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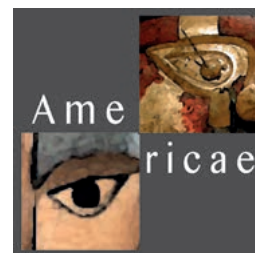
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Commensality, irrigation and agrarian entanglements in Early Horizon Nepeña, Coastal Peru

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This article considers the extensification of cultivated fields and irrigation networks, and the concomitant intensification of farming practices in the lower Nepeña Valley during the Early Horizon (800-200 BC). This period marked shifts in local procurement strategies, production intensities and food preferences. Beginning around the sixth century BC, various processes led to profound, long-lasting shifts in the perception and management of agriculture in this small valley of the north-central coast of Peru. Recent archaeological investigations highlight the emergence of dense human settlements, the increased importance of camelids for regional trade, and a heavy reliance on maize to produce alcoholic beverages. The synergistic effect of these processes appear to have included new opportunities for social and political competition in which food—and in particular maize cultivation—might have occupied a more salient role. While taxonomic data on floral and faunal remains have been published and allow a reconstruction of diachronic changes in local foodways, little is known about ancient field systems. This article considers the distribution of irrigation systems and ancient human settlements to evaluate levels of farming production during the first millennium BC. Results of the spatial analyses are considered in light of the complex entanglements between commensal politics, agrarian labor traps, and broader path dependencies in ancient coastal Peru.

Keywords: Peru, Early Horizon, agriculture, irrigation, feasting, entanglement theory.

Commensalité, irrigation et enchevêtrements agraires à Nepeña durant l'Horizon ancien, côte du Pérou

Cet article explore l'expansion des champs cultivés et des réseaux d'irrigation, ainsi que l'intensification conjointe des pratiques agraires dans la basse vallée de Nepeña, durant l'Horizon ancien (800-200 av. J.-C.). Cette période connaît des changements dans les stratégies d'approvisionnement, dans l'intensité de production et dans les préférences alimentaires. Dès le début du VI^e siècle av. J.-C., divers processus ont conduit à des modifications profondes et durables de la perception et de la gestion de l'agriculture. Des enquêtes archéologiques récentes soulignent l'émergence d'établissements humains denses, l'importance accrue des camélidés dans les échanges régionaux, et une forte dépendance au maïs pour produire des boissons alcoolisées. L'effet synergique de ces processus semble avoir inclus de nouvelles opportunités de compétition sociale et politique, dans lesquelles la nourriture – et en particulier la culture du maïs – aurait pu occuper un rôle prépondérant. Alors que les données taxonomiques de restes botaniques et fauniques ont été publiées, permettant ainsi la reconstruction des changements alimentaires locaux à travers le temps, nous en savons encore très peu sur les anciens champs cultivés. Cet article examine la distribution des systèmes d'irrigation et des établissements humains anciens dans le but d'évaluer les différents niveaux de production agraire durant le premier millénaire avant J.-C. Les résultats des analyses spatiales sont considérés à la lumière de la « théorie des enchevêtrements » (entanglement theory) et se penchent sur les liens complexes entre la politique commensale, les pièges de la main-d'œuvre agraire et les trajectoires plus larges de développements culturels sur la côte du Pérou ancien.

Mots-clés : Pérou, Horizon ancien, agriculture, irrigation, festin, théorie de l'enchevêtrement.

Comensalidad, irrigación y enredos agrarios en Nepeña durante el Horizonte temprano, costa del Perú

Este artículo considera la extensión de los campos de cultivo y las redes de riego, y la intensificación asociada de las prácticas agrícolas en el valle bajo de Nepeña durante el Horizonte temprano (800-200 a.C.). Este período marcó cambios en las estrategias locales de adquisición, la intensidad de producción y las preferencias alimentarias. Comenzando alrededor del siglo VI a.C., varios procesos condujeron a cambios profundos y duraderos en la percepción y el manejo de la agricultura en este pequeño valle de la costa nor-central del Perú. Investigaciones arqueológicas recientes resaltan la aparición de densos asentamientos humanos, la mayor importancia de los camélidos para el intercambio regional y una gran dependencia al maíz para producir bebidas alcohólicas. El efecto sinérgico de estos procesos parece haber incluido nuevas oportunidades de competencia social y política en las que los alimentos, y en particular el cultivo del maíz, podrían haber ocupado un papel más destacado. Mientras que los datos taxonómicos de restos de plantas y animales han sido publicados y utilizados para reconstruir los cambios alimentarios locales a través del tiempo, se sabe muy poco sobre los antiguos campos de cultivo. Este artículo considera la distribución de los sistemas de riego y de los asentamientos humanos con el objetivo de evaluar los niveles de producción agrícola durante el primer milenio a.C. Los resultados de los análisis espaciales se consideran a la luz de los complejos enredos (entanglement theory) entre la política comensal, las trampas laborales agrarias y las trayectorias de desarrollos culturales en la costa del Perú antiguo.

