the beginning of the current occupation (AD 1840s), suggesting that the construction of the architectural complex ended around AD 1300, with a maximum building time of around 300 years. In that time, the mounds would have been visible from the shoreline.

As indicated, construction of the complex began around AD 1000. This was a time of significant change in southern Chile, as reflected in the region's incorporation of new technologies and goods, higher population densities, and almost certainly the emergence of more complex social organization. Therefore, undertaking a construction project of this scale is by no means unexpected. It is important to indicate that, at that moment, the area selected for the platform-and-mound complex must have contained one of the few developed soils of the Holocene plains surrounding Mocha Island, since it was located on one of the few older terraces above the 38 m strandline (Nelson and Manley 1992).

Given that an effective and permanent colonization of Mocha Island can be dated from AD ~1000 onwards, and since the base levels of the eight communities (expansive domestic areas ranging from 4 to 15 ha that most closely resemble homesteads) identified in the island (Figure 2) date to that moment and/or their middens increase dramatically from that time on (Supplemental Table 1), the commencement of construction on this architectural complex can be interpreted as marking a "foundational event" for the Mocha Island community. This date also coincides with changes in the island's vegetation and a decline in forest species, recorded in the palynological record of a nearby stratigraphic column (Le-Quesne et al. 1999). This occurred contemporaneously with the presence of charcoal in the record, suggesting forest clearance activities that probably were undertaken to habilitate space for camelid (*Camelidae* sp.) grazing and agricultural activities. In addition, the AD ~1300 date, taken as a milestone for the conclusion of the complex's construction, marks a moment in which these eight communities were already established, based on the absolute dates obtained for them.

These characteristics are reminiscent of Dillehay's ethnographic work in Purén-Lumaco. He indicates that some mound complexes or *rehuekuel* served as the plaza where ritual, political, and/or festive activities were performed. On Mocha Island, the very nature of the filling sediment used to build the architectural complex –with its remarkable differentiation from any surrounding materials, in terms of both color and texture–allows us to propose that it was the deliberate intention of the indigenous inhabitants to set apart this area, creating a unique space that was unequivocally distinguishable by its appearance and where a visible physical boundary marked whether one was inside or outside this space. In fact, no less than 600 m separate this architectural complex from the closest domestic sites (P29-1 and P31-1; Figure 1d), and because of its amphitheatre-like location, there is no intervisibility between the complex and these sites. In fact, the soil at site P29-1, which formed in a parent material of calcareous sand similar to the CQ profile, was not used in the construction of the mounds and platform. These characteristics thus lead us to propose that the complex was a truly public space, not owned by any one particular island community.

Additionally, from within the platform area it is possible to distinguish at least two strips of earth. These are each about one meter wide and 100 to 200 m long, extending from the mounds to the southern edge (the ancient landslide) of this apparent ceremonial space (Figure 8). Initially, we interpreted these strips as possible causeways (Campbell 2011:206–207), but without ruling out that possibility, we are also inclined to think that these may correspond to boundaries of a field for the *palín* game. According to López (2011:147–158), *palín* fields are demarcated by digging a ditch and lining the removed dirt along the field's edges. The size of *palín* fields varies significantly, ranging from 50 to 500 m long and 5 to 83 m wide.

The already advanced implications of the Mocha Island complex are even more remarkable if one considers that it is the only such site on the entire island, a point supported by the full coverage survey that we conducted (excluding the steep central forest). Therefore, this complex would have been the central ideological hub for the island's entire indigenous population. This situation is again a clear contrast with Purén-Lumaco, where more than 300 mounds have been identified. As such, it could indicate that Mocha Island did not reach the degree of social complexity achieved at Purén-Lumaco, and that the island population did not have to sustain a similar level of construction activity over the centuries. Still, the Mocha Island architectural complex may denote the occurrence of a much more hierarchical or consolidated political situation compared to Purén-Lumaco, one that prevented the spread of this building practice to other sectors of the island.

It is worth mentioning that Spanish, Dutch, and English ethnohistorical sources (Campbell 2011:298–354) explicitly indicate the existence of individuals of social prestige and political importance on Mocha Island. In addition, one of these explorers (Van Noort 1600 [Ijzerman 1926:54–58; Van Meurs 1993]) arrived at the island when its inhabitants were holding a festival, strikingly analogous to Dillehay's ethnographic reports on ceremonies that occur in the present day at the Purén-Lumaco *rehuekuel*. Still, the contrasting views that emerge from Mocha Island and Purén-Lumaco might also represent different social, political, and ideological approaches to the construction, use, and significance of early public architecture.

Turning to a different aspect of mound building, it is worth mentioning the Mapuche myth of the struggle between the water and earth snakes, *Cai-Cai* and *Tren-Tren*, respectively, in which humankind is saved by escaping to the top of *Tren-Tren* and then making a human sacrifice (Foerster 1993). Therefore, in a territory as prone to earthquakes and tsunamis as southern Chile (Ely et al. 2014; Garret et al. 2015; Huellas Mapuches 2011; Lenz 1912), building a mound can take on the significance of creating a local protective *Tren-Tren*, where the myth is reenacted through successive constructions, rituals, and offerings. In fact, in Purén-Lumaco the largest and most important *kuel* is *TrenTrenkuel* (Dillehay 2007:106). In the case of Mocha Island, it is possible that the filling material came from the large ancient landslide that demarcates the architectural complex to the south; that landslide could even have been an outcome of one of these catastrophic events.

Finally, having in hand estimates of the material removed and used to build the Mocha

Figure 8. Strip of earth going from the mounds to the ancient landslide.

Island architectural complex (42,996 m^3 and 58,045 tons), of the years elapsed between the start and end of its construction (300 years), and of the island's native population (1,500 people), the next step would be to estimate the labor requirement for a public project such this one. Nevertheless, approximations of this kind are virtually absent in the anthropological literature.

One of the few such attempts was by Erasmus (1965), using actual ethnographic experiments. Based on his results, with a distance of 200 m between the source material excavation site and the fill destination, as is the case with the ancient landslide and the Mocha Island mounds, a single worker is able to carry 1.1 tons per day. This translates into a total of 52,767 worker-days for the island's complex, implying that a workforce of 500 people—one-third of the estimated native population for Mocha Island—could have built it in 106 days. If we opt to use another of Erasmus' estimations, in which he calculated 5.25 worker-days per m^3 of fill, building the Mocha Island complex would then require 225,729 worker-days, translating to 451 days of construction, again with a workforce of 500.

Given that the first estimation is much more optimistic, we prefer the second one. In any case, both show that building the complex was a perfectly feasible endeavor for a small population, and that they would have been able to accomplish it in a rather short time span. Thus we consider this estimation of labor requirements to be entirely congruent with the gathered geoarchaeological information, which indicates rapid construction.

Elaborating on estimations by Erasmus (1965), among others, Drennan and colleagues (2010) and Peterson and Drennan (2011) have proposed a "tax rate" index, understood as the per-capita burden for carrying out public works, or as the number of days' labor per year per available laborer that is required for construction. This kind of index allows for the development of a comparative perspective beyond the culture-historical peculiarities of each society, helping increase our understanding of the processes of social change worldwide (Smith et al. 2012).

In this fashion, the "tax rate" for the Mocha Island architectural complex can be estimated at 1.5 days/worker/year. This value turns out to be a close equivalent to the "tax rate" calculated for the construction of an archaeological landmark such as Pueblo Bonito in Chaco Canyon (Drennan et al. 2010:64–70).

Conclusions

The research conducted shows that mounds and platforms and the practices related to their construction and usage are a key aspect to understanding the late prehistoric and historical indigenous societies of southern Chile, the southernmost population in the Americas that engaged in the construction of these public spaces. Beyond this overarching statement there emerges a picture of remarkable local peculiarities. On one hand, not all communities engaged in the construction of public architecture, and those who built such structures did not do so in a homogeneous fashion. While the landscape at Purén-Lumaco is dotted with mounds, on Mocha Island there are just two mounds in a very circumscribed setting; at the former the mound fill contains artifacts, features, and a variety of soil types, and at the latter these are almost absent.

