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Desert travels in the Atacama: making place through movement (c. 2500-1500 cal BP)

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Social worlds are constituted by movement. Mobility entails the circulation not only of people, but also of material goods, imaginaries, experiences, flows of information, and knowledge. In this article, we examine different forms of movement in the Atacama Desert during the Formative Period (c. 2500-1500 cal BP), such as pedestrian travels, llama caravans, and navigation on sea lion-skin vessels along the Pacific, incorporating various material means and encompassing a wide array of incentives. We present different case studies that challenge monolithic assumptions about mobility in the South-Central Andes, commonly understood through the lens of ecological complementarity and primarily driven by economic exchange. Extending Binford's classic distinction between residential and logistical mobility as two ideal types of hunter-gatherers' settlement systems to include groups of early farmers, in combination with the territorial categories of local and extra-local, we interrogate the spatial and temporal scale of these journeys – from daily to seasonal, from short to long distance – and its materialization. In these examples, we approach movement and travel as a way of life, expanding the traditional view of mobility through an exploration of the varied ways in which it was practised and integrated into the social lives of desert dwellers.

Recent literature on the archaeology of deserts characterizes them as landscapes that have captured public imagination because they are commonly perceived as places to assess human resilience, technological innovation, adaptation, and change. Rendered as extreme and inhospitable environments, they have played a major role in inspiring anthropological inquiries as well, including ethnographical accounts of 'desert peoples' and the study of the evolution of human societies (Veth, Smith & Hiscock 2005: 1-2).

The purpose of this article is to examine the ways in which the Atacama Desert has been historically inhabited through movement and travel. Commonly viewed as a vast landscape of bare lands, the Atacama provides an important scenario to reconsider the movement of people and objects not only as an adaptive strategy, but also as a place-making practice: that is, a set of sociopolitical and material processes by which people (re-)create the geographies in which they live (Pierce, Martin & Murphy 2011). This article considers the importance of understanding the relationship between movement and material culture for identifying different forms and scales of mobility (see Kelly 1992). We begin by providing a characterization of its ecological characteristics to understand the limitations and possibilities it offers for human life. Second, we discuss traditional approaches to mobility in the South-Central Andes, underscoring their partial interpretative legacies while presenting some of the critiques that have been mobilized against them in recent literature. Finally, we synthesize different case studies from the Formative Period (c. 2500-1500 cal BP) that challenge traditional models of verticality and the predominance of economic arguments as the main incentive for travel, upending conventional forms of explaining the logic and logistics of movement in the South-Central Andes. These examples illustrate different modes of travel that operated simultaneously during the Formative Period, with some cases dating back to the Late Archaic (c. 6500-4000 cal BP). Rather than attempting to fit each of our case studies into the variety of models of mobility offered by Andean archaeology, the evidence we present renders visible the particularities of certain localities without losing sight of their relevance in the broader networks of mobility in the Atacama. It does so by focusing on the material markers of travelling, considering the extraordinary preservation conditions that the desert offers, which makes certain indicators of mobility uniquely visible in the archaeological record. Thus, this article provides insight into the multiple ways in which travelling took place in and through the Atacama, contributing to current discussions about mobility and travelling in the Andean desert, and in archaeology more broadly.

Desert geographies: situating the Atacama Desert

The Atacama Desert comprises a territory that extends along the Pacific Coast and the western slopes of the Andes (Fig. 1). Habitable areas are located around water resources. This geographical pattern has generated a landscape of discontinuous and sparse settlements, with lower demographic densities than the Central Andes, and a greater emphasis on pastoralism and the development of interregional traffic (Nielsen 2009; 2013; Núñez & Dillehay 1995; Rivera 1991; 2008).

The Atacama is characterized by its aridity, and has been described as one of the driest and oldest desert in the world (McKay *et al.* 2003), where rainfall ranges from 300 mm a year above 3000 m.a.s.l. to less than 1 mm a year below 2300 m.a.s.l. (Houston 2006). In this article, we focus mainly on what has been called the ‘hyperarid core’ (below 2500 m.a.s.l.), an area where human occupation revolved around springs or shallow groundwater seepages, oases, and seasonal watercourses. It is a territory comprised by different ecosystems: (1) the Coastal Range and Pacific coast to the west, whose high productivity depends on the Humboldt Current – an upwelling system that supports an exceptionally diverse marine biomass; (2) the hinterland or Pampa del Tamarugal basin (PDT), where water availability occurs in seasonally activated watercourses that depend on summer rainfalls in the highlands, discharging into this inland basin in short pulses; and (3) the Loa River Valley and the Atacama saltpan basin

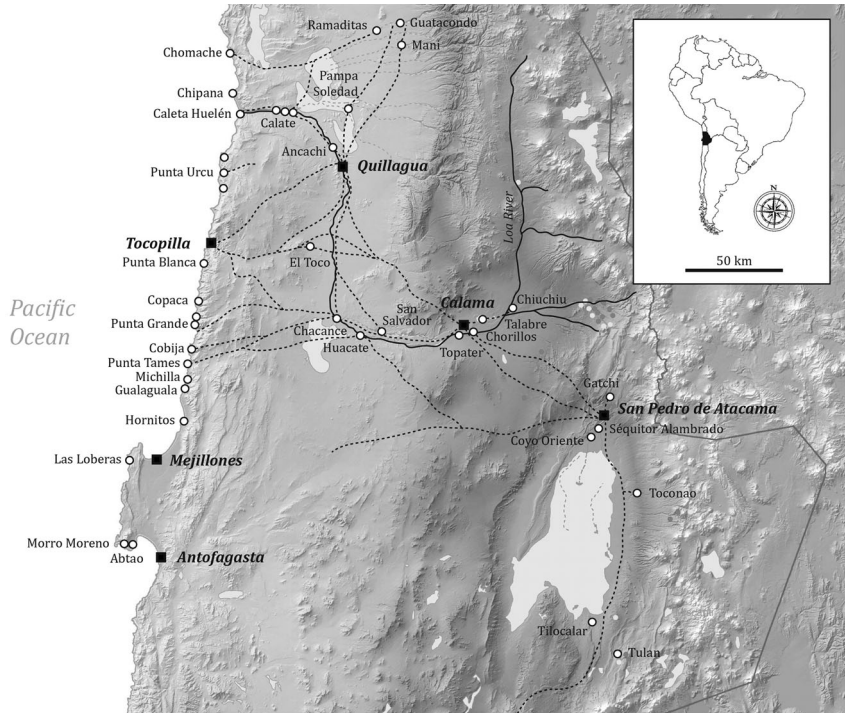


Figure 1. Map of the area of study, including archaeological sites and routes mentioned in the text. (Credit: © Google Earth 2019, modified by the authors.)

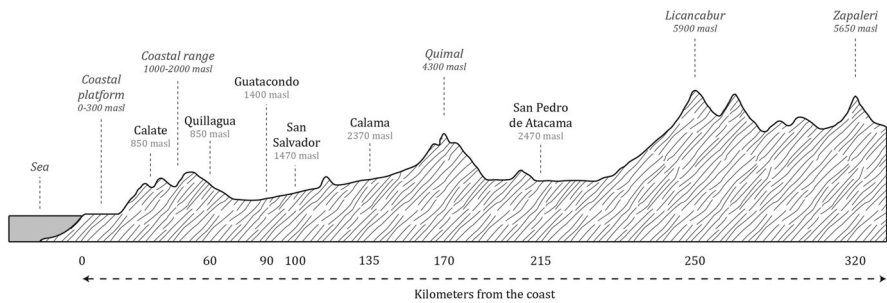


Figure 2. East-West altitudinal profile ($23^{\circ}35'S$) of the Atacama Desert, indicating the localities mentioned in the text. (Credit: Image created by the authors.)

to the south, where a number of ravines (*quebradas*) converge to release their seasonal waters (Clarke 2006; McKay *et al.* 2003; Marquet *et al.* 1998; Santoro *et al.* 2017) (Fig. 2).

Archaeological and palaeoecological records suggest increased humidity during the Late Holocene (c.3000-500 cal BP) (Gayó, Latorre, Jordan, *et al.* 2012; Gayó, Latorre, Santoro, Maldonado & De Pol-Holz 2012; Maldonado, Betancourt, Latorre & Villagrán 2005; Marquet *et al.* 1998), resulting in greater water availability at surface levels and in underground aquifers that stimulated the natural vegetation coverage of taxa across the PDT, most of which are still present in valleys and oases throughout the region (García *et al.* 2014).