Palabras claves: Peru, Horizonte temprano, agricultura, irrigación, festín, teoría del enredo.

THE RECENT TURN TO “THINGS” in social sciences and humanities has sparked the development of several different approaches to consider how social life and non-human agents, including objects, plants, animals, and foodstuffs, are relationally produced. From the concepts of enchainment (Strathern 1988) to distributed personhood (Gell 1998) and entanglement (Dietler 2010; Hodder 2012, 2016), “New Materialist” scholars emphasize the heterogeneity and importance of relationalities in the structuration of societies, things, and environments. In archaeology, these more symmetrical and relational approaches have been particularly fruitful to reconceptualize the flows and entanglements in early complex farming societies, and their impact in creating entrapments, path dependencies, and ecological transformations (Fuller et al. 2016; Hodder 2018). One particularly fascinating region to study the intricate and powerful entanglements between agrarian practices, foodways and fields is the Central Andes, where ancient complex societies thrived in unique fashions since at least the late Preceramic Period some 5000 years ago. While scholars have debated the relative importance of marine exploitation, farming and animal husbandry in coastal Peru (Moseley 1975; Quilter and Stocker 1983; Raymond 1981; Wilson 1981), the value of entanglement models to study the development of human-agriculture interactions has yet to receive sustained archaeological attention.

In this article, we examine the case of Nepeña (Figure 1), a small valley where—during the Early Horizon (800-200 BC)—many concomitant changes in settlement patterns, commensal politics, plant and animal domesticates, material culture, and canal irrigation appear to have had long-lasting effects in the structuration of complex societies and agrarian practices. In particular, we focus on the extensification of irrigation networks, the intensification of maize cultivation, processing, and consumption, and the related technological chainworks materialized in food processing and cooking equipment. Although ancient coastal groups relied on a hybrid and often complementary maritime and terrestrial procurement strategies, archaeological evidence suggests the increased entrapment of complex societies in agrarian practices and materialities. This process contributed to the rich entanglements between state-level polities, urban economies and irrigation farming that became so prominent and archaeologically visible during the first millennium AD and beyond (e.g., Moche [Billman 2002; Castillo 2010], Chimú [Moore 1988; Netherly 1984]).

Archaeological excavations in Nepeña since the early 2000s have brought significant insights into long-lasting changes in forms of community organization, materialities, food crops, and animal domesticates. The results of those different field projects have served as the foundations of several specialized analyses published and summarized elsewhere (Chicoine 2006, 2010a, 2010b, 2011; Chicoine, Clement and Cummings n.d.; Chicoine, Clement and Stich 2016; Chicoine and Ikehara 2010,

2014; Chicoine, Ikehara and Ortiz n.d.; Chicoine and Rojas 2012, 2013; Chicoine et al. n.d., 2020; Chicoine and Whitten 2019; Cotrina et al. 2003; Helmer 2015; Helmer and Chicoine 2015; Helmer et al. 2018; Ikehara 2010a, 2010b, 2016; Ikehara, Paipay and Shibata 2013; Ikehara and Shibata 2008; Rengifo 2016; Shibata 2006, 2010, 2011, 2013; Sutherland et al. 2020; Szpak et al. 2016; Trever 2017). Based on those, the Early Horizon can be summarized as a period of particularly dynamic cultural transformations (see Chicoine et al. 2017; Ikehara and Chicoine 2011). During the local Nepeña Phase (800-450 BC) (Table 1), small temple complexes associated with the Chavín and Cupisnique religious movements—and located near the river in the middle of the arable portion of the lower valley—were renovated for the last time and eventually abandoned. Coevally, portions of the local population, under the guidance of dissident factions, and emerging elites who justified their authority in radically different ways, began to settle in what would become dense habitation centers on the valley margins. The topography of the lower valley and location of irrigation canals strongly suggest that this shift was bound to an extension of cultivable lands. Meanwhile, data from zooarchaeological and archaeobotanical analyses indicate a diversification of economic strategies, a greater reliance on camelid caravans, and the intensification of maize cultivation, including for the production of alcoholic beverages.