Both situations must be linked to the sociopolitical changes that populations in southern Chile experienced starting in AD ~1000, marked by the emergence and development of much more complex societies, encompassed under the label of El Vergel Complex. In this context, it is worth noting that in spite of Mocha Island's geographical marginality, its low population density in comparison to Purén-Lumaco, and the abrupt and drastic termination of its occupation in AD 1687, its indigenous inhabitants were not disconnected from the contemporary regional processes occurring on the mainland. Therefore, geographical position need not be equated with sociopolitical preeminence or backwater status.

It remains to be seen whether the mechanisms outlined in Purén-Lumaco (population growth, social emulation, competitive feasting, differential power relations between lineages, circumscription) as leading to mound building were the same ones operating across all of southern Chile. In addition, it is fundamental that we further examine the sociopolitical processes occurring in those areas where these architectural complexes did not manifest. In other words, we must assess to what extent these processes and their materials correlate to and can be explained by circumscribed and local factors or by broader and regional factors, or both, and how this can illuminate our understanding of cultural diversity at large. Finally, our research also highlights the importance of integrating different scientific approaches (archaeology and pedology) to produce a richer and more complete knowledge of past social dynamics.

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Data Availability Statement. The photographs used in the manuscript are the property of the authors. The drawings were designed by the authors. Topographic data were obtained from a field survey and may be requested from the authors.

Supplemental Materials. Supplemental materials are linked to the online version of this article, which is accessible via the SAA member login at https://doi.org/10.1017/laq.2017.42.

Supplemental Figure 1. Southward aerial view of Mocha Island, with the main cultural and natural features mentioned in the text.

Supplemental Figure 2. Westward view of the mounds. Part of the ancient landslide is on the left edge.

Supplemental Figure 3. Transversal major axis section of auger cores from research area NW-SE, showing the paleosurface and auger core depth. Vertical and horizontal axes are not at the same scale.

Supplemental Figure 4. Horizontal section of mound trench. Mound Base profile (MB) at the left, and Mound Top profile (MP) at the right.

Supplemental Figure 5. Profiles showing the parent material for the two main soil types present on Mocha Island: (a) Typic Udipsamment soil developed in a parent material of Calcareous sand; (b) Dystric Haplustept soil developed in a parent material of Tertiary rocks corresponding to the Tubul and Ranquil formations.

Supplemental Figure 6. Micromorphological features of: (a) Mound Top Profile (MP) Bt1 horizon (130 cm), showing the jumbled nature of the soil aggregates in the fill: an unweathered silt aggregate (S) residing next to an iron oxide nodule fragment (Fe) and a silt aggregate with iron oxide quasicoating (upper right); (b) sharp boundary contact between the fill material (horizon 2C) and paleosol (horizon 3Ab).

Supplemental Text 1. Soils Pits Horizon (Stratum) Description (For Nomenclature used see Supplemental Text 2)

Supplemental Text 2. Soil horizon terminology used (From Schoenberger et al. 2002)

Supplemental Text 3. Micromorphological Soil Features

Supplemental Text 4. Mocha Island's population estimate

Supplemental Table 1. Absolute dates from Mocha Island archaeological sites

Supplemental Table 2. Carpological remains recovered from the Mound top Profile (MP) trench

Supplemental Material References.

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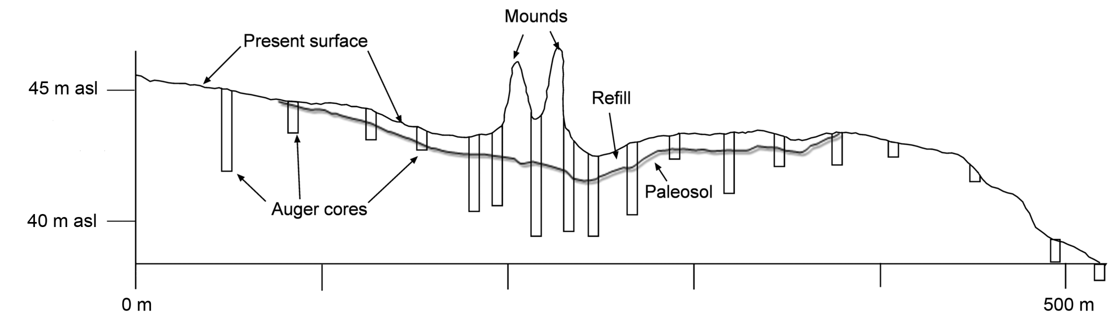
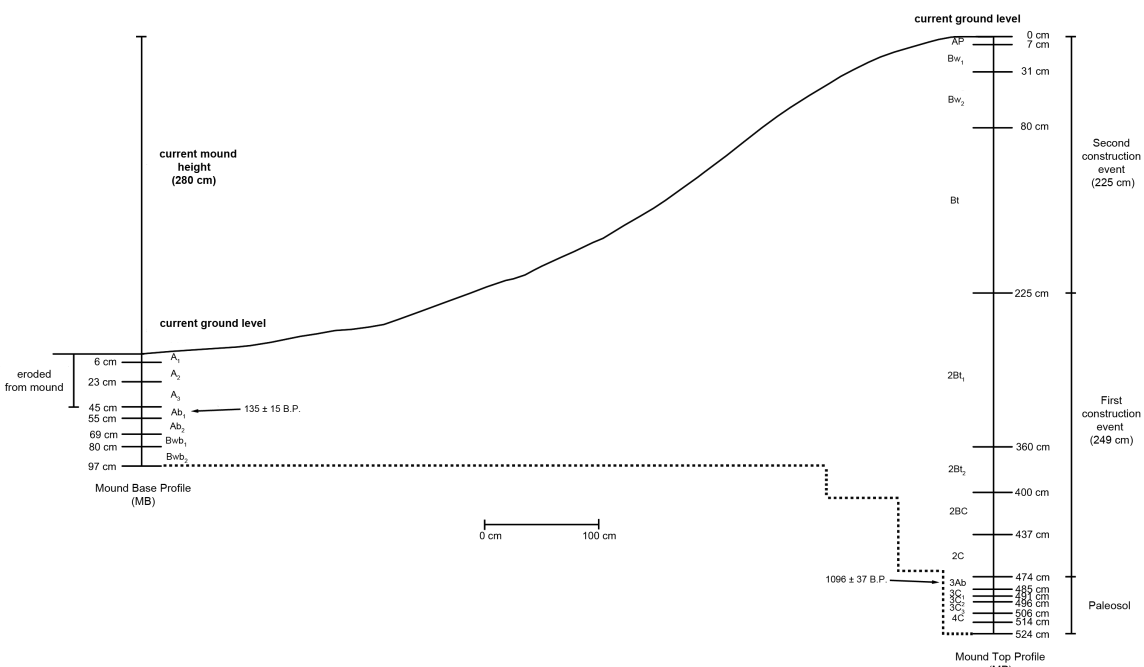
Supplemental Materials

Supplemental Figure 1.A southward aerial view of Mocha Island, with the main cultural and natural features mentioned in the text.

Supplemental Figure 2. Westward view of the mounds. Part of the ancient landslide is on the left edge.

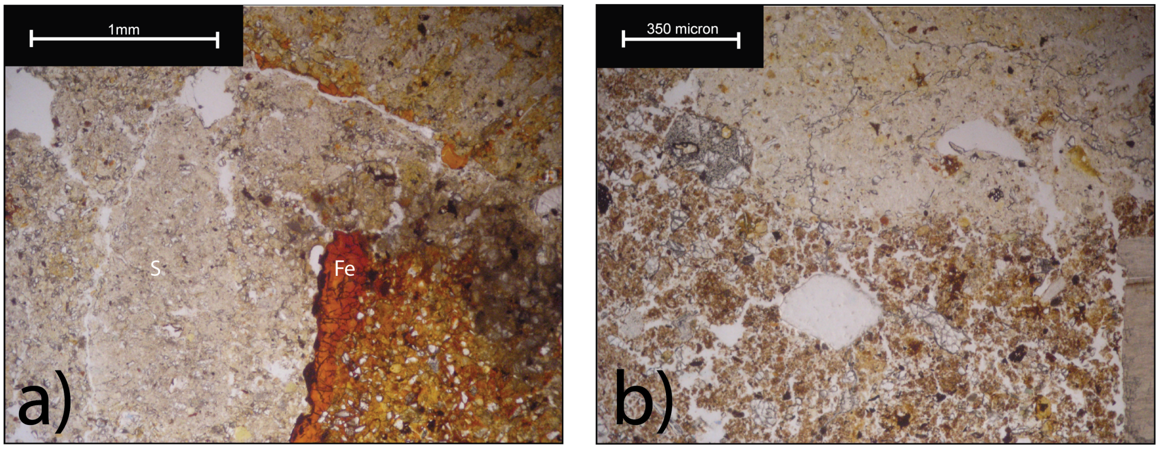


Supplemental Figure 3. Transversal major axis section of auger cores from research area NW-SE, showing the paleosurface and auger core depth. Vertical and horizontal axes are not at the same scale.