Long-distance travels and the vertical archipelago model

It has been long assumed that the Formative Period in the Americas involved a drastic reduction of mobility and precipitated radical changes in food storage, modes of production, demography, territoriality, and exchange (Lavallée 2006; Lumbreras 2006; Muñoz 1989; 2004; Núñez 1974; Rivera 1994; Willey & Phillips 1958). In the Andes, mobility continued to play a key role in the sociopolitical and economic organization of the cultural groups that inhabited the area from pre-Hispanic times, throughout the Colonial Period and up until the present, when many of the local economies still depend upon commerce and exchange (Núñez & Dillehay 1995).

Traditionally, mobility in the South-Central Andes has been understood through the lens of what Murra (1972) calls 'ecological complementarity'. For populations of hunters and gatherers of the Archaic Period, transhumance emerged as a mobility strategy and a mode of subsistence based on the principle that each ecological niche was unable to provide the necessary resources to ensure the livelihood of the group, driving people to move from one environment to the other in order to gain direct access (Bustos 1975; Lynch 1971; 1975; 1983; Núñez 1975; Núñez, Zlatar & Núñez 1975).

In the case of sedentary groups, 'ecological complementarity' consolidated the notion that long-distance provisioning involved the movement of llama caravans that articulated large economic networks (e.g. Browman 1974; Murra 1972; 1985; Núñez & Dillehay 1995; Schiappacasse, Castro & Neimeyer 1989; Van Buren 1996). Described as a system that pre-dated the Inca expansion, the model postulates that societies living in the Andean highlands established colonies in other ecological zones to access locally produced goods and diversify their resources without the need to engage in inter-ethnic trade. A maximum possible number of ecological zones were thus brought under *direct* control (Murra 1972). Characterized by a pattern of land use that created a patchy landscape of ethnic territories, the model was premised upon the notion that exchange between ethnic groups was either minimal or non-existent, and that the operation of trade networks functioned under politically and cultural independent communities (Martínez 1998; Nielsen 2009; 2013). It has also been employed as a paradigmatic example of non-market economies focusing on *reciprocity* as a unique trait of Andean economy, in contrast to *exchange* or other commercial forms of interaction (Hirth & Pillsbury 2013; Van Buren 1996).

While the model was based on ethnographic and ethnohistorical information, and Murra himself never applied it to the archaeological record, its application as a frame of interpretation to the pre-Hispanic past has been challenged on several accounts. For instance, it has been generally agreed that colonies from the highlands in other regions of the Andes did not exist prior to the Inca expansion, and that inter-ethnic exchange existed among different polities (see Nielsen 2009; Van Buren 1996). As discussed by Nielsen (2009), archaeologists have proposed different models for the pre-Columbian era that focus on importance of inter-ethnic trade and the central role it played in the political economy of the Southern Andes, such as Browman's (1980) '*altiplano* mode' and Núñez and Dillehay's (1995) 'circuit mobility'. However, these models have rendered invisible other groups involved in traffic – such as coastal populations (Pimentel, Ugarte, Blanco, Torres-Rouff & Pestle 2017).

The examples we present propose different modalities of travel in the Atacama, expanding the scope of traditional models developed in the Andes beyond the 'ecological imperative' (Salomon 1985). Different case studies are taken into account in order to attend to the question of who and what travels, and which geographical areas

were articulated through these movements. We argue that mobility created a mode of existence in the Atacama Desert, a well-integrated practice in the lives of desert dwellers that began taking shape at least in the Late Archaic, showing an evident consolidation during the Formative Period. Moreover, some of the modalities defined in the following pages operated simultaneously, suggesting that moving was not necessarily the result of an ever-expanding or more efficient adaptation to this territory. Rather than just an adaptive strategy – or a practice that was exclusively associated with certain modes of production – movement was a way of inhabiting the desert, and not the exclusive domain of hunter-gatherers.

Travelling in the Atacama

Daily movements in the valley of Guatacondo: the comings and goings of everyday life

The valley of Guatacondo has been identified as one of the earliest loci of Formative Period occupations in the Atacama Desert (Meighan & True 1980; Mostny 1970a; Rivera 2005). This period is broadly characterized by the emergence of agglomerated villages often incorporating large enclosed spaces, to which public functions have been attributed (Adán, Urbina, Pellegrino & Agüero 2013; Graffam & Martindale 1995; Rivera, Shea, Carevic & Graffam 1995/6). Among them, the village of Guatacondo 1 (G-1) has more than 100 circular enclosures made of mudbrick distributed around a central space that covers a surface of almost 2,000 m², and includes a variety of architectural features, such as small windows and doorways; postholes for the support of roofs; storage pits; and modelled figures on the walls of some buildings (Mostny 1980; Urbina, Adán & Pellegrino 2012). The architectural investment contrasts with the scarce material recovered from excavations, where grinding tools and fragments of small cooking vessels and large jars to store and transport liquids predominate, suggesting that G-1 may have operated as a site for occasional gatherings (Meighan 1980; Mostny 1970a; 1970b). G-1 is placed on an area associated with once-extant *Prosopis* forests and several thousands of hectares of farming fields fed by an intricate irrigation system (Rivera *et al.* 1995/6; Vidal, García & Méndez-Quiroz 2015).

Smaller architectural complexes are distributed on the same area, including the sites of Ramaditas, Guatacondo 2, and Guatacondo 4 – which share with the former the extensive use of mud and mudbricks as building material (Fig. 3). Although information on the local archaeological sequence remains insufficiently understood, the material record indicates that this desert valley was consistently occupied during the Formative Period (Adán *et al.* 2013; Meighan & True 1980; Mostny 1965; 1970a; Núñez 1976a) (Fig. 4). Recent excavations conducted at these sites have provided similar evidence: the dominant pottery type corresponds to the earliest ceramic regional tradition (Loa Café Alisado or LCA), and lithic tools are predominantly made with a fine-grained local basalt that was employed for the production of large flakes, wood-planers, scrapers, and choppers – probably associated with the exploitation and processing of wood – along with other instruments used for grinding, especially mortars and pestles, recovered from discrete occupational layers or on surface levels. Less ubiquitous but consistently present are shells and fish vertebrae from the Pacific coast, copper ore and shell beads, small sheets of copper, and copper slag (García *et al.* 2014; Meighan & True 1980; Rivera *et al.* 1995/6).

Palaeoenvironmental records suggest that episodes of seasonal activation of the stream in Guatacondo and other adjacent ravines – which rely almost exclusively on

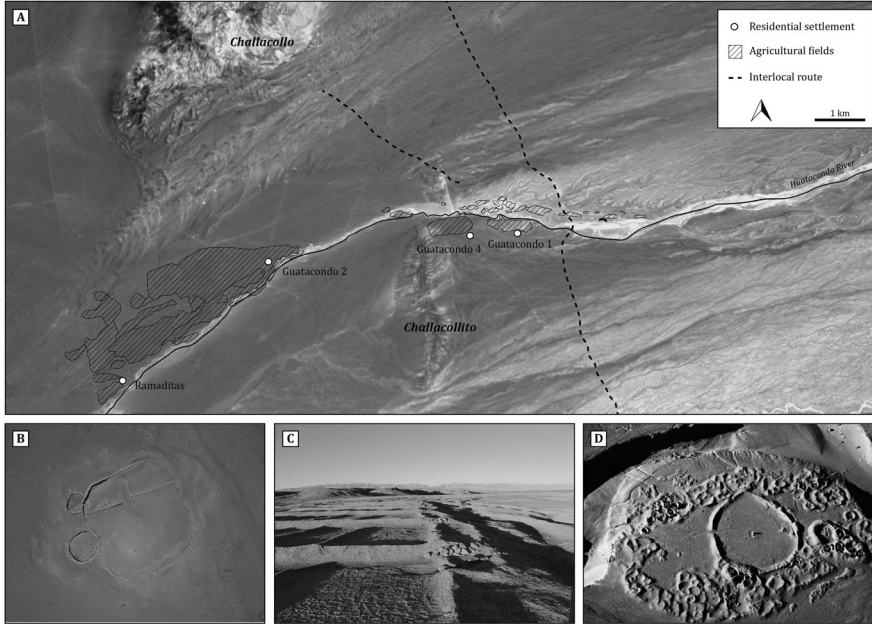


Figure 3. (A) Map of the Guatacondo Valley indicating the location of sites and routes. (Credit: © Google Earth 2019, modified by the authors.) (B) Aerial view of Compound 1, Ramaditas. (Credit: Image created by the authors.) (C) View of agricultural fields. (Credit: Photo by the authors.) (D) Aerial view of Guatacondo-1. (Credit: Photo by the authors.)