Local Phase	cal BC	Central Andes
Samanco	450-150	Early Horizon
Nepeña	800-450	
Cerro Blanco	1100-800	Initial Period
Huamboycán	1500-1100	

Table 1 – Chronological table for the Initial Period, and Early Horizon in the lower Nepeña Valley, Peru (modified from Shibata 2011: 116, tab. 1).

The Early Horizon system, centered at the urban center of Caylán, peaked during the following Samanco Phase (450-150 BC) and encompassed the ancient settlements of Sute Bajo, Huambacho, Samanco, and perhaps Punkurí Alto (Daggett 1987a; Proulx 1968: 57-58) (Figure 2, next pages). Based on the scale and complexity of Caylán and its satellites, but also on changes in commensal politics—in particular the consumption of maize beer in festive contexts—it is hypothesized that urban developments exacerbated the dependence of coastal populations on irrigation farming and generated new forms of entanglements, especially in relation to the agricultural strategies and the associated anthropogenic modifications of the Nepeña Valley.

Our paper builds and departs from the published literature by examining the relationships between settlement patterns and potential irrigation networks, and weaving those observations with our current understanding of the



Figure 1 – Map of Peru showing the location of the Nepeña Valley (map D. Chicoine).

shifts in materialities and foodways. Theoretically, we offer to move away from neo-evolutionary considerations and approach the Nepeña datasets in light of agrarian entanglements and commensal entrapments.

AGRARIAN ENTANGLEMENTS AND COMMENSAL ENTRAPMENTS

This article follows Ian Hodder's contributions to entanglement theory which recognize that "human dependence on things is productive, but it also draws humans more fully into a dependence on and care for

things that is entrapping" (Hodder 2016: 1). Hodder's entanglement model can be summarized in four types of relationships: humans depend on things, things depend on things, things depend on humans, and humans depend on humans (Hodder 2014: 19-20). These relationships create entanglements that form two types of dependence: one that is enabling, and the other that is constraining and entrapping. The term "entanglement" captures the ways humans and things entrap each other. Entanglements are in constant flow and often partially "determined by pre-existing cultural history and contingent ideologies, and set in place path dependencies in terms of cultural traditions" (Fuller et al. 2016: 166).

