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Diet and foodways across five millennia in the Cusco region of Peru

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ABSTRACT

The Central Andes of South America boasts a rich history of complex societies and sophisticated economic networks. Reconstructing patterns of diet across time is important to understanding the relationships between subsistence and food preparation and their roles in mediating consumption and hegemony through time. The region surrounding the city of Cusco in the southern Peruvian highlands is best known as the heartland of the Inca Empire (520-418 BP); however, it has a long history of social complexity and regional exchange, including colonization by the highland Wari Empire (1350-950 BP) and *in situ* development in earlier periods. Elucidating subsistence and mobility over time in the Cusco region is therefore essential for reconstructing the evolution of complex Andean polities and their effects on local communities.

This study presents carbon, nitrogen, and oxygen isotopic data from human bone and tooth enamel at four Cusco-region sites: the hunter-gatherer site of Kasapata (6350- 4150 BP, N = 8); the village site of Yuthu (2350-2050 BP, N = 22); the Wari colony of Hatun Cotuyoc (1350-950 BP, N = 9) and the contemporaneous village site of Ak'awillay (N = 22). Key aims are to estimate diachronic shifts in foodways and nutrition, and those related to Wari control. Results indicate nearly-identical isotope values at Kasapata and Yuthu trending toward lower-trophic level C_3 proteins and C_3 energy sources, while values indicate mixed C_3/C_4 diets at Ak'awillay and diets dominated by terrestrial meat and C_4 foods at Hatun Cotuyoc. Interestingly, oxygen isotope values suggest water source variation consistent with minimal mobility at Kasapata and regional mobility at Yuthu, but possibly with overlapping but divergent foodways at Ak'awillay and Hatun Cotuyoc resulting in differential evaporative pressures on consumed water rather than increased mobility.

1. Introduction

The Cusco region of the southern Peruvian Andes is best known as being the heartland of the Inca Empire of the 15th and 16th centuries. However, archaeological research indicates a long history of social complexity and regional exchange in the region; this includes colonization by the highland Wari Empire to the north and influence from the southern Tiwanaku polity during the Middle Horizon (1350-950 BP), and local complex societies in earlier periods. These cultural transformations occurred against a backdrop of vertically-integrated economies, and both long- and short-distance migration. Elucidating population movements, subsistence practices and exchange over time in the Cusco region is therefore a critical component of understanding the ways in which the evolution of Andean complex states affected local populations.

This study presents carbon, nitrogen, and oxygen isotopic data from the remains of individuals interred at four sites in the Cusco region of southern central Peru (Fig. 1). The site of Kasapata dates to the Late Archaic Period (6350- 4150 BP), a time known for nomadic hunter-gatherers, while the site of Yuthu dates to the Formative Period (2350-2050 BP), characterized by population increase and the increased commitment to the production of domesticated plants and animals. The remains from the other two sites—Hatun Cotuyoc and Ak'awillay—date to the Middle Horizon (1350-950 BP), a period characterized by Wari, and to a much lesser extent, Tiwanaku, influence in Cusco. Together these four sites represent three important cultural periods (Archaic,

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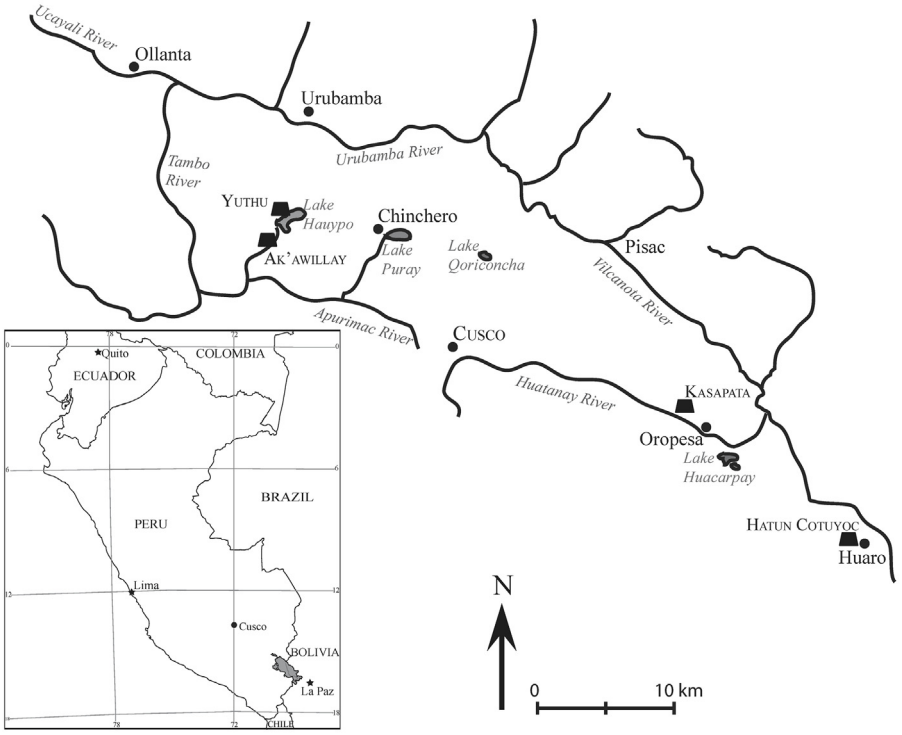