precipitations in the highlands – amplified during the Formative Period. This ‘moisture anomaly’ promoted the expansion of wetland ecosystems into the hyperarid core, facilitating the development of horticultural regimes and the intensification of gathering practices (García *et al.* 2014; Gayó, Latorre, Jordan, *et al.* 2012; Gayó, Latorre, Santoro, *et al.* 2012; Santoro *et al.* 2017). Archaeologically, this phenomenon is reflected in the development of technologies for managing surface water, such as water dams, irrigation networks, and cultivation fields around the archaeological sites, which consistently show radiocarbon dates that coincide with the Formative Period (García *et al.* 2014; Rivera 2005; Shea & Rivera 1995/6; Vidal *et al.* 2015). While Rivera (2002) reports the evidence of *Cheno-am* pollen, *Chenopodium* and *Zea mays* phytoliths, as well as potato (*Solanum tuberosa*) and maize (*Zea mays*) starch in Ramaditas, recent excavations at the site have not reported any cultigen remains (Vidal *et al.* 2015). For G-1, on the other hand, over 1,000 grains of quinoa have been recovered, along with exiguous remains of maize and gourd (*Lagenaria* sp.) (García *et al.* 2014). Tartaglia (1980) reports evidence of *Zea mays*, lima beans (*Phaseolus lunatus*), and gourds in small quantities in G-1, noting that the most ubiquitous plant remain at the site was the *algarrobo* (*Prosopis* sp.).

It has been suggested that the intermittent hydraulic regime of the valley, the relatively low quantity of cultivated plants present in the archaeological record, the discrete occupational layers found at the sites, the ubiquity of *algarrobo* seeds and pods, and the nature of the lithic assemblage signal the systematic use of the *Prosopis* forest, rather than a settlement system that depended upon intensive agriculture (Adán *et al.* 2013; Uribe & Vidal 2012; Vidal *et al.* 2015).

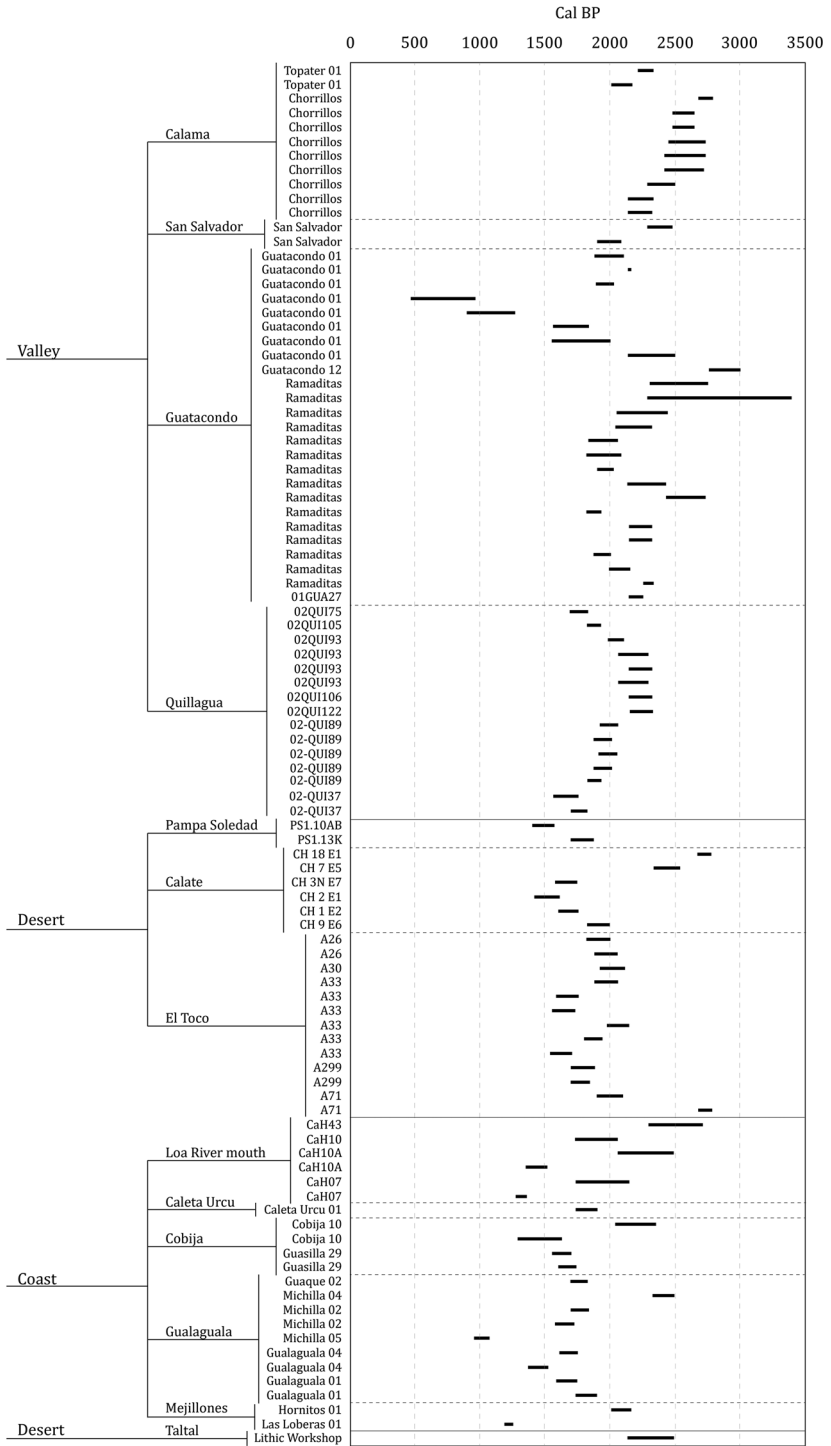


Figure 4. Calibrated radiocarbon dates (SHCal13) for the sites mentioned in the text. (Credit: Image created by the authors.)

Recent surveys on the southern terrace of the *quebrada*, to the west of G-1, confirmed that extensive areas outside of the main villages concentrate significant amounts of material remains (pottery, lithic tools – including hoe-heads, mortars, *manos*, and projectile points – fish bones, shells, beads, and wood), revealing that daily activities were also carried out in open-air sites outside the main architectural complexes.

Considering the strong material indications of the continuous use of open spaces, movement of people and resources along the valley was a constant. This type of daily mobility, which involved short distances between sites, workshops, and cultivation plots, is rarely accounted for due to its lack of visibility in the archaeological record. Nevertheless, the daily comings and goings of people through the valley was an essential component of their everyday experiences, connecting places in the immediate landscape, and fostering encounters and social interactions. This type of movement operated in conjunction with other forms of mobility that involved longer distances, as evidenced by the ubiquity of coastal products in the valley, among other foreign goods. The continuous supply of non-local goods, particularly marine resources, required broader and more complex networks of organization and infrastructure.

Caravan route Guatacondo-Quillagua: moving through the desert

Daily movements were functioning alongside other forms of travelling that involved longer distances and greater investments in infrastructure, bringing different groups into contact. A segment of a caravan route that connected the valley of Guatacondo with the oasis of Quillagua, in the Loa River Valley – two drainage basins separated by nearly 80 km of absolute desert – offers a glimpse of how inter-valley journeys operated (see also Briones 2006; Briones, Núñez & Standen 2005; Clarkson & Briones 2001).