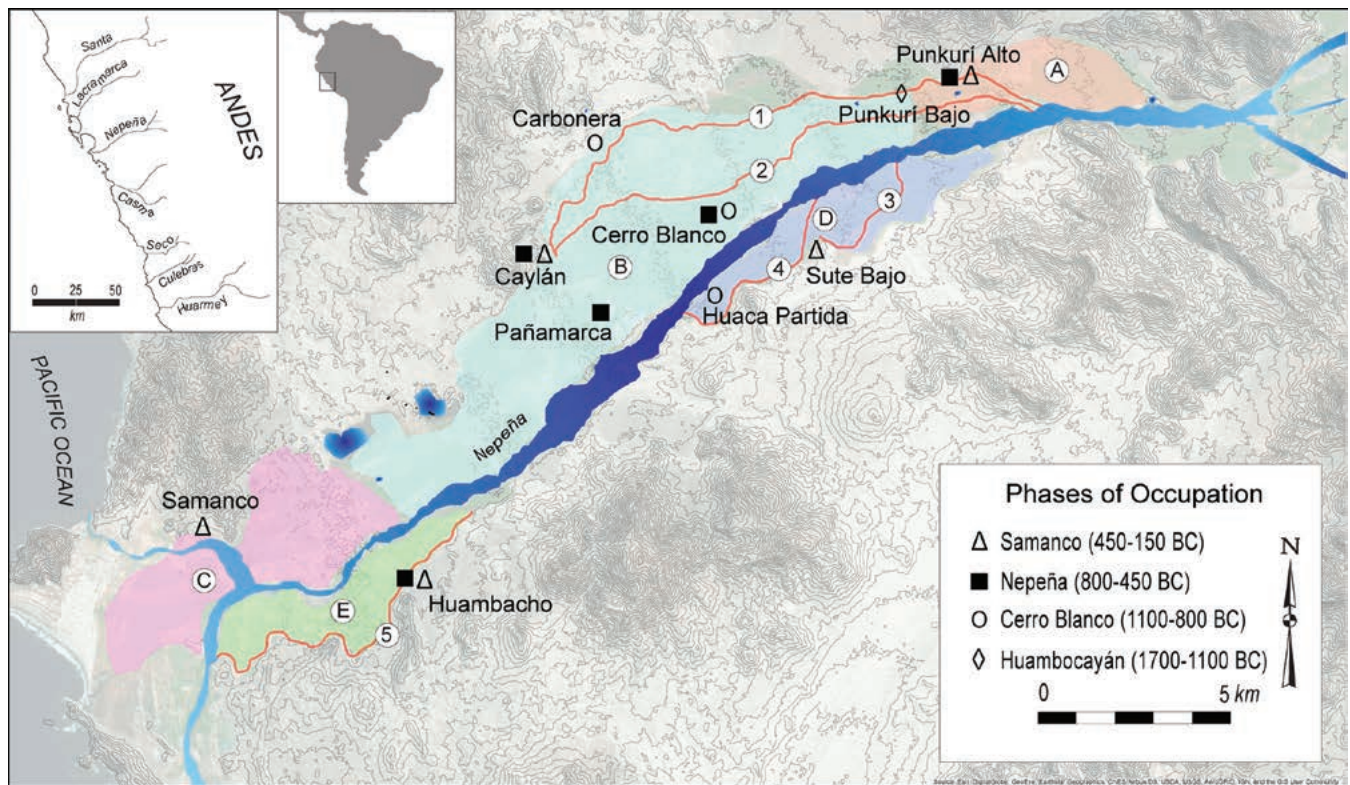


Figure 2 – Map of the Nepeña Valley based on 30 m resolution DEM

showing the location of the archaeological sites mentioned in the text and the primary ancient canals:

1. Punkurí-Caylán A; 2. Punkurí-Caylán B; 3. Sute A; 4. Sute B, and 5. Huambacho.

Early Horizon influence areas are hypothesized for Punkurí (A), Caylán (B), Samanco (C), Sute (D), and Huambacho (E). (10 m contour intervals; map C. McNabb and D. Chicoine).

Hodder's entanglement theory developed out of a long intellectual tradition investigating the complex relationships between human beings, things and their environments, whether ecological, social, material, technological, historical and/or political (Giddens 1984; Heidegger 1975; Latour 2005). Here, we are particularly interested in the relational production of humans, crops, animal domesticates, subsistence technologies, and social environments. Such ideas have become familiar to scholars of the Anthropocene and environmental humanists who have highlighted the complex relationships between humans, plants, animals and their environments (Haraway 2015; Scott 1998; Steffen et al. 2011). In archaeology, such theoretical developments have contributed to our understanding of the complex interdependence between biotic and abiotic components of socio-ecosystems or "anthroposystems" (see Lévêque et al. 2003). Globally, the long-term impact of agriculture include sedentism, demographic shifts, an increased reliance on a more limited range of domesticated foodstuffs, and a concomitant diversification in material technologies and chainworks (Fuller et al. 2016: 152; Hodder 2018). For instance, the transition to the Neolithic in the Middle East and the increased emphasis on cereals trapped sedentary farmers into getting more equipment, in particular groundstones (Hodder 2014: 29-30). Perhaps more importantly, archaeologists should

acknowledge that these operational sequences depend on other operational sequences (Hodder 2016: 3).

In this article, we focus on the interrelatedness and co-dependencies related to shifts in commensal politics, the provisioning of alcohol, and the rise of incipient urban populations. In Andean prehistory, major trends in agrarian entanglements include the development of hydraulic technologies on the coast and the highlands, terracing in the highlands, the production of durable containers, an increasing reliance on maize as a staple crop, in particular malted corn in the production of *chicha de maíz*, the use of groundstones, and at some point state-sponsored irrigation projects and agriculture (Billman 2002; Bruno 2014; Castillo 2010; Gumerman 1994; Hasforf 1993; Jennings 2005; Johanessen and Hastorf 1994; Kosiba 2018; Kus 1984; Lane 2009; Vaughn 2004).

PRECOLUMBIAN CULTURAL DEVELOPMENTS AND SUBSISTENCE ECONOMIES IN COASTAL PERU

In late Precolumbian Peru, crops cultivated for thousands of years were the basis of foodways and commensal politics deeply entangled in cultural identities, social interactions, and political formations (Hastorf 2009). In Inca

times, some of the most famous sociopolitical institutions were entangled with the production, processing, and strategic endowment of *chicha de maíz* including the *mit'a* labor tribute system—critical to building the empire's infrastructures (Jennings and Bowser 2009). On the north coast of Peru, the Inca conquered the kingdom of Chimor towards the end of the 15th-century AD. Also known as Chimú, this expansionist state and its leaders were the heirs of a rich north coast cultural tradition. Here, human groups mobilized large amounts of labor as early as the late Preceramic Period (3500-1800 BC) and built large-scale platform mound complexes. Indeed, the Central Andean region is often cited by scholars of ancient civilizations as a unique geographic case where social complexity developed based on maritime foraging economies (Moseley 1975). According to many scholars, the maximum extent of prehistoric agriculture in the region was reached by AD 1300 and, until very recently, exceeded modern capacities (Kosok 1965: 34; Schaedel 1986: 320).

