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Biogeochemical reconstructions of life histories as a method to assess regional interactions: Stable oxygen and radiogenic strontium isotopes and Late Intermediate Period mobility on the Central Peruvian Coast

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ABSTRACT

Biogeochemical reconstructions of life histories of mobility offer a means to obtain nuanced information about regional interactions in the past. We test this method using the Late Intermediate Period Ychsma society on the central Peruvian coast as a case study. Archaeological and ethnohistoric evidence indicates that the Rimac and Lurín Valleys inhabited by the Ychsma served as a key regional hub for the religious and administrative activities of the Inca Empire and the Spanish Viceroyalty. The nature of regional interactions prior to Inca imperial influence, however, remains unclear. Well-known historical narratives describe populations from the adjacent Huarochirí highlands defeating coastal Ychsma populations for agricultural land, but archaeological evidence concerning the timing and extent of coastal-highland interactions is debated. Here, we assess the potential for radiogenic strontium and stable oxygen isotopic reconstruction of mobility over the life course to shed light on the regional interactions of coastal Ychsma groups during the Late Intermediate Period. We present ⁸⁷Sr/⁸⁶Sr and $\delta^{18}\text{O}$ results for 61 regional environmental baseline samples and archaeological human tooth enamel and bone samples from 64 individuals buried at Armatambo and Rinconada Alta, in the Rimac Valley. Results reveal a broad isotopic range for baseline and archaeological samples likely due to diversity in water and bedrock sources. Nevertheless, one individual presents a non-local strontium value indicating mobility to an outside region. We discuss the advantages of a life history approach, the complications of using isotopes to assess mobility in the Central Andes, and suggested directions for future research.

1. Introduction: biogeochemical reconstructions of life histories to assess regional interaction

Biogeochemical analysis has become a widely used technique for investigating paleomobility. Commonly, archaeological human tooth enamel and/or bone elements are analyzed for isotopic or elemental ratios that exhibit geological variation, enabling researchers to identify first-generation immigrants as individuals with tissues that exhibit values distinct from local ranges (e.g., Budd et al., 2004; Burton et al., 2003; Buzon et al., 2011; Knudson and Buikstra, 2007; Knudson et al., 2012a; Knudson and Price, 2007b; Perry et al., 2008; Price et al., 1994; Price et al., 2000; Webb et al., 2011). Comparisons of intra-individual biogeochemical values in multiple human tissues that form at different stages over the life course permit the reconstruction of the life history of mobility of individuals (Sealy et al., 1995). Generally, such biogeochemical life history reconstructions of paleomobility are used to investigate the lived experience of a single individual recovered

from a unique burial context (e.g., Frei et al., 2015; Knudson et al., 2012b; Müller et al., 2003). The present study demonstrates how biogeochemical life history reconstructions can also serve as a means to investigate large scale patterns of regional and interregional interactions.

Focusing on the Late Intermediate Period (c. 900–1470 CE) Ychsma society on the central Peruvian coast as a case study, this research evaluates the utility of life history reconstructions using radiogenic strontium and stable oxygen isotope analysis as a means to assess the nature of pre-Columbian regional interactions in the area that today forms the capital city of Lima, Peru. The Rimac and Lurín Valleys on the Central Andean coast where Lima is located once served as a prominent regional hub of administrative and religious activities for both the Spanish Viceroyalty and the Inka Empire. Although archaeological evidence indicates that complex societies inhabited the Lima area for well over a millennium prior to Inka arrival, little is yet known about the nature and extent of regional and interregional mobility and

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interactions in the area preceding Inka imperial influence. The present study demonstrates the advantages of a biogeochemical life history approach to regional interactions, while also highlighting challenges specific to the Central Andean coast.

2. Regional mobility and interactions on the central Peruvian coast

The Spanish Viceroyalty established Lima as its capital city in the Rimac Valley in the coastal desert of the Central Andes in 1535. Early Spanish colonial records indicate that at the time of Spanish arrival, the area comprised by the Rimac and Lurín River Valleys served as a key provincial administrative center for the Inka Empire (Cornejo, 2000; Rostworowski, 2002b). The capital of this Inka Province was Pachacamac, a ceremonial center in the Lurín Valley honoring the coastal deity, also called Pachacamac. The Inkas are said to have sought out this region specifically in search of this world creator deity (Santillan, 1968 [1563]). The Inkas considered the “supreme and invisible Maker and Creator” Pachacamac as complementary to the “most noble part of the visible created universe”, the Sun (Garcilaso de la Vega, 1976 [1609]:67; MacCormack, 1991:344). According to Spanish chroniclers, the Pachacamac ceremonial center was an immensely important pilgrimage site. Father Bernabé Cobo (1990:85) writes, “In magnitude, devotion, authority and richness, the Temple of Pachacama was second only to the magnificent [Cuzco] Temple of the Sun. Since it was a universal sanctuary, people came to the Temple of Pachacama on pilgrimages from all over the Inca empire...” Present-day oral histories continue to describe the Pachacamac deity as the creator of the world, of humans, and of agriculture, and as lord of earthquakes and of the night, and have been recorded among indigenous groups living as far away as jungle villages located on the opposite side of the Andean mountains (Rostworowski, 2002c; Varese, 2006). Such narratives reveal the significance and breadth of influence of this pre-Columbian coastal god.