Fig. 1. Map of the Central Andes (inset) and the Cusco region. The four sites of interest to this study are in small-caps, while rivers and lakes are labeled in italics. Modern towns and cities are in regular text.

Formative, and Middle Horizon) in what would later become the center of the hemisphere's largest indigenous empire, the Inca. Carbon and nitrogen isotope ratios were characterized in bone collagen, while carbon and oxygen isotope ratios were characterized in bone and enamel carbonate to (1) assess the role of maize in local Archaic and Formative versus Wari and local Middle Horizon economies, and (2) identify temporal shifts in overall subsistence.

Moreover, characterizing isotopic values in multiple tissues from each individual—where available—permits the creation of multi-isotopic profiles and interpretation using a life-course perspective. Tooth enamel crowns form and mature at generally predictable rates during infancy and childhood and do not remodel once crown formation is complete (Hillson, 1996); cortical or compact bone remodels rapidly during infancy and childhood, then slows dramatically during and following adolescence. In adults, isotope values in cortical bone represent averages over as much as three decades (Goldman et al., 2003; Hedges and Reynard, 2007; Manolagas, 2000; Sealy et al., 1995). Isotopic values from bone collagen and carbonate therefore represent averaged dietary composition during the life course, while those from enamel carbonate represent the first few years of life. Consequently, this study provides a nuanced diachronic reconstruction of diet, and the first in what became the center of South America's greatest indigenous empire.

2. Background

2.1. Culture and subsistence in the Cusco region, [6350-950 BP]

The Cusco region extends from the Urubamba through Lucre Valleys and includes the modern city of Cusco; most of the region ranges in altitude between 3000 and 4000 m above sea level (masl) and contains significant agricultural and pastoral land spanning several ecozones. Humans have inhabited the region for at least six thousand years, and pollen records indicate significant human activity throughout. Wetter conditions in the Cusco region beginning 3000 BP likely prompted a shift from cultivation of Amaranthacae species, primarily quinoa, to that of maize, corresponding with an increase in regional population and village sizes (Bauer, 2004). A systematic paleoclimate survey (Chepstow-Lusty et al., 1996) suggests climatic changes approximately 1450 BP and again 900 BP, potentially corresponding to regional cultural shifts (Chepstow-Lusty, 2011; Chepstow-Lusty et al., 1998). Indeed, Sublette Mosblech et al. (2012) suggest that a wetter climate in the early Middle Horizon aided in active expansion and management of *Alnus spp.* forests in the highland Cusco region by the burgeoning Wari state. In the highland sierra, the altitudinal gradients of the Andean cordillera result in horizontally-stratified ecological zones, each of which permits the cultivation of different resources. Fruits are cultivated along lower altitudes, while grains and legumes flourish in the temperate *quechua* zone (2700–3500 masl). Some grains, including maize, and tubers are cultivable in the *suni* zone (3500–3850 masl), though maize is less commonly found above 3500 masl (National Research Council, 1989). The high elevation of the *puna* (3850–4700 masl) and cordillera (> 4700 masl) are too marginal for most food crops, but the abundant scrub grasses are used to pasture camelids. Andean groups have for millennia circumvented the limited horizontal space for agricultural fields by digging agricultural terraces into the slopes of mountains, opening up a substantial amount of arable land for agriculture and cultivating crops in multiple ecological zones, aided by intensive irrigation of highland rivers in later periods.

Bioarchaeologists and archaeologists have long been interested in the intersections of diet and cultural complexity in the Andes (Bray, 2003; Burger et al., 2003; Goldstein, 2003; Hastorf, 1990; Kellner and Schoeninger, 2008). The focus of this research has broadened considerably in recent years, shifting away from a primary emphasis on the political and economic significance of maize consumption (Iriarte, 2009) and a more or less linear conception of increasing social complexity and increasing disparity in foodways (Cuéllar, 2013). Instead, recent research increasingly recognizes the marked variation in Andean foodways (Dillehay, 2011), and the nuanced interplay of consumption, hegemony, and foodways (Smith and Schreiber, 2006). Seminal work in the Upper Mantaro Valley (Earle et al., 1987; Hastorf, 1990) underscored the significance of changes in foodways, some that would be