Supplemental Figure 4. Horizontal section of mound trench. Mound Base profile (MB) at the left, and Mound Top profile (MP) at the right.

Supplemental Figure 5. Profiles showing the parent material for the two main soil types present on Mocha Island: (a) *Typic Udipsamment* soil developed in a parent material of Calcareous sand; (b) *Dystric Haplustept* soil developed in a parent material of Tertiary rocks corresponding to the Tubul and Ranquil formations.



Supplemental Figure 6. Micromorphological features of: (a) Mound Top Profile (MP) Bt1 horizon (130cm), showing the jumbled nature of the soil aggregates in the fill: an unweathered silt aggregate (S) residing next to an iron oxide nodule fragment (Fe) and a silt aggregate with iron oxide quasicoating (upper right); (b) sharp boundary contact between the fill material (horizon 2C) and paleosol (horizon 3Ab).

Supplemental Text 1.

Soils Pits Horizon (Stratum) Description

(For Nomenclature used see Supplemental Text 2)

Profile: Mound top profile (MP)

Soil Taxonomy Classification: Typic Haplanthrept over Typic Udipsamment (Paleosol)

Ap (0-7cm). Silty Loamy, very dark brown (10 YR 2/2). Lighlty plastic and adhesive.

Bw_1 (7-31cm). Silty Loamy, dark brown (10YR 3/3). Lighlty plastic and adhesive. 40% fragments of very dark grey (7.5Y 3/1) sandstone.

Bw_2 (31-80cm). Silty sandy loam, brown (10YR 4/3). Lighlty plastic and adhesive. Weak clay coatings on clods. 40% fragments of very dark grey (7.5Y 3/1) sandstone.

Bt_1 (80-225cm). Silty loamy sand, brown (10YR 4/3). 70% fragments of very dark grey (7.5Y 3/1) sandstone.

Bt_2 (225-360cm). Texture, color and clasts fragments identical as above. Presence of cutans in clast faces.

Bt_3 (360-400cm). Texture, color and clasts fragments identical as above. With Presence of intensive weathering features like coatings of Fe oxides and nodules. Presence of clay coatings in clast borders and pores.

2BC (400-437cm). Mix of very dark grey (7.5Y 3/1) sandstone and dark yellowish brown (10YR 4/4) siltstone with Fe oxides and Mn oxides in a brown (10YR 4/3) matrix.

2C (437-474 cm). Similar origin and proportion of materials but with a lower level of weathering. Rock fragments with casts of fossils of *Epitoniidae*, which have been described for the Tubul Formation (Nielsen and Valdovinos, 2008).

3Ab (474-485cm). Very dark (7.5 YR 1.7/1) silt loam. Presence of fine sandstone fragments. Two bones, charcoal and ceramic fragments at the top. Charcoal fragments used for ^{14}C datation.

$3C_1$ (485-491cm). Very pale brown (10YR 8/4) coarse sand of shell fragments with few gravel fragments. Low reaction to HCl.

$3C_2$ (491-496cm). Very pale brown (10YR 8/4) coarse sand of shell fragments with fragments of very dark brown (10YR 2/3) sand. Moderate reaction to HCl.

$3C_3$ (496- 504 cm). Very pale brown (10YR 8/4) sand. Moderate reaction to HCl.

Profile: CQ

Soil Taxonomy Classification: Typic Udipsamment

Ap (0-7cm). Very dark greyish brown (10YR 3/2) sandy loam.

A_2 (7-13 cm). Black (10YR 1.7/1) loamy sand with about 10% of fragmented shells.

Bw_1 (13-24 cm). Very dark brown (10YR 2/2) sand with 50% of gravel size shell fragments.

Bw_2 (24-37 cm). Very pale brown (10YR 7/4) loamy sand with 60% of gravel size shell fragments.

C (37-60cm). Very pale brown (10YR 8/4) sand made of shell fragments.

Profile: LP

Soil Taxonomy Classification: *Dystric Haplustept*

A_1 (0-8cm) Dark brown (10YR 3/3) loam.

A_2 (8-15cm). Dark grayish brown (10YR 4/2) loam.

Bw (15-30cm). Pale brown (10YR 6/3) and Brown (10YR 4/3) sandy loam.

Supplemental Text 2.

Soil horizon terminology used (From Schoenberger et al. 2002)

Horizon nomenclature

Horizon	Criteria
A	Mineral soil, formed normally at surface, with little remnant rock structure.
B	Mineral soil, typically formed below A, with little or no rock structure.
C	Mineral soil, little affected by pedogenesis and lack properties of A or B horizons.

Horizon suffixes

Suffix	Criteria
b	Buried genetic horizon
p	Plow layer or other artificial disturbance
t	Illuvial accumulation of silicate clays. Clay that is transported from an upper soil horizon (layer) and deposited at a lower horizon.
w	Incipient color or pedogenic structure development; minimal illuvial accumulations.

Horizon prefixes

	Horizon prefixes indicate a lithological discontinuity, for instance a 2C horizon after a C horizon indicates a different provenance of the material or different events of deposition

Supplemental Text 3.

Micromorphological Soil Features

Two horizons from the MP were selected for micromorphological analysis: Bt_1 and 2C. Both horizons show a matrix of clay-forming microaggregates, with fine quartz and plagioclase grains in the matrix. There are fine, typically discontinuous clay coatings in some pores. Iron and clay coating fragments incorporated in the soil matrix are common, reflecting transport processes; soil aggregates corresponding to different components of the Tubul and Ranquil formations are also common (Supplemental Figure 6).

Supplemental Text 4.

Mocha Island´s population estimate

Mocha Island´s population estimate is an educated guess that emerges from examinations of different sources. On the one hand, from the ethnohistorical sources (Bibar 1966 [1558]; Carvallo Goyeneche 1875 [1796]; Garro 1686 (in Goicovich and Quiroz 2008); Goicovich 2010; Fletcher 1854 [1578]; Morales Melgarejo 1685 (in Goicovich and Quiroz 2008); Ovalle 1646; Rosales 1877 [1674]; Quiroga 1979 [1692]; Quiroz 1994; Tribaldos de Toledo 1864 [1625]; and compiled in Campbell 2011:45-48, 298-354) one can calculate population estimates that range from as low as 588 up to 4,200 people. Nevertheless, most of these estimates converge at under 2,000 people, and are even more tightly concentrated at under 1,000. On the other hand, one adopt Dillehay's (2007:304) proposition, which used ethnoarchaeological and archaeological evidence to propose "that 1/2 ha of settlement contains one house lot (Dillehay 2004) . If each house lot (ruca) contains approximately seven persons, as it does today, it follows that a family would include homesteads of 1/2 ha or less." Then, from the site size estimated for each of the island homesteads, based on surveys and test pits, one can calculate an island population of about 1,000 people. Finally, Dillehay (2007:311) also proposes that "that a chiefly patrilineage territory in late pre-Hispanic times was approximately 25 sq km [...] and associated with an estimated population of 1,500 to 3,000 people". Mocha Island is 50 km^2, although its inhabitable coastal strip is only 25km^2; its population can then be calculated as between the two values presented above. The estimated figure of 1,500 people thus emerges, based our attempts to account for the population figures from these various sources.