More recent research, especially in the Norte Chico area and its flagship site of Caral has revealed that some late Preceramic coastal societies also engaged in subsistence and surplus trade farming (Haas et al. 2013). At Caral, Shady (2003: 48-49) argues for a “cotton-for-fish model” in which inland agricultural lands “could have been irrigated by means of a simple system of canals conducting water from the river or the abundant springs, which are still in use today.” Kus (1972: 79) suggests that major canals were built at the start of the Moche period around AD 200, and their techniques and networks eventually refined in Chimú times. The Chicama-Moche Intervallley Canal, a ca. 75 km long canal project that was never completed and/or fully operational, epitomizes such large-scale irrigation initiatives (see Denevan 2001: 152-157). For others, like Engel (1976), agriculture in coastal Peru was, prior to AD 1000, mostly small in scale and non-intensive.

Although new empirical data have pushed back in time the development of coastal agriculture in the Central Andes, shifts from marine foraging to irrigation agriculture continue to be mostly interpreted through neo-evolutionary lenses. From such a standpoint, the intensification of agricultural practices, diversification of food crops, and extensification of irrigation networks and cultivated lands are often understood in functional and quantitative terms as they relate to surplus production, labor investment and increased managerial needs. Meanwhile, few studies have paid attention to the entanglements between agrarian practices, forms of human settlements, commensal politics, foodstuffs, and how those materialized in broader shifts in political economies. Considering recent developments in the social archaeology of humans and things, in particular the entrapping and dependence between societies, materials, and subsistence goods, this article offers an analysis of commensal politics, farming strategies and irrigation networks in Nepeña, a small valley located on the north-central coastal Peru.

EARLY HORIZON ENTANGLEMENTS IN NEPEÑA: COMMENSALITY, AGRICULTURE, AND IRRIGATION

The coast of Peru is one of the driest regions on earth. Here, geological, oceanic and atmospheric conditions combine to create arid coastal valleys separated by rocky hill systems. Rainfall to the east feeds the several mountainous basins of the Andean Cordillera, which in turn drains eastward into the meandering Amazon, as well as westward into several dozen coastal drainages. Nepeña is one of those coastal rivers located in the modern-day Department of Ancash, north-central Peru. The valley has a mean annual temperature of 19.7 Celsius and is classified as a BWhn climate in the Koppen System which corresponds to a warm and foggy barren desert (Proulx 1968: 3). This article focuses on the lower valley, the area below the Moro Pocket. The topography is characterized by flat bottomlands with isolated hills, and low mountains on the desert margins.

Like the other 40 or so perennial rivers descending from the Andes, the Nepeña River cuts through the Pacific coastal desert and waters the valley bottomland. The land found between the river valleys is mainly characterized by zones of rock-covered pampas, windswept dunes, and rugged outliers of the cordillera. Periodic fogs allow occasional epiphytic plants to cover the mountain slopes and create scattered patches of vegetation and seasonal fog meadows (*lomas*). Annually, the river discharges 74.7 million cubic meters, mostly in February and March, allowing the irrigation of ca. 6400 hectares before the water runoff reaches the sea near the Bahía de Samanco (ONERN 1972). This debit is relatively low when compared to the neighboring Casma and Santa rivers (Wilson 1988: 18, tab. 1 based on figures reported by Robinson 1964: 166-169). Nevertheless, its geomorphology made it an attractive setting for early agrarian populations. For example, in the Santa Valley it is estimated that 93% of the water runoff carried out by the deeply entrenched incised river makes it to the ocean (Wilson 1988: 27). In contrast, Nepeña is much less entrenched and most of the cultivable land is subject to seasonal flood, wetlands, and/or irrigation. Nowadays most farmlands in the lower valley are dedicated to the cash cropping monoculture of sugar cane and fruits via canal or drip irrigation. Archaeological investigations, however, suggest more vibrant and diverse agrarian strategies and crop selection in prehispanic times.