Debate continues, however, over how far back in time the widespread regional influence of Pachacamac extends. Archaeological evidence shows probable continuous occupation at the site of Pachacamac beginning with the Lima society during the Early Intermediate Period (c. 200 BCE–650 CE). Additional constructions were possibly added during the Middle Horizon Period (c. 650–1000 CE), and 15 monumental structures were built during the Late Intermediate Period (c. 1000–1470 CE) (Eeckhout, 2013; but see Segura and Shimada, 2010). The identification of Wari elements in Pachacamac iconography has led several scholars to suggest pilgrimages to the site began as early as the Middle Horizon (Eeckhout, 2013; Menzel, 1964). Analyses of burial contexts at Pachacamac by Peter Eeckhout (2010), however, so far reveal that funerary rituals practiced during the Middle Horizon and Late Intermediate Periods were local in style.

Ethnohistoric information indicates that, in addition to influencing large-scale, pan-Andean mobility, the Pachacamac site and surrounding region likely also were associated with extensive local regional mobility. The famed *Huarochirí Manuscript*, a collection of narratives compiled by a Spanish priest in the early seventeenth century and written in Quechua, likely by an indigenous scribe, suggests extensive movement and social interactions occurred between the Yunca or Ychsma population from the local coastal area and the Yauyos population from the adjacent Huarochirí highlands (Feltham, 2005; Salomon and Urioste, 1991 [c. 1600]). Specifically, the Huarochirí narratives describe pilgrimages between the coastal shrine of Pacha Camac and the highland shrine of Paria Caca, as well as invasions by highland Yauyos groups into the mid-valley to confiscate Ychsma agricultural lands.

Whether or not such regional interactions pre-date Inka imperial influence, however, remains a source of discussion. Some scholars suggest that highland groups were only able to obtain access to valley

lands through Inka control and land redistribution strategies (Cornejo, 1995; Rostworowski, 2002c). Researchers have attempted to establish the location of a boundary between the coastal Ychsma and highland Yauyos groups during the Late Intermediate Period (c. 900–1470 CE) using archaeological evidence from the Lurín Valley. The coastal-highland boundary has been variously identified as a specific site in a small ravine (*quebrada*) called Anchucaya (Sánchez, 2000), as a site complex 4 km in area near the modern town of Sisicaya (Cornejo, 1995), and as a mid-valley zone of ~12 km stretching from the site of Río Seco to the site of Avillay in the Sisicaya area (Marcone, 2004; Marcone and Lopez-Hurtado, 2002). These boundary definitions are based largely on differential architectural features that characterize lower, middle, and upper valley sites, although authors disagree over the definitions of such features (e.g., Feltham, 2005; Marcone, 2004; Sánchez, 2000). Other researchers, such as Macneish et al. (1975), have suggested that the border between the Ychsma and Yauyos groups was likely blurred due to continuous raids by each group into one another's territory. An extensive survey of the Lurín Valley by Feltham (1983) shows that ceramics made from orange littoral clays and those made from brown highland clays gradually gradate in proportion to one another from the coast to the highlands and are intermixed in all parts of all sites in which they co-occur (Feltham, 1983, 1984, 2005).

At middle Lurín Valley sites, evidence of socioeconomic hierarchy evident in domestic architecture may reflect sociopolitical and/or socioeconomic differences between the Ychsma and Yauyos groups. Multi-room adobe structures interpreted as elite residences were constructed near pyramidal platforms with ramps, while simple cane (*quincha*) structures skirted the edges of sites along the *quebrada* slopes (Eeckhout, 1999; Feltham, 2005; Marcone and Lopez-Hurtado, 2002). Feltham (2005:136) argues, however, that neither inter- nor intra-site variation in ceramics, architecture, or settlement is adequate to suggest differences between the Ychsma and Yauyos groups and states that “the archaeological record suggests that both peoples [lived] fairly peaceably together” in the middle valley. No fortified structures, weapons, traumatic skeletal lesions, or other evidence to indicate violent interactions has yet been found in the area (Feltham, 2005; see also Sánchez, 2000). Additional evidence comes from linguistic analyses of names from a census document from Sisicaya, a modern upper mid-valley village associated with the archaeological site of Avillay. Specifically, this document indicates that prior to Inka arrival, highland and coastal groups, who likely spoke distinct languages, shared a name pool and birth-order naming practices, traditions commonly associated with ethnic identification in the region (Salomon and Grosboll, 2011).

Additional ethnohistoric data suggest that any attempt to define a border or specific zone of interaction between the Ychsma and Yauyos overlooks the full extent of potential social interactions and possible movement between the two populations. As mentioned previously, the narrative oral histories of the *Huarochirí Manuscript* describe the sites of both Pachacamac on the coast and Pariacaca in the mountains as pilgrimage destinations to which peoples from both regions were said to have trekked (Rostworowski, 2002c; Salomon and Urioste, 1991 [c. 1600]). These narratives also tell of highland Yauyos groups displacing the Ychsma in entire areas of the lower Rimac Valley site of Latim or Ate (currently Rinconada) and the middle Rimac Valley sites of Naña and Mama (Cornejo, 2000; Espinoza, 1984). Pedestrian movement between the highlands and the coast has continued in recent history. During seasons of harvest, highland families come down to work and live in the valleys and occasionally intermarry with the local coastal population (Matos Mar et al., 1964). Family members who have moved permanently to the lower Lurín Valley will occasionally make the one- or two-day hike up to the *lomas* or to highland villages to visit family (S. Marsteller, personal observation, 2010). Permanent highland residents also sometimes take ancient footpaths into the valleys when roads become washed out during the rainy season (F. Salomon, personal communication, 2010).

Numerous other ethnohistoric examples illustrate the malleable

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