Supplemental Table 1.

Absolute dates from Mocha Island archaeological sites

Site	Laboratory code	Material[b, c]	^{14}C Age B.P.	Cal Age B.C./A.D. Range (2σ)	Cal Age B.P. Range (2σ)	p	Median Probability[d]		$\Delta^{13}C$	Reference(s)
							Cal B.C./A.D	Cal B.P.		
Mounds Complex	KCCAMS 109404	Charcoal	135 ± 15	1698 - 1724	226 - 252	.162	1861	89	-25.0	Campbell and Quiroz 2015
				1808 - 1869	81 - 142	.366				
				1876 - 1952	0 - 74	.472				
	AA 89415	Charcoal	1096 ± 37	890 - 1043	907 - 1060	1	994	956	-25.4	Campbell 2011
P5-1	AA 109585	Homo sapiens	506 ± 25	1416 - 1456	494 - 534	1	1438	512	-14.7	This study
	UB 26214	Zea mays	552 ± 26	1400 - 1443	507 - 550	1	1420	530	-10.0	This study
	UB 26216	Camelidae sp.	605 ± 26	1319 - 1351	599 - 631	.316	1396	554	-21.2	This study
				1385 - 1426	524 - 565	.684				
	AA 108920	Camelidae sp.	611 ± 23	1319 - 1351	599 - 631	.379	1393	557	-20.7	This study
				1385 - 1420	530 – 565	.621				
	UB 24529	Camelidae sp.	683 ± 26	1294 - 1391	559 - 656	1	1347	603	-21.1	This study
	UB 24528	Camelidae sp.	668 ± 26	1299 - 1395	555 - 651	1	1345	605	-20.9	This study

	UB 26215	Zea mays	635 ± 25	1309 - 1360	590 - 641	.653	1343	607	-10.2	This study
				1378 - 1409	541 - 572	.347				
	UB 24524	Chenopodium quinoa	718 ± 22	1281 - 1319	631 - 669	.537	1315	635	-28.6	This study
				1351 - 1385	565 - 599	.463				
	Beta 73674	Charcoal	740 ± 100	1152 - 1435	515 - 798	1	1300		-28.7	Sánchez 1997
	UB 26213	Camelidae sp.	751 ± 35	1229 - 1252	698 - 721	.063	1292	658	-	This study
				1260 - 1320	630 - 690	.68				
				1350 - 1386	564 - 600	.257				
	UB 24525	Zea mays	796 ± 25	1225 - 1288	662 - 725	1	1262	688	-9.0	This study
	UB 24523	Chenopodium quinoa	816 ± 27	1218 - 1282	668 - 732	1	1249	701	-27.9	This study
	UB 24526	Zea mays	992 ± 30	1025 - 1157	793 - 925	1	1094	856	-9.7	This study
	OxA 34844	Homo sapiens	1022 ± 30	1015 - 1151	799 - 935	1	1087	863	-15.6	This study
	Beta 73675	Charcoal	1210 ± 110	651 - 1046	904 - 1299	.981	866	1081	-27.6	Sánchez 1997
				1088 - 1110	840 - 862	.012				
				1118 - 1131	819 - 832	.007				
	UB 26212	Pudu puda	3566 ± 32	-1952 - -1744	3693 - 3901	1	-1841	3790	-20.1	This study
	AA 108919	Pudu puda	3651 ± 29	-2122 - -2093	4042 - 4071	.042	-1969	3918	-20.5	This study
				-2042 - -1883	3832 - 3991	.958				
P10-1	AA 109584	Homo sapiens	1169 ± 26	885 - 987	963 - 1065	1	933	1017	-14.7	This study
	UCTL 537	Pottery	1560 ± 150	130 - 730			430			Sánchez 1997
P12-1	UB 29283	Zea mays	453 ± 28	1435 - 1503	447 - 515	.904	1465	485	-9.6	This study
				1592 - 1614	336 - 358	.096				
	Beta 79917	Charcoal	550 ± 70	1298 - 1501	449 - 652	.982	1417	533	-28.4	Campbell and Quiroz 2015

				1595 - 1612	338 - 355	.018				
	UB 29284	Zea mays	656 ± 27	1300 - 1368	582 - 650	.74	1343	607	-9.8	This study
				1372 - 1400	550 - 578	.26				
	Beta 79918	Charcoal	680 ± 80	1229 - 1250	700 - 721	.03	1341	609	-27.8	Campbell and Quiroz 2015
				1260 - 1434	516 - 690	.97				
	UB 29282	Camelidae sp.	744 ± 32	1234 - 1243	707 - 716	.013	1296	654	-19.8	This study
				1265 - 1321	629 - 685	.68				
				1348 - 1387	563 - 602	.307				
	UB 29286	Camelidae sp.	753 ± 27	1234 - 1243	707 - 716	.016	1288	662	-20.3	This study
				1265 - 1316	634 - 685	.789				
				1355 - 1382	568 - 595	.194				
	UB 29285	Spheniscus sp.	4064 ± 45	-2083 - -2080	4029 - 4032	.001	-1891	3840	-12.7	This study
				-2072 - -1714	3663 - 4021	.999				
P21-1	Beta 162420	Charcoal	310 ± 60	1459 - 1681	269 - 491	.853	1599	351	-26.1	Quiroz and Sánchez 2005; Campbell and Quiroz 2015
				1730 - 1802	148 - 220	.147				
	Beta 75240	Charcoal	420 ± 80	1410 - 1655	295 - 540	1	1532	418	-27.8	Sánchez 1997
	AA 109586	Homo sapiens	563 ± 25	1397 - 1440	510 - 553	1	1416	534	-15.7	This study
	Beta 75239	Charcoal	640 ± 50	1293 - 1420	530 - 657	1	1350	600	-26.9	Quiroz and Sánchez 2005; Campbell and Quiroz 2015
	UCTL 529	Pottery	750 ± 80	1080 - 1400			1240			Sánchez 1997
	UCTL 528	Pottery	770 ± 80	1060 - 1380			1220			Sánchez 1997
	Beta 162421	Charcoal	870 ± 60	1045 - 1091	859 - 905	.087	1207	744	-26.2	Quiroz and Sánchez 2005; Campbell and Quiroz 2015
				1107 - 1122	828 - 843	.016				
				1128 - 1288	662 - 822	.897				

	Beta 181243	Charcoal	900 ± 60	1044 - 1273	677 - 906	1	1179	771	-26.5	Quiroz and Sánchez 2005; Campbell and Quiroz 2015
	Beta 69935	Charcoal	910 ± 70	1032 - 1272	678 - 918	1	1166	784	-25.0	Sánchez 1997
	UCTL 530	Pottery	1010 ± 100	780 - 1180			980			Sánchez 1997
	UCTL 539	Pottery	1020 ± 100	770 - 1170			970			Sánchez 1997
	UCTL 540	Pottery	1030 ± 110	740 - 1180			960			Sánchez 1997
	UCTL 541	Pottery	1060 ± 100	730 - 1130			930			Sánchez 1997
	UCTL 531	Pottery	1790 ± 180	-160 - 560			200			Campbell and Quiroz 2015
P22-1	AA 108923	Otariidae sp.	1033 ± 24	1405 - 1583	367 - 545	1	1477	473	-11.6	This study
	AA 108922	Camelidae sp.	453 ± 23	1440 - 1499	451 - 510	.955	1461	489	-21.7	This study
				1598 - 1610	340 - 352	.045				
	UB 29292	Charcoal	520 ± 33	1405 - 1456	494 - 545	1	1432	518	-26.9	This study
	AA 108924	Camelidae sp.	572 ± 23	1395 – 1437	513 - 555	1	1412	538	-21.3	This study
	AA 108921	Camelidae sp.	709 ± 23	1284 - 1322	628 - 666	.485	1346	604	-18.3	This study
				1347 - 1387	563 - 603	.515				
	UB 29293	Charcoal	707 ± 30	1281 - 1327	623 - 669	.474	1342	608	-27.8	This study
				1340 - 1390	560 - 610	.526				
	Beta 71646	Charcoal	1200 ± 140	640 - 1162	788 - 1310	.998	879	1069	-25.0	Sánchez 1997
				1170 - 1174	776 - 780	.002				
	AA 108925	Pudu puda	1220 ± 24	772 - 900	1050 - 1178	.834	864	1086	-21.3	This study
				927 - 964	986 - 1023	.166				
	UCTL 542	Pottery	1210 ± 130	520 - 1040			780			Sánchez 1997
	UCTL 543	Pottery	1250 ± 100	540 - 940			740			Sánchez 1997
P23-2	AA 108927	Pudu puda	243 ± 23	1648 - 1677	273 - 302	.315	1751	199	-21.2	This study