While the earliest permanent and sedentary human occupations in the valley appear to at least go back to the third millennium BC, the first significant evidence of human constructions date to the Initial Period (1800-800 BC), during the Huambocayán Phase (1500-1100 BC) (Proulx 1968: 9-10, 215-216; Thompson 1962: 206). Indeed, and although its dating is debated, a low platform mound at Punkurí Bajo is currently the earliest known ceremonial center in the lower valley and was

likely built in Huambocayán times (Daggett 1987b; Samaniego 2011). During the following Cerro Blanco Phase (1100-800 BC), groups mobilized to build, maintain and renovate a small number of temple mounds (see Chicoine et al. 2017). Excavations at Cerro Blanco and Huaca Partida have revealed elaborate mural art depicting supernatural beings symbolically associated with themes common to the Chavín and Cupisnique phenomena (Shibata 2011).

The location of Initial Period ceremonial centers, in the middle of the arable plain and near the river—away from known ancient canals—does not support the hypothesis that canal irrigation technologies were of great concern for Nepeña populations at the time. Instead, limited “water concentration” technologies, such as floodplain or water-table fields (Denevan 2001: 16), likely existed in the vicinity of lagoons, reservoirs, wetlands and near the river itself. In contrast, the Nepeña Phase (800-450 BC) marked a relocation of some groups on the valley margins, in association with primary canals. Indeed, the Early Horizon sites of Samanco, Huambacho, Caylán and Sute Bajo are all located next to canals. Stratigraphic information and direct dates for the canals will be necessary to confirm this scenario, but based on the evidence currently available it stands to reason that the initial construction of many canals began towards end of the Nepeña Phase. This period also marked significant cultural transformations including megalithic renovations of late Initial Period religious structures, as well as their subsequent abandonment. The second half of the Early Horizon, or Samanco Phase (450-150 BC), marked the development of a regional system with several sites integrated economically, culturally and perhaps politically. Caylán stands as the largest of those Samanco Phase settlements. All major known settlements at this time are located near irrigation canals.

Excavation data from feasting and other food consumption contexts at Cerro Blanco (Ikehara and Shibata 2008; Shibata 2013), Huambacho (Chicoine 2006, 2011), Samanco (Helmer 2015), and Caylán (Chicoine and Ikehara 2010, 2014) yield insights into the plants and animals exploited during the first millennium BC. Taxonomic analyses of zooarchaeological remains have been published elsewhere and reveal that, in particular fish and shellfish, likely supplied the bulk of animal protein (Chicoine 2011; Chicoine and Rojas 2012, 2013; Chicoine et al. 2020, n.d.; Helmer 2015: 67-75; Ikehara, Paipay and Shibata 2013; Ikehara and Shibata 2008; Shibata 2013). Also, several species of wild waterfowls were opportunistically hunted, as well as *viscachas* (*Lagidium viscacia*). Animal domesticates, meanwhile, are represented by camelids (likely *Lama glama*), dogs (*Canis familiaris*), and guinea pigs (*Cavia porcellus*). While the growing importance of camelids in Early Horizon Nepeña appears related to their role as beasts of burden (Szpak et al. 2016), the presence of skeletal remains with cut marks suggest camelids were also eaten

(Chicoine et al. 2020: 204, fig. 7.5). A camelid corral was even excavated at Samanco, pointing to local camelid husbandry (Helmer and Chicoine 2015: 636, fig. 10). Along the same line, butchered canine remains appear ubiquitous throughout the lower valley which suggest that dogs were part of Early Horizon foodways, perhaps as a special or feasting food (Shibata 2013). More anecdotal animal remains found in Early Horizon refuse include deer (*Odocoileus virginianus*), sea lion (*Otaria* sp.), and cats (*Felis* sp.). It is unclear how these marginal taxa were procured and/or if they were consumed on a regular basis. In the remainder of this article, we focus on food plants, in particular, cultigens and semi-domesticates which cultivation was closely tied to modifications in agricultural fields and irrigation systems.