An exploration of 25 km (Fig. 5) provided material evidence of different moments of occupation of the route – from the Formative to the Republican periods (nineteenth century) (Pimentel 2013). Among the approximately 5,000 ceramic fragments collected, Early Formative and Late Formative Period types were identified. Forty-six structures were recorded in direct association with the route, including small waystations, and ritual features related to regional traffic, such as stone alignments, small mounds, geoglyphs, and lithic or mineral scatters. Two structures were excavated, revealing discrete Formative Period occupational layers. The first one, site 10AB, was comprised

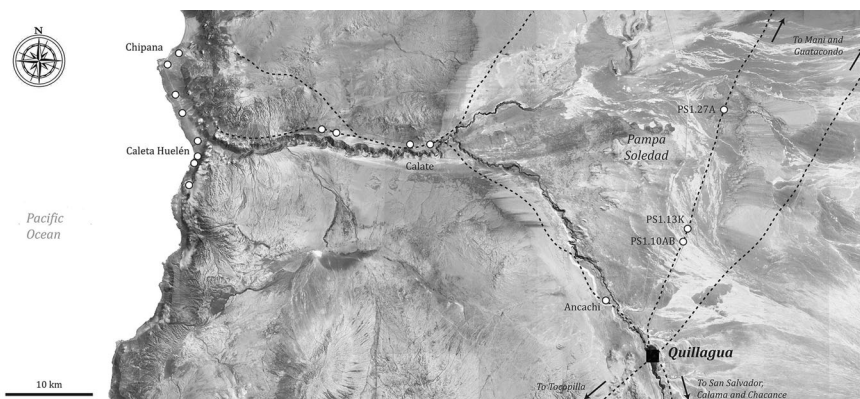


Figure 5. Map showing Formative Period routes of the lower section of the Loa River Valley. (Credit: © Google Earth 2019, modified by the authors.)

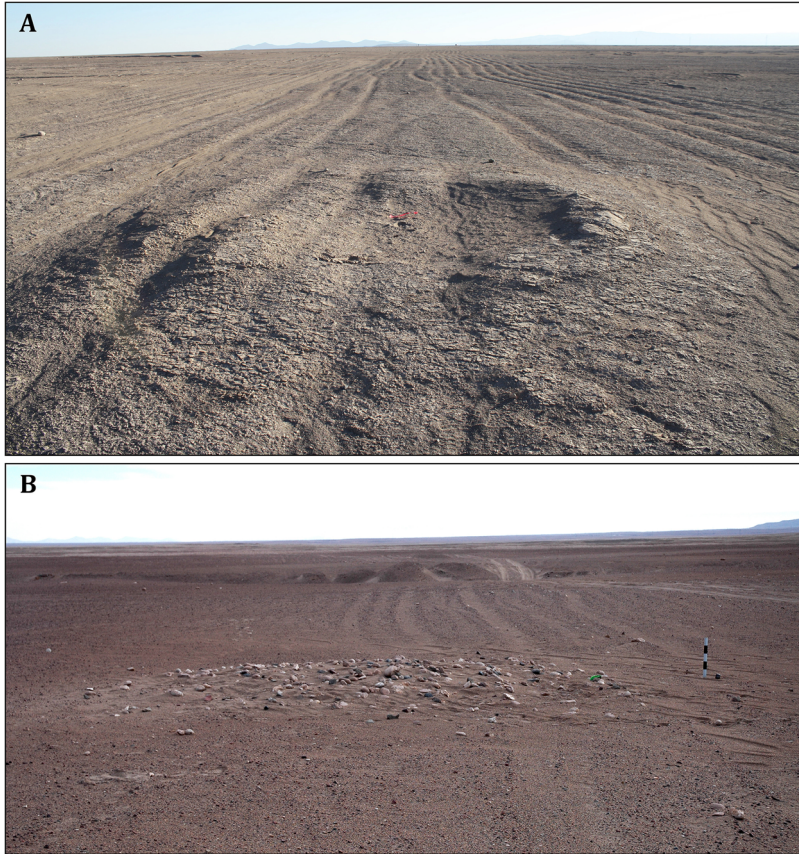


Figure 6. View of two Formative Period sites in Pampa Soledad: (A) PS1.13K; (B) PS1.27A. (Credit: Photos by the authors.)

of two structures located by the side of the route (Fig. 6A). The pottery recovered was highly varied, including types from Tarapacá and Atacama, predominantly from the Late Intermediate Period ($n = 395$), followed by Formative Period types ($n = 33$). Two other similar structures – PS1.13L and PS1.13K – were also excavated, showing analogue remains, but in the second case, also including maize husks and kernels, *algarrobo* pods, wood fragments, charcoal, camelid dung, a piece of copper ore, a fish scale, and two small wool cords.

A circular mound excavated along the route (Fig. 6B) was evocative of the morphology of *apachetas*, accumulations of stones piled by Andean travellers at crossroads, mountain crossings, and other important sections of the road (Hyslop 1992; Pimentel 2009; Sanhueza 2004). Two test pits yielded a variety of material remains, such as plants, animal bones, fish bones, feathers (including what appears to be the feather of a *guacamayo*, a parrot from the neotropical forests), beads, and Late Formative and Late Intermediate Period pottery. Three small polished stone figurines made with onyx, pumice, and crystalline gypsum were also recovered, along with thirty pendants made with sheets of the same material joined by a cord to form a necklace – comparable to objects reported in Quillagua (Carrasco 2002).

These findings provide consistent evidence of the long occupation of the route. Pottery came from the Atacama basin (e.g. Séquitor type) (Gallardo, Correa, Blanco & Pimentel 2017) and from the highlands and lowlands of Tarapacá (e.g. Isluga and Pica Charcollo types, respectively). Gypsum and limestone plates are ubiquitous in Quillagua, and have been reported at different sites around the oasis (Blanco, Correa, Flores & Pimentel 2017; Carrasco 2002). The parrot feather, on the other hand, alludes to a much wider sphere of circulation that incorporates the eastern slopes of the Andes. Both the morphology of the route and the presence of camelid remains (bones and dung) point to the circulation of caravans led by herders with a series of shared cultural practices, such as the construction of geoglyphs and ceremonial mounds. This form of inter-valley mobility, therefore, was primarily geared towards the distribution of objects and resources from places of production to places of consumption.

The study of this route provides important evidence for the characterization of middle-distance travels in the lowlands of the Atacama, representing an example of north-south movements within similar ecological zones, adding important information for understanding a mode of circulation and exchange that thus far has been well documented in the *puna* region of Atacama (Nielsen 2006; Núñez & Nielsen 2011; Yacobaccio 2012; Yacobaccio, Escola, Pereyra, Lazzari & Glascock 2004).

Road infrastructure: the case of San Salvador

Different regions in the Andes were connected through a network of pathways that facilitated communications and trade, incorporating infrastructure that provided shelter and provisions for travellers. During Inca times, buildings and roads were maintained and organized according to state interests, but often utilizing the same routes that had been in operation since the Formative Period (Pimentel 2009; 2013).

Multiple logistical sites near the old Bolivian trade outpost of Huacate were identified through the survey of a route connecting the coast of Cobija with the oasis of Calama. The Loa River acts as a natural corridor given that it is the only watercourse that traverses the hyperarid core of the Atacama Desert, from the Andes to the Pacific. The small village of San Salvador and its associated cemetery (Fig. 7) have provided significant clues for understanding occupations directly associated with caravan routes crossing areas with very low population densities (Torres-Rouff, Pimentel & Ugarte 2012).

This settlement – located approximately 110 km inland – is a residential complex placed in close proximity to a large riverside grassland. It is comprised of fifteen to twenty subcircular pits with wooden posts supporting thatched roofs, an architectural pattern that is consistent with other settlements found along the middle portion of the Loa River, like Chiuchiu 200 (see Benavente 1978; Pollard 1970). The prevalent ceramic type found in San Salvador shows strong similarities with the pottery recovered from the cemeteries of Topater-1 and Chorrillos in Calama – located approximately 40 km upstream (González & Westfall 2010; Pollard 1970; Thomas, Benavente, Cartajena & Contreras 2002; Thomas, Benavente, Cartajena & Serracino 1994; Uribe & Ayala 2004).

Excavations confirmed the presence of camelids, a high frequency of *algarrobo* seeds, fish remains (*Trachurus simetricus*, *Cilus gilberti*, *Graus Nigra*), and shells from the Pacific, including shell beads and fragments (Castillo 2015; Torres-Rouff, Pestle & Gallardo 2012). Among the objects recovered, vegetable and wool cordage, leather, feathers, a projectile point, cactus spines, and wood-carved instruments were identified.