				1734 - 1799	151- 216	.685				
	AA 108926	Camelidae sp.	400 ± 23	1455 – 1515	435 - 495	.501	1526	424	-21.2	This study
				1541 – 1625	325 - 409	.499				
	AA 108929	Camelidae sp.	700 ± 23	1286 - 1325	625 - 664	.445	1350	600	-19.1	This study
				1343 - 1390	560 - 607	.555				
	UB 29289	Phaseolus vulgaris	679 ± 25	1297 - 1391	559 - 653	1	1347	603	-24.4	This study
	AA 108928	Camelidae sp.	740 ± 23	1274 - 1315	635 – 676	.722	1295	655	-21.4	This study
				1356 - 1381	569 - 594	.278				
	UB 29290	Zea mays	1108 ± 28	896 - 933	1017 - 1054	.194	989	961	-9.2	This study
				959 - 1026	924 - 991	.806				
P25-1	Gd 9198	Charcoal	240 ± 170	1460 - 1950	0 - 490	1	1707	241	-25.0	Campbell and Quiroz 2015
	Beta 137969	Shell	810 ± 60	1156 - 1317	633 - 794	.94	1691	259	1.8	Campbell and Quiroz 2015
				1354 - 1383	567 - 596	.06				
	Gd 10008	Charcoal	270 ± 100	1478 - 1819	131 - 472	.814	1685	263	-25.0	Sánchez 1997
				1825 - 1896	54 - 125	.115				
				1904 - 1950	0 - 46	.071				
	AA 108931	Camelidae sp.	428 ± 23	1447 - 1507	443 - 503	.794	1480	470	-20.1	This study
				1585 - 1619	331 - 365	.206				
	AA 109583	Homo sapiens	516 ± 24	1413 - 1452	498 - 537	1	1434	516	-14.0	This study
	Beta 132088	Charcoal	620 ± 60	1294 - 1437	513 - 656	1	1362	588	-26.9	Sánchez et al. 2004; Campbell and Quiroz 2015
	AA 108934	Camelidae sp.	703 ± 23	1285 - 1324	626 - 665	.459	1349	601	-20.7	This study
				1344 - 1389	561 - 606	.541				
	UB 29287	Zea mays	644 ± 35	1300 - 1369	581 - 650	.684	1345	605	-9.6	This study

			1371 - 1407	543 - 579	.316				
AA 108930	Camelidae sp.	687 ± 33	1290 - 1392	558 - 660	1	1345	605	-21.4	This study
UB 29288	Zea mays	661 ± 30	1299 - 1398	552 - 651	1	1344	606	-10.2	This study
Beta 132089	Charcoal	720 ± 80	1213 - 1418	532 - 737	1	1318	632	-26.6	Sánchez et al. 2004; Campbell and Quiroz 2015
AA 108932	Camelidae sp.	758 ± 23	1235 - 1242	708 - 715	.014	1285	665	-21.1	This study
			1265 - 1312	638 - 685	.877				
			1359 - 1380	570 - 591	.109				
Beta 137970	Charcoal	880 ± 70	1040 - 1285	665 - 910	1	1193	757	-24.6	Sánchez et al. 2004; Campbell and Quiroz 2015
Beta 62819 / CAMS 14037	Charcoal	890 ± 70	1038 - 1280	670 - 912	1	1184	766	-25.1	Sánchez 1997
Beta 114462	Charcoal	900 ± 80	1026 - 1283	667 - 924	1	1172	778	-26.2	Sánchez et al. 2004; Campbell and Quiroz 2015
UCTL 538	Pottery	820 ± 100	970 - 1370			1170			Sánchez 1997
AA 108933	Pudu puda	944 ± 24	1045 – 1096	854 - 905	.327	1149	801	-22.8	This study
			1106 – 1124	826 - 844	.045				
			1126 – 1211	739 - 824	.628				
AA 108936	Pudu puda	1053 ± 27	988 - 1048	902 - 962	.765	1024	926	-21.6	This study
			1083 - 1140	810 - 867	.235				
AA 108935	Camelidae sp.	1055 ± 25	989 – 1047	903 - 961	.828	1021	929	-20.4	This study
			1085 – 1134	816 - 865	.172				
UCTL 535	Pottery	1240 ± 130	490 – 1010			750			Sánchez 1997
UCTL 536	Pottery	1310 ± 130	420 - 940			680			Sánchez 1997
Gd 10007	Charcoal	1760 ± 130	27 - 599	1351 - 1923	1	314	1620	-25.0	Sánchez 1997
Gd 9197	Charcoal	1940 ± 180	-357 - -276	2225 - 2306	.041	103	1827	-25.0	Sánchez 1997

				-259 - 502	1448 - 2208	.954				
				506 - 520	1430 - 1444	.006				
P27-1	Beta 110337	Shell	3650 ± 70	-1594 - -1184	3133 - 3543	1	-1384	3338	1.3	Quiroz et al. 2000b
	Beta 71647 / CAMS 13062	Charcoal	3220 ± 50	-1009 - -743	2692 - 2958	1	-1453	3391	-28.3	Quiroz and Vásquez 1996
	Beta 110336	Shell	3740 ± 50	-1659 - -1343	3292 - 3608	1	-1493	3442	0.8	Quiroz et al. 2000a
P29-1	AA 108937	Camelidae sp.	654 ± 23	1301 - 1365	585 - 649	.746	1342		-20.7	This study
				1375 - 1400	550 - 575	.254	608			
	AA 89418	Charcoal	759 ± 38	1226 - 1318	632 - 724	.801	1286	663	-25.6	Campbell 2011
				1353 - 1384	566 - 597	.199				
	AA 108938	Camelidae sp.	821 ± 24	1219 - 1279	671- 731	1	1247	703	-20.6	This study
	AA 89417	Charcoal	825 ± 36	1190 - 1193	757 - 760	.006	1245	705	-25.0	Campbell 2011
				1197 - 1287	663 - 753	.994				
	AA 89416	Charcoal	895 ± 38	1049 - 1082	868 - 901	.066	1192	758	-26.4	Campbell 2011
				1142 - 1271	679 - 808	.934				
	AA 89419	Charcoal	964 ± 36	1029 - 1192	758 - 921	.993	1108	840	-26.6	Campbell 2011
				1198 - 1200	750 - 752	.007				
	AA 89420	Charcoal	1105 ± 36	893 - 942	1008 - 1057	.239	988	960	-24.1	Campbell 2011
				948 - 1029	921 - 1002	.761				
P30-1	Gd 4884	Charcoal	3270 ± 120	-1262 - -611	2560 - 3211	1	-1506	3443	-25.0	Quiroz and Sánchez 1993
	Beta 57810 / CAMS 5348	Charcoal	3280 ± 60	-1106 - -777	2726 - 3055	1	-1517	3450	-25.0	Quiroz and Sánchez 1993
	Gd 4885	Charcoal	3310 ± 90	-1213 - -765	2714 - 3162	1	-1553	3490	-25.0	Quiroz and Sánchez 1993
P31-1	AA 89423	Charcoal	334 ± 34	1496 - 1654	296 - 454	1	1563	387	-24.0	Campbell 2011
	AA 89421	Charcoal	408 ± 37	1451 - 1526	424 - 499	.512	1525	425	-26.0	Campbell 2011