FOOD PLANTS FROM EXCAVATED CONTEXTS

The excavation of commensal contexts and the analysis of their respective contents bring insights into the foodstuffs produced and consumed across time in the lower Nepeña Valley. Detailed results of those analyses have been published elsewhere (Chicoine 2011: 449, tab. 5; Chicoine, Clement, and Cummings n.d.; Chicoine, Clement and Stich 2016; Helmer 2015: 72-73, tab. 5.12-5.13). The integration of the published botanical data into our analytical framework is complicated by scalar differences in the preservation of remains, variations in methodological approaches, and discrepancies in the reporting of the results. Yet, and keeping those limitations in mind, four sites in particular bring insights into deposits associated, at least in part, with feasting events: Cerro Blanco, Huambacho, Samanco, and Caylán. At Cerro Blanco, Shibata (2006, 2010, 2011) and his team excavated a small platform associated with the main ceremonial plaza. Their work yielded deposits linked to three feasting episodes dated to the Cerro Blanco and Nepeña phases, and their transition (Ikehara and Shibata 2008). The analysis of starch from pottery residue identified the following edible plants: manioc (*Manihot esculenta*), sweet potato (*Ipomoea batatas*), maca (*Lepidium meyenii*), maize (*Zea mays*), potato (*Solanum* sp.), bean (*Phaseolus* sp.), and Maranthaceae, perhaps arrow root (Ikehara, Paipay and Shibata 2013: 223). Coupled with changes in the relative frequency of vessel types associated with the fermenting of manioc in basins (or *baldes*) and maize in neckless jars (*ollas sin cuello*), respectively, Ikehara, Paipay and Shibata (ibid.: 227) suggest that the popularity of maize increased during the Nepeña Phase. Research at Huambacho and Caylán supports their findings and confirms the increased visibility of maize in archaeological deposits of the Samanco Phase. Here, we approach this shift from the perspective of the entanglement between commensal politics, feasts and the cultivation, processing, and fermenting of maize (Chicoine 2011). The remainder of this paper focuses on excavation results from Huambacho, Samanco and

Caylán, the three main Early Horizon sites associated with the extension of irrigation systems. Details on excavation methods, sampling strategies, archaeological contexts, and overall site interpretations have been published elsewhere (Chicoine 2006, 2011; Chicoine, Clement and Stich 2016; Chicoine and Ikehara 2014; Chicoine and Rojas 2012, 2013; Helmer 2015; Helmer and Chicoine 2015). Here, we pay particular attention to animal vertebrates, plant remains, and the physical location of irrigation canals.

At Huambacho, where archaeological contexts were found relatively clean, the taxonomic analysis of edible macrobotanical remains from feasting refuse identified maize, peanut (*Arachis hypogaea*), bean, avocado (*Persea americana*), squash (*Cucurbita* sp.), paca (*Inga feuillei*), and manioc (Chicoine 2011: 449, tab. 5). Here, the limited botanical assemblage is associated with the intermittent use and overall low intensity of the occupation at the small elite center. In contrast, botanical data from the small town of Samanco, located only 2 km from the Pacific on the northern margin of the valley, are abundant and taxonomically much richer. Preservation at Samanco is excellent and deposits very dense. Here, excavations by Helmer (2015: 72, tab. 5.12) have yielded remains of maize, sweet potato, bean, Lima bean (*Phaseolus lunatus*), peanut, paca, chili pepper (*Capsicum* sp.), lúcuma (*Pouteria lucuma*), palillo (*Campomanesia lineatifolia*), squash, avocado, achira (*Canna* sp.), cansaboca (*Bunchosia armeniaca*), snap bean (*Phaseolus vulgaris*), achiote (*Bixa orellana*), manioc, tara (*Caesalpinia spinosa*), pajuro (*Erythrina edulis*), guava (*Psidium guajaba*), coca (*Erythroxylum* sp.), and potato. Notwithstanding issues of taphonomy and preservation, the diversity in food plants at Samanco bring insights into the complexity, vibrancy, and richness of horticultural and agricultural practices in the lower valley during the Early Horizon.

Excavations at the larger and more complex Caylán, where conservative demographic approximations argue for a permanent resident population of at least 3,000 (Chicoine and Whitten 2019: 93), have yielded more numerous samples, larger in overall size, and representative of various functional contexts. Considered together, the aggregated floral data from the analysis of macrobotanics has identified the following plant edibles: maize, peanut, avocado, paca, common bean (*Phaseolus vulgaris*), palillo, squash (*Cucurbita* cf. *moschata*), Lima bean, lúcuma, cansaboca, jack bean (*Canavalia* sp.), cherimoya (*Annona cherimola*), and chili pepper (Chicoine, Clement and Stich 2016: 157, tab. 1). At Caylán, the archaeobotanical record was enhanced by the discovery of expedient latrine contexts in association with abandoned buildings and renovation episodes. Excavations documented a total of 58 features with desiccated fecal remains, 19 of which were rehydrated for analysis. The rehydrated sample represents more than 30% of the total excrement features so far documented at Caylán. Detail

on rehydration techniques, analytical methods and results of the multi-proxy analysis of the coprolite analysis is presented elsewhere (Chicoine, Clement and Cummings n.d.; Kováčik et al. 2012). While the coprolite evidence is still preliminary and complicated by scalar differences and taphonomic issues, a few key observations can nevertheless be made.