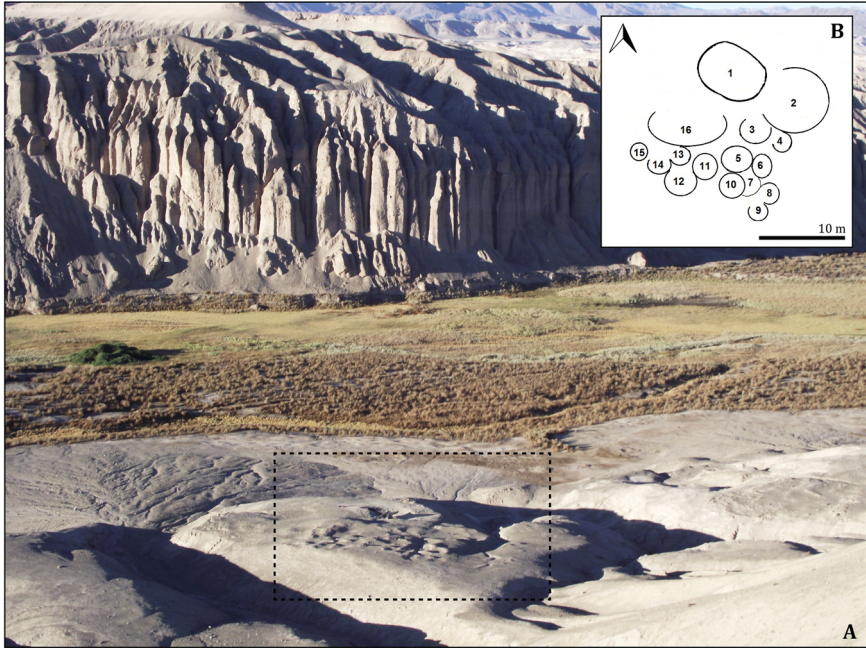


Figure 7. (A) General view of San Salvador. (B) Detail of the floorplan of the site. (Credit: Images created by the authors.)

The presence of grinding tools suggests that *algarrobo* flour must have been produced at the site, as an exchange good and/or a dietary staple.

A series of bioarchaeological and biogeochemical analyses were conducted on human skeletal remains. The seventeen individuals recovered from the looted cemetery varied in age and sex, suggesting that families were living at the site, therefore indicating an important degree of permanence. Both carbon- and nitrogen-stable isotopes yielded signatures that reveal a combination of primarily C_3 dietary carbohydrates and a protein diet of mostly C_3 -foddered terrestrial fauna, plus varying amounts of marine protein (Torres-Rouff, Pestle & Gallardo 2012: 63). According to Torres-Rouff and colleagues (Torres-Rouff, Pestle & Gallardo 2012), the isotopic results indicate that the inhabitants of San Salvador consumed *algarrobo* primarily, particularly during their childhood. During their adulthood, they gained access to coastal and highland food resources via interregional trips. The minimal consumption of corn, the abundance of marine remains, and the results of the stable carbon and nitrogen analyses reveal that the population of San Salvador had continuous access to marine protein, which they consumed habitually, demonstrating a direct engagement in long-distance networks of travel and trade (Pestle, Torres-Rouff, Gallardo, Ballester & Clarot 2015; Pestle, Torres-Rouff, Hubbe, *et al.* 2015).

The architectural pattern and the goods found at the cemetery indicate a strong connection with other communities living in the middle Loa River Valley. For instance, a textile fragment bears a strong resemblance to a contemporary piece found in Calama, at the site of Topater (Fig. 8). The strategic location of the settlement suggests that this was an outpost that served as a campsite for people travelling between the coast and the interior, but also functioned as a trading post with its own stable population, who

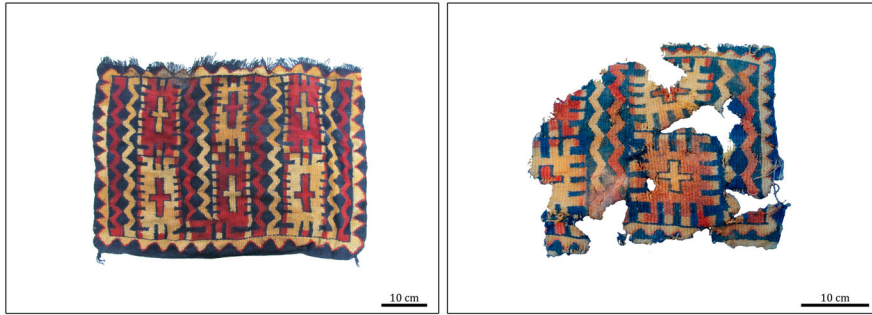


Figure 8. Decorated textiles recovered from the cemeteries of Topater 01 (left) and San Salvador (right). (Credit: Photos by the authors.)

produced *algarrobo* flour and provided fodder for the animals and other supplies for travellers. While the subsistence of local people depended on local and coastal products, crafts such as pottery and textiles, among others, were brought in from other locales.

Unlike the previous case, this example represents a type of mobility that spans greater distances on an east-west axis, articulating different ecological milieus and cultural groups. The population settled in this small village accessed coastal products at a frequency and rate that impacted their dietary patterns, while maintaining strong cultural and material links with the middle Loa River Valley. Although mobility was recurrent, the existence of a cemetery next to the village signals the intergenerational occupation of the area, which could potentially suggest that this was a group specialized in the transportation of goods and resources between the coast and the interior.

Dying en route: human burials by the road

For the interior of the Atacama Desert, two modalities of mobility have been described from the Formative Period onwards: one facilitated by long-distance movements of llama caravans associated with populations from the highlands and inland oases (Caravan mode) (Llagostera 1982; Núñez 1976b; Núñez & Dillehay 1995); and the other characterized by pedestrian movements of marine hunter-gatherers from the

Pacific coast (Coastal mode) (Knudson, Pestle, Torres-Rouff & Pimentel 2012; Pimentel 2013; Pimentel, Rees, de Souza & Arancibia 2011; Pimentel, Rees, de Souza & Ayala 2010; Torres-Rouff, Pimentel & Ugarte 2012). Although coastal populations employed sea lion-skin vessels to move along the coast – a type of movement that is rarely considered in studies of Andean mobility – this modality of travel (Marine mode) operated in combination with periodical excursions inland for the procurement of lithic resources and possibly for the exchange of products with other populations (Ballester & Crisóstomo 2017; Blanco *et al.* 2017; Blanco, de la Maza & Rees 2010; Borie *et al.* 2017). A burial found along a route in the proximities of El Toco provides a good example of this travel modality (Cases, Rees, Pimentel, Labarca & Leiva 2008; Knudson *et al.* 2012; Pimentel *et al.* 2011; 2010). Findings such as this are not uncommon in the region

and have been documented for the coast, at Cerro Mono (Briones *et al.* 2005) and Calate (Torres-Rouff, Pimentel & Ugarte 2012). In the latter area (15 to 25 km from the coast), nine individual burials have been studied, dating from the Early Formative Period (c. 1476-1470 cal BP) to the Late Horizon (c. 460-374 cal BP), including those of men, women, and children. The burials include bodies that were directly covered

with stones and sand – indicating that the process was very expeditious – and certain cases where interments involved the construction of circular pits that were then covered with sand and rocks, forming small mounds. Grave goods were often deposited with the individuals, indicating that they did not travel alone and were subjected to funerary rites that took place as people were moving, given that the only settlements associated with them are small campsites or rest stops (*paskanas*) (Torres-Rouff, Pimentel & Ugarte 2012). The general characteristics of these burials suggest a modality of travel that was practised by people who lived on the coast, and that involved moving by foot, in small groups, and/or with family units (Pimentel *et al.* 2011; 2010; Pestle, Torres-Rouff, Hubbe, *et al.* 2015; Torres-Rouff, Pimentel & Ugarte 2012).

The traveller found near El Toco was recovered in an isolated burial next to a single pedestrian route (Cases *et al.* 2008). The body, an adult male approximately 28-35 years old, was laid in an extended position and covered with rocks and sand. His burial included a small loop-stitch bag made with plant fibres that contained fish remains and maize husks, in addition to a miniature bag made with camelid fibre that contained a cactus-spine fishhook. He was wearing a tunic that was heavily mended, associated with the Alto Ramírez style – diagnostic of the Formative Period of the valleys of Arica and Tarapacá – a necklace made with plant fibres, and a small hair pendant. Five small feathers, an *algarrobo* seed, and a small rodent were also recovered from his grave. The contents of his stomach revealed the perimortem consumption of a type of fish typically found on rocky shores (*Labrisomidae* family) (Cases *et al.* 2008).

An examination of palaeodiet and palaeomobility using stable and radiogenic isotopes of enamel, bone, and hair revealed that this was a person who was regularly moving from the coast to the interior. Nitrogen isotope data from hair keratin, for example, suggests that he travelled extensively during the last twenty months of his life, spending the six- to eight-month period before his death consuming marine resources and living on the coast (Knudson *et al.* 2012: 444). Given the expeditious nature of the burial, his scant belongings, and his isotopic signatures, it has been proposed that this individual was engaged in periodic trips inland with logistical purposes – as opposed to trade or exchange. This evidence indicates that for coastal groups, forays into the desert during the Formative Period were much more frequent and complex than has been previously proposed (Knudson *et al.* 2012; Pestle, Torres-Rouff, Hubbe, *et al.* 2015), and that their patterns of mobility were not restricted to the littoral.