			1534 - 1627	323 - 416	.488				
Gd 7152	Charcoal	450 ± 50	1419 - 1521	429 - 531	.682	1485	466	-25.0	Sánchez et al. 1994
			1536 - 1626	324 - 414	.318				
Beta 57811	Charcoal	500 ± 50	1394 - 1506	444 - 556	.942	1443	507	-25.0	Sánchez et al. 1994
			1586 - 1618	332 - 364	.058				
Gd 7174	Charcoal	500 ± 40	1401 - 1496	454 - 549	1	1440	510	-25.0	Sánchez et al. 1994
Beta 95085	Charcoal	510 ± 60	1321 - 1348	602 - 629	.032	1440	510	-25.8	Sánchez et al. 2004; Campbell and Quiroz 2015
			1387 - 1511	439 - 563	.883				
			1550 - 1558	392 - 400	.006				
			1574 - 1622	328 - 376	.079				
AA 89422	Charcoal	519 ± 37	1399 - 1460	490 - 551	1	1432	518	-24.0	Campbell 2011
Gd 6429	Charcoal	530 ± 80	1300 - 1368	582 - 650	.15	1431	519	-26.6	Quiroz et al. 1993; Sánchez et al. 1994
			1372 - 1513	437 - 578	.736				
			1545 - 1624	326 - 405	.114				
Gd 7144	Charcoal	530 ± 60	1316 - 1355	595 - 634	.079	1428	522	-25.0	Sánchez et al. 1994
			1382 - 1504	446 - 568	.891				
			1590 - 1616	334 - 360	.03				
Gd 5901	Charcoal	560 ± 40	1324 - 1343	607 - 626	.058	1416	534	-25.0	Quiroz et al. 1993; Sánchez et al. 1994
			1389 - 1451	499 - 561	.942				
Gd 6431	Charcoal	640 ± 90	1230 - 1249	701 - 720	.017	1354	596	-25.0	Quiroz et al. 1993; Sánchez et al. 1994
			1261 - 1456	494 - 689	.983				
AA 108939	Camelidae sp.	706 ± 23	1284 - 1323	627 - 666	.468	1348	602	-21.2	This study
			1346 - 1388	562 - 604	.532				

	Beta 95086	Charcoal	700 ± 50	1276 - 1399	551 - 674	1	1338	612	-25.3	Sánchez et al. 2004; Campbell and Quiroz 2015
	Gd 5902	Charcoal	710 ± 50	1270 - 1399	551 - 680	1	1332	618	-26.8	Quiroz et al. 1993; Sánchez et al. 1994
	AA 89424	Charcoal	826 ± 27	1214 - 1280	670 - 736	1	1246	704	-25.7	Campbell 2011
	Gd 6428	Charcoal	840 ± 70	1046 - 1089	861 - 904	.058	1227	723	-24.2	Quiroz et al. 1993; Sánchez et al. 1994
				1109 - 1120	830 - 841	.009				
				1130 - 1315	635 - 820	.903				
				1356 - 1381	569 - 594	.029				
Laguna Huairavos[a]	Beta 62523	Charcoal	1760 ± 80	127 - 189	1761 - 1823	.079	316	1617	-	Le-Quesne et al. 1999
				192 - 520	1430 - 1758	.921				

Note: Dates were calibrated using the software Calib 7.0 (Stuiver et al. 2005) and the calibration curve SHCal13 (Hogg et al. 2013), unless indicated. Negative values on dates correspond to B.C. dates

[a] It is an environmental column, not an archaeological site.

[b] Dates on pottery are thermoluminescence dates; base year 1990.

[c] Dates on shell and *Spheniscus* sp. and *Otariidae* sp. were calibrated considering a marine reservoir effect value of 190 ± 40 (as indicated by Stuiver and Braziunas [1993] for the South American South Pacific), and using the calibration curve Marine13 (Reimer et al. 2013).

[d] After Telford et al. 2004.

Supplemental Table 2.

Carpological remains recovered from the Mound top Profile (MP) trench

Taxa	Level1 (474-479 cm)	Level 2 (479-484 cm)	Level 3 (484-489 cm)	Level 4 (489-494 cm)	Total
Chenopodium sp. (charred)	2				2
Poaceae (uncharred)			1		1
Poaceae (charred)				3	3
Unidentifiable (charred)			2	4	6
Total	2		3	7	12

Supplemental Table 1.

Absolute dates from Mocha Island archaeological sites

Site	Laboratory code	Material[b, c]	^{14}C Age B.P.	Cal Age B.C./A.D. Range (2σ)	Cal Age B.P. Range (2σ)	p	Median Probability[d]		Δ^{13}C	Reference(s)
							Cal B.C./ A.D	Cal B.P.		
Mounds Complex	KCCAMS 109404	Charcoal	135 ± 15	1698 - 1724	226 - 252	.162	1861	89	-25.0	Campbell and Quiroz 2015
				1808 - 1869	81 - 142	.366				
				1876 - 1952	0 - 74	.472				
	AA 89415	Charcoal	1096 ± 37	890 - 1043	907 - 1060	1	994	956	-25.4	Campbell 2011
P5-1	AA 109585	Homo sapiens	506 ± 25	1416 - 1456	494 - 534	1	1438	512	-14.7	This study
	UB 26214	Zea mays	552 ± 26	1400 - 1443	507 - 550	1	1420	530	-10.0	This study
	UB 26216	Camelidae sp.	605 ± 26	1319 - 1351	599 - 631	.316	1396	554	-21.2	This study
				1385 - 1426	524 - 565	.684				
	AA 108920	Camelidae sp.	611 ± 23	1319 - 1351	599 - 631	.379	1393	557	-20.7	This study
				1385 - 1420	530 – 565	.621				
	UB 24529	Camelidae sp.	683 ± 26	1294 - 1391	559 - 656	1	1347	603	-21.1	This study
	UB 24528	Camelidae sp.	668 ± 26	1299 - 1395	555 - 651	1	1345	605	-20.9	This study

	UB 26215	Zea mays	635 ± 25	1309 - 1360	590 - 641	.653	1343	607	-10.2	This study
				1378 - 1409	541 - 572	.347				
	UB 24524	Chenopodium quinoa	718 ± 22	1281 - 1319	631 - 669	.537	1315	635	-28.6	This study
				1351 - 1385	565 - 599	.463				
	Beta 73674	Charcoal	740 ± 100	1152 - 1435	515 - 798	1	1300		-28.7	Sánchez 1997
	UB 26213	Camelidae sp.	751 ± 35	1229 - 1252	698 - 721	.063	1292	658	-	This study
				1260 - 1320	630 - 690	.68				
				1350 - 1386	564 - 600	.257				
	UB 24525	Zea mays	796 ± 25	1225 - 1288	662 - 725	1	1262	688	-9.0	This study
	UB 24523	Chenopodium quinoa	816 ± 27	1218 - 1282	668 - 732	1	1249	701	-27.9	This study
	UB 24526	Zea mays	992 ± 30	1025 - 1157	793 - 925	1	1094	856	-9.7	This study
	OxA 34844	Homo sapiens	1022 ± 30	1015 - 1151	799 - 935	1	1087	863	-15.6	This study
	Beta 73675	Charcoal	1210 ± 110	651 - 1046	904 - 1299	.981	866	1081	-27.6	Sánchez 1997
				1088 - 1110	840 - 862	.012				
				1118 - 1131	819 - 832	.007				
	UB 26212	Pudu puda	3566 ± 32	-1952 - -1744	3693 - 3901	1	-1841	3790	-20.1	This study
	AA 108919	Pudu puda	3651 ± 29	-2122 - -2093	4042 - 4071	.042	-1969	3918	-20.5	This study
				-2042 - -1883	3832 - 3991	.958				
P10-1	AA 109584	Homo sapiens	1169 ± 26	885 - 987	963 - 1065	1	933	1017	-14.7	This study
	UCTL 537	Pottery	1560 ± 150	130 - 730			430			Sánchez 1997
P12-1	UB 29283	Zea mays	453 ± 28	1435 - 1503	447 - 515	.904	1465	485	-9.6	This study
				1592 - 1614	336 - 358	.096				
	Beta 79917	Charcoal	550 ± 70	1298 - 1501	449 - 652	.982	1417	533	-28.4	Campbell and Quiroz 2015

				1595 - 1612	338 - 355	.018				
	UB 29284	Zea mays	656 ± 27	1300 - 1368	582 - 650	.74	1343	607	-9.8	This study
				1372 - 1400	550 - 578	.26				
	Beta 79918	Charcoal	680 ± 80	1229 - 1250	700 - 721	.03	1341	609	-27.8	Campbell and Quiroz 2015
				1260 - 1434	516 - 690	.97				
	UB 29282	Camelidae sp.	744 ± 32	1234 - 1243	707 - 716	.013	1296	654	-19.8	This study
				1265 - 1321	629 - 685	.68				
				1348 - 1387	563 - 602	.307				
	UB 29286	Camelidae sp.	753 ± 27	1234 - 1243	707 - 716	.016	1288	662	-20.3	This study
				1265 - 1316	634 - 685	.789				
				1355 - 1382	568 - 595	.194				
	UB 29285	Spheniscus sp.	4064 ± 45	-2083 - -2080	4029 - 4032	.001	-1891	3840	-12.7	This study
				-2072 - -1714	3663 - 4021	.999				
P21-1	Beta 162420	Charcoal	310 ± 60	1459 - 1681	269 - 491	.853	1599	351	-26.1	Quiroz and Sánchez 2005; Campbell and Quiroz 2015
				1730 - 1802	148 - 220	.147				
	Beta 75240	Charcoal	420 ± 80	1410 - 1655	295 - 540	1	1532	418	-27.8	Sánchez 1997
	AA 109586	Homo sapiens	563 ± 25	1397 - 1440	510 - 553	1	1416	534	-15.7	This study
	Beta 75239	Charcoal	640 ± 50	1293 - 1420	530 - 657	1	1350	600	-26.9	Quiroz and Sánchez 2005; Campbell and Quiroz 2015
	UCTL 529	Pottery	750 ± 80	1080 - 1400			1240			Sánchez 1997
	UCTL 528	Pottery	770 ± 80	1060 - 1380			1220			Sánchez 1997
	Beta 162421	Charcoal	870 ± 60	1045 - 1091	859 - 905	.087	1207	744	-26.2	Quiroz and Sánchez 2005; Campbell and Quiroz 2015
				1107 - 1122	828 - 843	.016				
				1128 - 1288	662 - 822	.897				

	Beta 181243	Charcoal	900 ± 60	1044 - 1273	677 - 906	1	1179	771	-26.5	Quiroz and Sánchez 2005; Campbell and Quiroz 2015
	Beta 69935	Charcoal	910 ± 70	1032 - 1272	678 - 918	1	1166	784	-25.0	Sánchez 1997
	UCTL 530	Pottery	1010 ± 100	780 - 1180			980			Sánchez 1997
	UCTL 539	Pottery	1020 ± 100	770 - 1170			970			Sánchez 1997
	UCTL 540	Pottery	1030 ± 110	740 - 1180			960			Sánchez 1997
	UCTL 541	Pottery	1060 ± 100	730 - 1130			930			Sánchez 1997
	UCTL 531	Pottery	1790 ± 180	-160 - 560			200			Campbell and Quiroz 2015
P22-1	AA 108923	Otariidae sp.	1033 ± 24	1405 - 1583	367 - 545	1	1477	473	-11.6	This study
	AA 108922	Camelidae sp.	453 ± 23	1440 - 1499	451 - 510	.955	1461	489	-21.7	This study
				1598 - 1610	340 - 352	.045				
	UB 29292	Charcoal	520 ± 33	1405 - 1456	494 - 545	1	1432	518	-26.9	This study
	AA 108924	Camelidae sp.	572 ± 23	1395 – 1437	513 - 555	1	1412	538	-21.3	This study
	AA 108921	Camelidae sp.	709 ± 23	1284 - 1322	628 - 666	.485	1346	604	-18.3	This study
				1347 - 1387	563 - 603	.515				
	UB 29293	Charcoal	707 ± 30	1281 - 1327	623 - 669	.474	1342	608	-27.8	This study
				1340 - 1390	560 - 610	.526				
	Beta 71646	Charcoal	1200 ± 140	640 - 1162	788 - 1310	.998	879	1069	-25.0	Sánchez 1997
				1170 - 1174	776 - 780	.002				
	AA 108925	Pudu puda	1220 ± 24	772 - 900	1050 - 1178	.834	864	1086	-21.3	This study
				927 - 964	986 - 1023	.166				
	UCTL 542	Pottery	1210 ± 130	520 - 1040			780			Sánchez 1997
	UCTL 543	Pottery	1250 ± 100	540 - 940			740			Sánchez 1997
P23-2	AA 108927	Pudu puda	243 ± 23	1648 - 1677	273 - 302	.315	1751	199	-21.2	This study

				1734 - 1799	151- 216	.685				
	AA 108926	Camelidae sp.	400 ± 23	1455 – 1515	435 - 495	.501	1526	424	-21.2	This study
				1541 – 1625	325 - 409	.499				
	AA 108929	Camelidae sp.	700 ± 23	1286 - 1325	625 - 664	.445	1350	600	-19.1	This study
				1343 - 1390	560 - 607	.555				
	UB 29289	Phaseolus vulgaris	679 ± 25	1297 - 1391	559 - 653	1	1347	603	-24.4	This study
	AA 108928	Camelidae sp.	740 ± 23	1274 - 1315	635 – 676	.722	1295	655	-21.4	This study
				1356 - 1381	569 - 594	.278				
	UB 29290	Zea mays	1108 ± 28	896 - 933	1017 - 1054	.194	989	961	-9.2	This study
				959 - 1026	924 - 991	.806				
P25-1	Gd 9198	Charcoal	240 ± 170	1460 - 1950	0 - 490	1	1707	241	-25.0	Campbell and Quiroz 2015
	Beta 137969	Shell	810 ± 60	1156 - 1317	633 - 794	.94	1691	259	1.8	Campbell and Quiroz 2015
				1354 - 1383	567 - 596	.06				
	Gd 10008	Charcoal	270 ± 100	1478 - 1819	131 - 472	.814	1685	263	-25.0	Sánchez 1997
				1825 - 1896	54 - 125	.115				
				1904 - 1950	0 - 46	.071				
	AA 108931	Camelidae sp.	428 ± 23	1447 - 1507	443 - 503	.794	1480	470	-20.1	This study
				1585 - 1619	331 - 365	.206				
	AA 109583	Homo sapiens	516 ± 24	1413 - 1452	498 - 537	1	1434	516	-14.0	This study
	Beta 132088	Charcoal	620 ± 60	1294 - 1437	513 - 656	1	1362	588	-26.9	Sánchez et al. 2004; Campbell and Quiroz 2015
	AA 108934	Camelidae sp.	703 ± 23	1285 - 1324	626 - 665	.459	1349	601	-20.7	This study
				1344 - 1389	561 - 606	.541				
	UB 29287	Zea mays	644 ± 35	1300 - 1369	581 - 650	.684	1345	605	-9.6	This study

			1371 - 1407	543 - 579	.316				
AA 108930	Camelidae sp.	687 ± 33	1290 - 1392	558 - 660	1	1345	605	-21.4	This study
UB 29288	Zea mays	661 ± 30	1299 - 1398	552 - 651	1	1344	606	-10.2	This study
Beta 132089	Charcoal	720 ± 80	1213 - 1418	532 - 737	1	1318	632	-26.6	Sánchez et al. 2004; Campbell and Quiroz 2015
AA 108932	Camelidae sp.	758 ± 23	1235 - 1242	708 - 715	.014	1285	665	-21.1	This study
			1265 - 1312	638 - 685	.877				
			1359 - 1380	570 - 591	.109				
Beta 137970	Charcoal	880 ± 70	1040 - 1285	665 - 910	1	1193	757	-24.6	Sánchez et al. 2004; Campbell and Quiroz 2015
Beta 62819 / CAMS 14037	Charcoal	890 ± 70	1038 - 1280	670 - 912	1	1184	766	-25.1	Sánchez 1997
Beta 114462	Charcoal	900 ± 80	1026 - 1283	667 - 924	1	1172	778	-26.2	Sánchez et al. 2004; Campbell and Quiroz 2015
UCTL 538	Pottery	820 ± 100	970 - 1370			1170			Sánchez 1997
AA 108933	Pudu puda	944 ± 24	1045 – 1096	854 - 905	.327	1149	801	-22.8	This study
			1106 – 1124	826 - 844	.045				
			1126 – 1211	739 - 824	.628				
AA 108936	Pudu puda	1053 ± 27	988 - 1048	902 - 962	.765	1024	926	-21.6	This study
			1083 - 1140	810 - 867	.235				
AA 108935	Camelidae sp.	1055 ± 25	989 – 1047	903 - 961	.828	1021	929	-20.4	This study
			1085 – 1134	816 - 865	.172				
UCTL 535	Pottery	1240 ± 130	490 – 1010			750			Sánchez 1997
UCTL 536	Pottery	1310 ± 130	420 - 940			680			Sánchez 1997
Gd 10007	Charcoal	1760 ± 130	27 - 599	1351 - 1923	1	314	1620	-25.0	Sánchez 1997
Gd 9197	Charcoal	1940 ± 180	-357 - -276	2225 - 2306	.041	103	1827	-25.0	Sánchez 1997