Making tools: lithic procurement in the hyperarid core

On the vast plains of the Atacama, there are numerous sites that reflect the exploitation of rock deposits for the production of lithic tools. The frequent presence of bifacial pieces led early investigators to postulate the existence of a Palaeolithic occupation (Bird 1943; Le Paige 1970; Uhle 1916; 1917). Recent studies have provided conclusive evidence regarding the nature of these sites, which functioned as quarries for the manufacture of bifacial cores and instruments by coastal groups (Ballester & Crisóstomo 2017; Blanco *et al.* 2017; 2010; Borie *et al.* 2017; Peralta, González, Westfall & Santander 2010). The fisher-gatherers of the Pacific coast were prolific producers of a tool kit that was characterized by bifacial knapping, using raw materials (silicified tuffs) whose sources were typically located on the eastern slopes of the Coastal Range. The link between finished objects recovered from large shell-middens on the littoral and the extensive workshops on the desert plains was first noticed by Uhle in Taltal (1916), followed by Bird (1943), Berdichewsky (1965), and Núñez (1984).

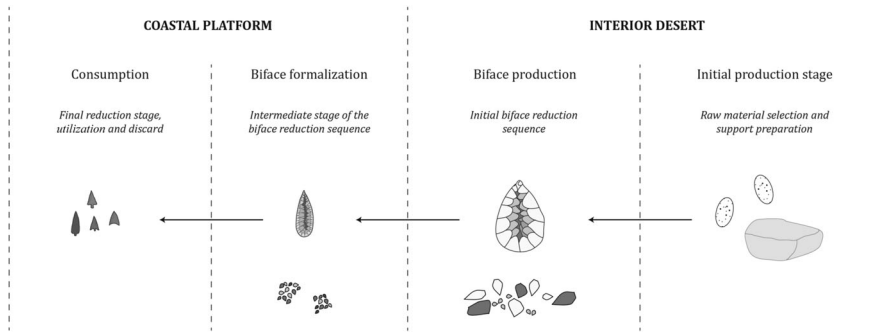


Figure 9. Production cycle of bifacial artefacts used by coastal populations during the Formative Period. (Credit: Image created by the authors.)

Recently, Blanco and collaborators (2010) have proposed a model for the lithic provisioning system of marine hunter-gatherers through the analysis of bifacial reduction sequences at the quarries and sites of the Intermediate Depression that were used in the production of large foliate blades known as ‘Taltaloides’ knives. These objects, together with a broad lithic assemblage comprised by projectile points, small blades, drills, scrapers, and net sinkers, have provided additional evidence for the technological network between the coast and the interior, where quarries and workshops have been detected at a distance ranging from 15 to 120 km inland (Ballester & Crisóstomo 2017; Blanco *et al.* 2010; Borie *et al.* 2017). Most of the sites present circular stone enclosures associated with FISH remains, shellfish, cactus wood, and discarded primary and/or secondary FLAKES, forming small open-air campsites (see Núñez 1984). These forays could have taken between five and ten days to complete, and, given the conditions of extreme aridity of this territory, it meant that the people involved in these expeditions had an exhaustive knowledge of the landscape and its resources, particularly water sources and rest stops.

This evidence indicates a much more complex ‘lithic landscape’ (*sensu* Gould & Saggars 1985) that was not limited to the littoral but encompassed the neighbouring Coastal Range, the Loa River Valley, and the *Pampa*, articulating a wide network of production and circulation that was in full operation during the Formative Period, and had its origins in the Archaic Period (Fig. 9).

Kinship and funerary mounds: the case of coastal mobility

The emergence of nucleated burials that gave shape to formal cemeteries has been regularly explained as the material manifestation of supra-familial modes of social integration, frequently cast as part of a broader phenomenon that entailed the reduction of mobility, territorial circumscription, and agricultural intensification (Brown 1995; Chapman 2003; Saxe 1970). Under these circumstances, these funerary practices served as a strategy to legitimize social claims through the figure of the ancestors (Bradley 1998; Hodder 2005), turning the dead into social capital for the living, which often involved the monumentalization of funerary spaces.

Funerary architecture emerges on the coast of the Atacama Desert during the Formative Period, materialized in the notable proliferation of mound (tumuli) cemeteries along the coast (Ballester & Clarot 2014; Capdeville 1928; Moragas 1982; Núñez 1971; 1974; Spahni 1967) (Fig. 10). The size of each mound is variable, ranging

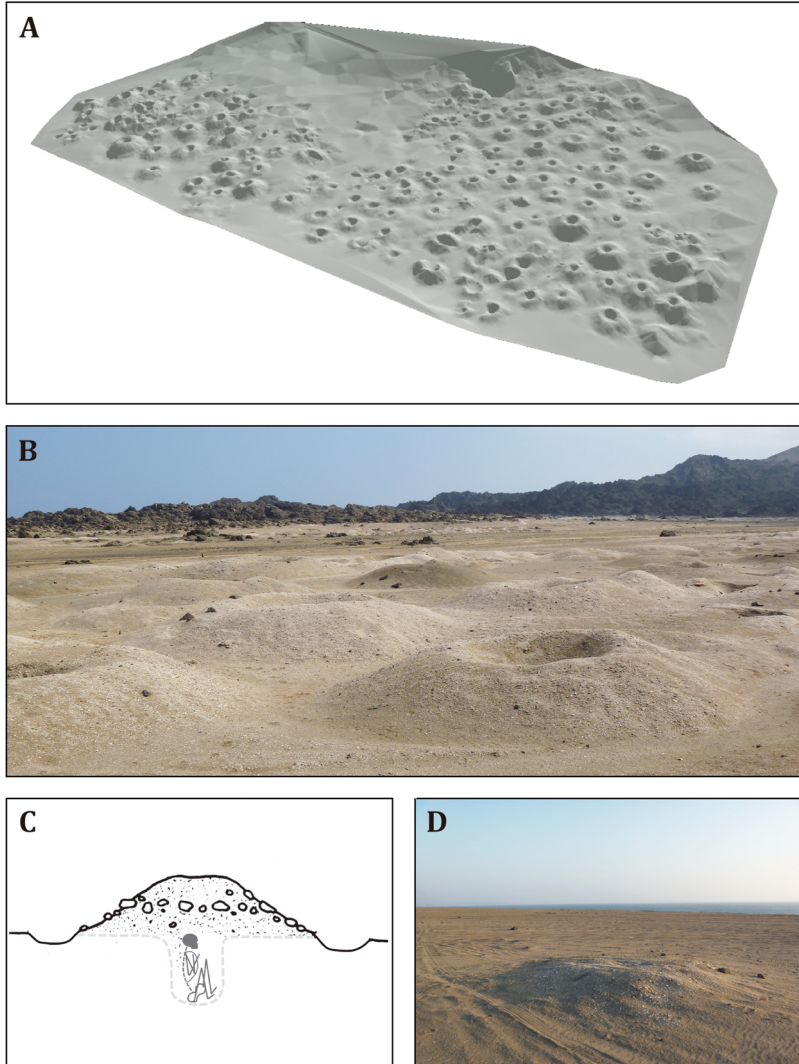


Figure 10. Tumular cemeteries from coastal populations during the Formative Period: (A) Microtopographical 3D reconstruction of the CaH 20 cemetery (121 tumuli. Surface: 8589 m²). (Credit: Image created by the authors.); (B) Punta Grande 02 cemetery (64 tumuli. Surface: 6439 m²). (Credit: Photo by the authors.); (C) Profile drawing of a funerary mound. (Credit: Image created by the authors.); (D) Hornitos 04 cemetery. (Credit: Photo by the authors.)

from 2 to 10 m in diameter, and over 1 m in height. An exploration using satellite imagery between Chipana (north of the Loa River) and the Morro de Caldera (north of the Copiapó River) identified over 89 cemeteries and around 1,700 individual mounds. Although there are cemeteries that contain over 200 mounds, smaller concentrations and individual graves are also frequent, indicating the use of certain cemeteries over shorter periods or isolated burials. At some cemeteries, mounds have shown chronological differences of approximately 1,000 years, demonstrating a historical continuity and the transgenerational value of these spaces.