				-259 - 502	1448 - 2208	.954				
				506 - 520	1430 - 1444	.006				
P27-1	Beta 110337	Shell	3650 ± 70	-1594 - -1184	3133 - 3543	1	-1384	3338	1.3	Quiroz et al. 2000b
	Beta 71647 / CAMS 13062	Charcoal	3220 ± 50	-1009 - -743	2692 - 2958	1	-1453	3391	-28.3	Quiroz and Vásquez 1996
	Beta 110336	Shell	3740 ± 50	-1659 - -1343	3292 - 3608	1	-1493	3442	0.8	Quiroz et al. 2000a
P29-1	AA 108937	Camelidae sp.	654 ± 23	1301 - 1365	585 - 649	.746	1342		-20.7	This study
				1375 - 1400	550 - 575	.254	608			
	AA 89418	Charcoal	759 ± 38	1226 - 1318	632 - 724	.801	1286	663	-25.6	Campbell 2011
				1353 - 1384	566 - 597	.199				
	AA 108938	Camelidae sp.	821 ± 24	1219 - 1279	671- 731	1	1247	703	-20.6	This study
	AA 89417	Charcoal	825 ± 36	1190 - 1193	757 - 760	.006	1245	705	-25.0	Campbell 2011
				1197 - 1287	663 - 753	.994				
	AA 89416	Charcoal	895 ± 38	1049 - 1082	868 - 901	.066	1192	758	-26.4	Campbell 2011
				1142 - 1271	679 - 808	.934				
	AA 89419	Charcoal	964 ± 36	1029 - 1192	758 - 921	.993	1108	840	-26.6	Campbell 2011
				1198 - 1200	750 - 752	.007				
	AA 89420	Charcoal	1105 ± 36	893 - 942	1008 - 1057	.239	988	960	-24.1	Campbell 2011
				948 - 1029	921 - 1002	.761				
P30-1	Gd 4884	Charcoal	3270 ± 120	-1262 - -611	2560 - 3211	1	-1506	3443	-25.0	Quiroz and Sánchez 1993
	Beta 57810 / CAMS 5348	Charcoal	3280 ± 60	-1106 - -777	2726 - 3055	1	-1517	3450	-25.0	Quiroz and Sánchez 1993
	Gd 4885	Charcoal	3310 ± 90	-1213 - -765	2714 - 3162	1	-1553	3490	-25.0	Quiroz and Sánchez 1993
P31-1	AA 89423	Charcoal	334 ± 34	1496 - 1654	296 - 454	1	1563	387	-24.0	Campbell 2011
	AA 89421	Charcoal	408 ± 37	1451 - 1526	424 - 499	.512	1525	425	-26.0	Campbell 2011

			1534 - 1627	323 - 416	.488				
Gd 7152	Charcoal	450 ± 50	1419 - 1521	429 - 531	.682	1485	466	-25.0	Sánchez et al. 1994
			1536 - 1626	324 - 414	.318				
Beta 57811	Charcoal	500 ± 50	1394 - 1506	444 - 556	.942	1443	507	-25.0	Sánchez et al. 1994
			1586 - 1618	332 - 364	.058				
Gd 7174	Charcoal	500 ± 40	1401 - 1496	454 - 549	1	1440	510	-25.0	Sánchez et al. 1994
Beta 95085	Charcoal	510 ± 60	1321 - 1348	602 - 629	.032	1440	510	-25.8	Sánchez et al. 2004; Campbell and Quiroz 2015
			1387 - 1511	439 - 563	.883				
			1550 - 1558	392 - 400	.006				
			1574 - 1622	328 - 376	.079				
AA 89422	Charcoal	519 ± 37	1399 - 1460	490 - 551	1	1432	518	-24.0	Campbell 2011
Gd 6429	Charcoal	530 ± 80	1300 - 1368	582 - 650	.15	1431	519	-26.6	Quiroz et al. 1993; Sánchez et al. 1994
			1372 - 1513	437 - 578	.736				
			1545 - 1624	326 - 405	.114				
Gd 7144	Charcoal	530 ± 60	1316 - 1355	595 - 634	.079	1428	522	-25.0	Sánchez et al. 1994
			1382 - 1504	446 - 568	.891				
			1590 - 1616	334 - 360	.03				
Gd 5901	Charcoal	560 ± 40	1324 - 1343	607 - 626	.058	1416	534	-25.0	Quiroz et al. 1993; Sánchez et al. 1994
			1389 - 1451	499 - 561	.942				
Gd 6431	Charcoal	640 ± 90	1230 - 1249	701 - 720	.017	1354	596	-25.0	Quiroz et al. 1993; Sánchez et al. 1994
			1261 - 1456	494 - 689	.983				
AA 108939	Camelidae sp.	706 ± 23	1284 - 1323	627 - 666	.468	1348	602	-21.2	This study
			1346 - 1388	562 - 604	.532				

	Beta 95086	Charcoal	700 ± 50	1276 - 1399	551 - 674	1	1338	612	-25.3	Sánchez et al. 2004; Campbell and Quiroz 2015
	Gd 5902	Charcoal	710 ± 50	1270 - 1399	551 - 680	1	1332	618	-26.8	Quiroz et al. 1993; Sánchez et al. 1994
	AA 89424	Charcoal	826 ± 27	1214 - 1280	670 - 736	1	1246	704	-25.7	Campbell 2011
	Gd 6428	Charcoal	840 ± 70	1046 - 1089	861 - 904	.058	1227	723	-24.2	Quiroz et al. 1993; Sánchez et al. 1994
				1109 - 1120	830 - 841	.009				
				1130 - 1315	635 - 820	.903				
				1356 - 1381	569 - 594	.029				
Laguna Huairavos[a]	Beta 62523	Charcoal	1760 ± 80	127 - 189	1761 - 1823	.079	316	1617	-	Le-Quesne et al. 1999
				192 - 520	1430 - 1758	.921				

Note: Dates were calibrated using the software Calib 7.0 (Stuiver et al. 2005) and the calibration curve SHCal13 (Hogg et al. 2013), unless indicated. Negative values on dates correspond to B.C. dates

[a] It is an environmental column, not an archaeological site.

[b] Dates on pottery are thermoluminescence dates; base year 1990.

[c] Dates on shell and *Spheniscus* sp. and *Otariidae* sp. were calibrated considering a marine reservoir effect value of 190 ± 40 (as indicated by Stuiver and Braziunas [1993] for the South American South Pacific), and using the calibration curve Marine13 (Reimer et al. 2013).

[d] After Telford et al. 2004.

Supplemental Table 2.

Carpological remains recovered from the Mound top Profile (MP) trench

Taxa	Level1 (474-479 cm)	Level 2 (479-484 cm)	Level 3 (484-489 cm)	Level 4 (489-494 cm)	Total
Chenopodium sp. (charred)	2				2
Poaceae (uncharred)			1		1
Poaceae (charred)				3	3
Unidentifiable (charred)			2	4	6
Total	2		3	7	12

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