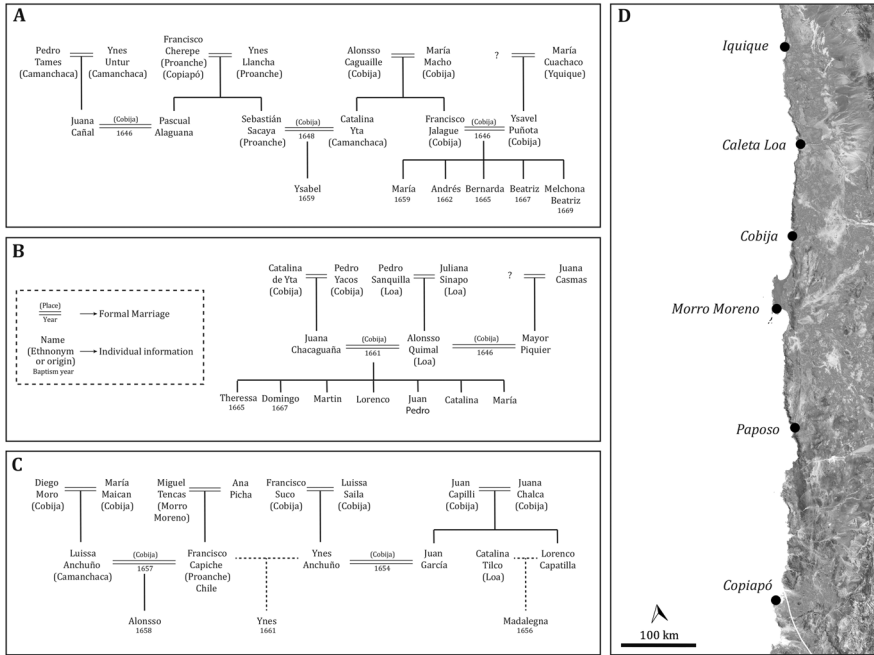


Figure 11. Kinship diagrams from the Atacama Desert coastal populations during the seventeenth century: (A) marriage alliances between families from Iquique, Cobija, and Copiapó; (B) marriage alliances between families from Caleta Loa and Cobija; (C) marriages between families from Caleta Loa, Cobija, and Morro Moreno; (D) map showing the localities mentioned in the diagrams. (Credit: Images created by the authors; map © Google Earth 2019, modified by the authors.)

This funerary practice can be considered as diagnostic of coastal populations of marine hunter-gatherers. It was part of a sphere of regional interaction that encompassed over 650 km of coastal territories, articulated through pedestrian movements or sea navigation, documented from the Late Archaic Period onwards (Ballester & Gallardo 2011; Bittmann 1978; Castro *et al.* 2016; Olguín, Salazar & Jackson 2014). Maritime transport provided not only larger carrying capacity but also a significant reduction in the duration of travels, as well as access to open seas. Seafaring had logistical purposes, but the transportation of families or larger groups for important social instances, such as burials or communal feasts for the consumption of large marine mammals, has also been reported in the region (Ballester & Gallardo 2011).

Historical records provide interesting examples to illustrate the scale of movements that these groups were engaged in during the Colonial Period. A document kept at the Chiuchiu Parrish, known as *Libro de Varias Ojas* – one of the earliest and most complete ecclesiastic records available for the Atacama region – reports twenty-four marriages and forty-seven baptisms that involve people from coastal towns between 1656 and 1669 (Casassas 1974). Both forms of kinship affiliation exclusively linked families living on the coast: that is, these groups were not establishing familial or formal social ties with people from interior locations (Ballester & Gallardo 2017). Figure 11 illustrates the marriages and family descent of three generations of coastal peoples.

These complementary lines of evidence shed light on the nature of mobility patterns and their territorial scale. Funerary mounds and marriages are both manifestations

of political alliances and social ties that are established by practices that link people – living or dead – with a particular territory (Ballester & Clarot 2014; Gallardo *et al.* 2017). Given the enormous and diverse productivity of the Atacama coast, its limited environmental fluctuations, and the stability of its resources, coastal mobility must not be solely understood as a subsistence strategy, but defined by a variety of social needs. The evidence available for the Formative Period indicates that the settlement system was comprised of small camps constructed using light, perishable materials such as sea lion skins, cactus wood, and whale bones, suggesting that they were used temporarily and were easily transportable – a practice that was also documented by historical accounts (Lizárraga 1999; Vásquez de Espinosa 1948 [1630]; Vivar 2001 [1558]). Travel made possible not only the production of enough surplus to maintain a constant flow of coastal goods to towns in the interior, but also the reproduction of a sociopolitical system through marriages, familial alliances, and common mortuary customs that involved the collective organization of labour and ritual.

Discussion

Prehistoric mobility in the South-Central Andes has been traditionally understood as a practice that was mainly associated with the circulation of goods and people, determined either by direct (transhumance and verticality) or indirect (*altiplano* mode, circuit mobility [Browman 1980; Núñez & Dillehay 1995, respectively]) access to valued products. However, the study of these long-distance movements has often failed to account for the variable ways in which mobility and travel unfolded at smaller scales.

In order to synthesize the different case studies presented above, we incorporate Binford's (1980) classic distinction between 'residential' and 'logistical' mobility as analytical tools, and problematize its boundaries by considering the territorial categories of 'local' and 'extralocal'. As originally stated, the first modality encompassed movements of the entire group between locales, while the second included movements of individuals or small task groups out from and back to the residential camp. We consider the 'local' as a locus of settlement characterized by aggregates of people, resources, and things – where face-to-face interactions are preponderant – generally surrounded by spaces with no or significantly less occupation (Leeds 1973). In this context, 'extralocal' mobility refers to movements that connect different people beyond the scope of everyday interactions, and put things, practices, and knowledge in circulation among localities by means of exchange, ceremonies, and information (Lazzari 2005).

As presented in Table 1, we consider four principal modalities of movement in the Atacama Desert. Each case study falls into one or more of these categories, illustrating the variability and complexity of the logics and logistics of mobility in this territory. Modalities A and B refer to local movements and the people involved in them, which is limited to cases I and VI, where either individuals, families, or task groups circulated

Table 1. Modalities of movement in the Atacama Desert

Modalities	Logistical	Residential
Local	A [I, VI]	B [I, VI]
Extralocal	C [II, IV, V, VI]	D [III, IV, VI]

between settlements and productive areas, configuring something akin to what Ingold (2000: 195) has called a 'taskscape', an array of related activities. The presence of what have been considered as permanent settlements, however, did not preclude the occurrence of episodic trips that involved the entire group or families, which transpired in parallel with the rhythms of everyday activities along the valley (in the case of Guatacondo) or the Pacific coast.

The second row (modalities C and D) shows more variability of actors and functions. The marine hunter-gatherers settled on the coast, engaged in periodic journeys inland and along the littoral for multiple purposes, including the procurement of coastal products (FISH, shellfish, marine mammals), and raw materials such as lithics, wood, pigments, as well as regularly transporting coastal goods to interior locations. Historical references attest to these journeys inland. Bollaert (1860), for example, mentions that 'changos' from Paposo travelled to San Pedro de Atacama – around 350 km away – to exchange dried FISH for coca leaves, FLOUR, and clothing. Arce (2004 [1930]) states that coastal groups moved to the area of Huacate, on the Loa River, in order to acquire red pigment used to insulate their vessels.

The burial at El Toco (Cases *et al.* 2008; Knudson *et al.* 2012), on the other hand, indicates yet another modality of travel during this period. This involved single individuals or task groups that moved to inland locations to obtain resources required for specific activities, rather than to engage in large-scale exchange (Modality C). Other burials along the route suggest, however, that movements inland also included women and children, and probably larger groups travelling to other locations – as attested by the sophisticated preparation of some of the burials found along these pathways (IV). The purpose of these journeys remains unclear, especially considering that the lack of beasts of burden resulted in less carrying capacity. The presence of coastal enclaves at inland locations, however, is documented by the existence of mound cemeteries in the proximities of Quillagua. This indicates that coastal groups indeed settled away from the coast – either permanently or seasonally – while maintaining cultural practices and dietary patterns that reveal a significant reliance on marine products (VI).

The same can be observed at the village of San Salvador (III), an inland outpost on a route connecting Quillagua and Calama through the Loa River Valley. The inhabitants of San Salvador had a mixed diet, with permanent access to marine products, although they relied heavily on the consumption of *algarrobo*, a staple that was used for direct consumption and for the manufacture of FLOUR and *chicha* (Muñoz, Barrera & Meza 1980; Villagrán *et al.* 1998). The demographic profile of the people buried at the local cemetery is varied, suggesting that there were multiple families living at the site. The diagnostic material, especially pottery and textiles, indicates a close cultural affiliation with Calama, while the architectural layout of the village exhibits strong similarities with other sites of the upper Loa River Valley – such as Chiuchiu 200 (Pollard 1970). While objects such as vessels and clothing were manufactured at nearby localities, the intensive exploitation of local plant resources, the maintenance of camelid herds, and the regular access to coastal products supports the idea that San Salvador functioned as a logistical settlement that facilitated the movement between coast and interior (Torres-Rouff, Pestle & Gallardo 2012: 54). However, the importance of coastal products in the diet of these individuals, as well as the existence of a cemetery where several individuals were buried, suggests a temporal continuity of the population that occupied this enclave (Modality D).

The caravan route between Guatacondo and Quillagua provides a good example of a space that serves as a channel of circulation that allows people who are not immediately present in everyday life to be in mutual contact (see Lazzari 2005), falling into the third modality of travel (C). It involves movements that could be characterized as logistical but that, while ephemeral, were sustained through time, with multiple and varied occupations that encompassed not only rest stops but also a complex infrastructure of ritual sites. Stone alignments, mounds, and geoglyphs are common along this and other regional routes, signalling not just a shared set of practices related to travelling, but also an important investment of collective labour for the design and construction of monumental works, such as geoglyphs (Briones 2006; Briones *et al.* 2005; Núñez 1976b; Pimentel 2011; 2013).

Circuits of mobility for mineral and lithic provisioning (V) also fall into the logistical and extralocal modality (C), the type of movement that exhibits greater variability. These periodic forays into the desert were carried out by coastal groups in search of specific materials that were not locally found. The use of mineral and lithic sources located on the eastern slopes of the coastal *cordillera* and along pathways connecting places on the coast and the interior from the Middle Archaic Period onwards is a testimony of the temporal depth of these mobility circuits and provides direct evidence of mining activities carried out by coastal hunter-gatherers (Ballester & Crisóstomo 2017; Blanco *et al.* 2017; Borie *et al.* 2017).

Conclusion

While archaeologists have devoted considerable attention to the issue of ‘mobility’ (see Kelly 1992), the concept itself remains rather elusive (Close 2000). The case studies presented here offer direct evidence of caravan routes, pedestrian trails, infrastructure, and other material markers associated with the movement of people and goods, contributing to the material characterization of social practices of travel and trade. Rather than understanding mobility as a *strategy* – often defined by distance, frequency, and technologies of travel – we approach it as a place-making practice. This means that we consider movement as a way to inhabit the desert, effectively incorporating this territory into the lifeways of desert dwellers, both cognitively and materially.

With these considerations in mind, we depart from approaches that characterize desert mobility as an economic strategy fuelled primarily by ecological or environmental pressures. The modalities outlined problematize the settled/nomad dichotomy and interrogate the directionality and the agents involved in travel. At the same time, they take into consideration the means through which movements unfolded, expanding the traditional focus on long-distance caravan travels. By making visible other forms of movement, and characterizing the infrastructure, logistics, potential purposes, and the people involved in them, it is possible to understand movement not just as an instrumental action, nor as the exclusive domain of a specialized group.

The emergence of settlements with permanent architecture did not preclude a noteworthy increase in travel, including the occupation of spaces that had been commonly regarded as ‘empty’. The evidence presented here points to logics of movement that are not restricted to vertical journeys articulated by highland populations while emphasizing the need to consider the social importance of people circulating within specific ecological regions through ephemeral but recurrent occupations along roads and trails, as well as daily trips activated by everyday tasks (Fig. 12).

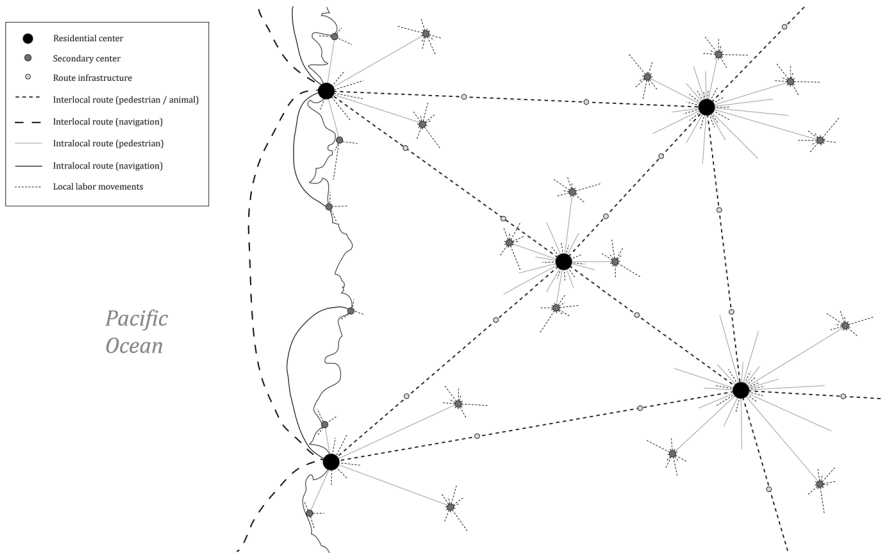


Figure 12. Map illustrating the variability of Formative Period routes in the Atacama Desert, considering modes of transportation, territorial scales, and types of sites. (Credit: Image created by the authors.)

This landscape, however, was not homogeneously inhabited. The materiality of these overlapping modalities of travel is a relevant factor for understanding how movement unfolded at different scales. Roads functioned as interfaces of people, places, and things, forming a network of familiar pathways. They played a significant role in generating the conditions for future movements as well as eliciting powerful temporal imaginaries for the travellers through continuous encounters with places, landmarks, and objects from previous journeys. Caravan routes, with their system of rest stops, geoglyphs, and mounds, created intersecting networks that expanded the ‘known world’, as an imagined space and as material infrastructure. Pedestrian trails, on the other hand, constituted a form of occupation of the desert that was less institutionalized, and more flexible in terms of distances, morphology, and locations. Routes that did not leave any material traces, like the ones created through sailing, constituted yet another form of travel, integrating a different kind of specialized technology and spatial knowledge.

While the Atacama’s specific environmental affordances undoubtedly contributed to the emergence of a particular way of life, the multi-layered connections created by desert dwellers were not limited by modes of subsistence economies. Diets, objects, families, images, and everyday tasks were assembled through movement. Seen through this lens, the desert can no longer be perceived as an empty space, but can be regarded as a familiar territory that was inhabited through a combination of transit and permanence, a landscape that fostered encounters between groups, and allowed the formation of social relations among people who left and absorbed legacies as they moved.

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Voyages dans le désert d'Atacama : créer un lieu par le mouvement (vers 2500-1500 cal AP)

Résumé

Les mondes sociaux sont faits de mouvement. La mobilité inclut la circulation non seulement des personnes mais aussi des biens matériels, des imaginaires, des expériences, des flux d'information et des connaissances. Dans le présent article, nous examinons différentes formes de mouvement dans le désert d'Atacama au cours de l'Ère formative (vers 1000 avant notre ère-500 de notre ère) : voyages à pied, caravanes de llamas, cabotage le long des côtes du Pacifique dans des bateaux en peau d'otarie, faisant

appel à différents moyens matériels et mus par des incitations très diverses. Nous présentons différentes études de cas qui remettent en question les hypothèses monolithiques relatives à la mobilité dans le sud de la Cordillère centrale des Andes, habituellement appréhendée à travers le prisme de la complémentarité écologique et principalement fondée sur les échanges économiques. En étendant aux premiers groupes d'agriculteurs la distinction classique des types idéaux de systèmes d'établissement des chasseurs-cueilleurs entre mobilité résidentielle et logistique établie par Binford et en lui associant les catégories territoriales « local » et « extra-local », nous interrogeons l'échelle spatiale et temporelle de ces voyages (du quotidien au saisonnier, de la courte à la longue distance) et sa matérialisation. Dans ces exemples, nous abordons le mouvement et le voyage comme un mode de vie, en élargissant la vision traditionnelle de la mobilité par une exploration des diverses manières dont elle était pratiquée et intégrée dans la vie sociale des habitants du désert.

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