Preliminary results of the multiple proxy lines confirm the importance of fish in Early Horizon diets at Caylán (Kováčik et al. 2012). Traces of fish remains are ubiquitous and found in 17 of the 19 samples. Vertebrae, otoliths, scales and marine diatoms, which are typically found on the skin, gills, and in the stomach of fish, suggest that small fish were consumed whole. The ubiquity of sardines (*Sardinops sagax*) across the deposits strengthen this observation (Chicoine et al. 2020). Results also indicate that maize, one of the most abundant plant remains in Early Horizon deposits, is virtually invisible at the macroscopic level in fecal samples. Macroscopically, maize only appears in one sample in the form of glume and kernel skin. The presence of a broken corn pollen grain most likely reflects grinding, while charred corn phytolith points to maize husks being used to wrap food (like *tamales* in contemporary Peruvian cuisine). Again, because of taphonomic and methodological issues, one must exert caution when integrating those multiple proxy lines. Nevertheless, the datasets from Nepeña point to the importance of small marine fish, as well as of plant edibles including tubers, fruits, nightshades and maize (including maize beer). Diachronically, the only discernible change appears to be the increasing visibility of maize in archaeological deposits.

Twenty kilometers south of Nepeña, research in the Casma Valley over the last three decades has yielded significant information to reconstruct patterns of subsistence and human-plant interactions during the Early Horizon. Survey and excavation work by Shelia and Thomas Pozorski (1987) at the lower valley settlements of San Diego and Pampa Rosario have revealed the presence of several tubers including potato (*Solanum tuberosum*), manioc (*Manihot esculenta*), achira (*Canna* sp.), and arrowroot (*Maranta arundinacea*). Other food plants include chili pepper (*Capsicum* sp.), lúcuma (*Pouteria lucuma*), and ciruela de fraile (*Bunchosia argentea*). Their results support in large part the Nepeña datasets. More research is needed on the ways maize was processed, served, and consumed during the Early Horizon, but data from settlement patterns and the distribution of canals allows us to hypothesize that its cultivation was linked to an extensification of irrigated areas and a concomitant intensification of agriculture.

IRRIGATION AND THE EXTENSIFICATION OF CULTIVATED AREAS

The archaeological study of ancient canals is often complicated by the fact that they are continually used,

maintained and reused, sometimes centuries and millennia after their original constructions (Denevan 2001: 137). For gravity-based irrigation systems like those of ancient coastal Peru, one way to glimpse at prehispanic canals and their extent is to analyze maps of modern canals in conjunction with topography and settlement data (Billman 2002; Castillo 2010; Ertsen 2010). In such systems, the main intake, primary or feeder canal (or *acequia madre*) is designed to collect water from the river and then move it continuously by gravity to secondary distribution canals (Denevan 2001: 146). In Nepeña, we can approximate the extent of irrigation systems in the past using maps of contemporary canals and ignoring canals that do not conform to topography and gravity. Our team used maps graciously made available by the *Comisión de Regantes de Nepeña* in order to extract spatial data for irrigation canals and upload those into ArcGIS. The chronological assessment of the canals was estimated using association with ancient settlements and their hypothesized periods of occupation (see Proulx 1968, 1973 for surface survey data). Our methodology provides preliminary insights to feed working hypotheses which will need to be tested in the field through ground-truthing, stratigraphic excavations and more direct dating techniques (e.g., radiocarbon).

In the lower Nepeña Valley, our team was able to approximate five ancient canal systems and potential

user groups: 1. Punkurí-Caylán A (15.4 km), 2. Punkurí-Caylán B (13.6 km), 3. Sute A (5.9 km), 4. Sute B (4.8 km), and 5. Huambacho (10.7 km) (Figure 2). All five are parabolic, stretching to the extent of cultivable land before curving back toward the river or ending in water catchment. During the Huambocayán Phase, only Punkurí Bajo appears associated with a known canal. Its proximity to an *acequia* and marshlands does not lend weight to extensive irrigation. In years of heavy rainfall in the highlands and shifting river flow on the coast, this *acequia* would have served as a second river stream, parallel to the main Nepeña channel to the south. First-hand geological ground-truthing is needed, but this assertion might be supported by modern soil salinity levels, which point to potential areas of higher water accumulation (Figure 3) (see ONERN 1972: map 7). Particularly high saline levels are found around Caylán and Samanco, two areas with surrounding wetlands and seasonal water streams where prehispanic agriculture might have been more intense. The high salinity might also point to the recent intensification of agriculture, and the use of modern fertilization techniques. At the moment, it appears impossible to discern between the modern and/or prehispanic origins of high salinities.

For the Cerro Blanco Phase, a similar situation can be postulated. All major sites, with the potential exception of La Carbonera, are located within one kilometer of the

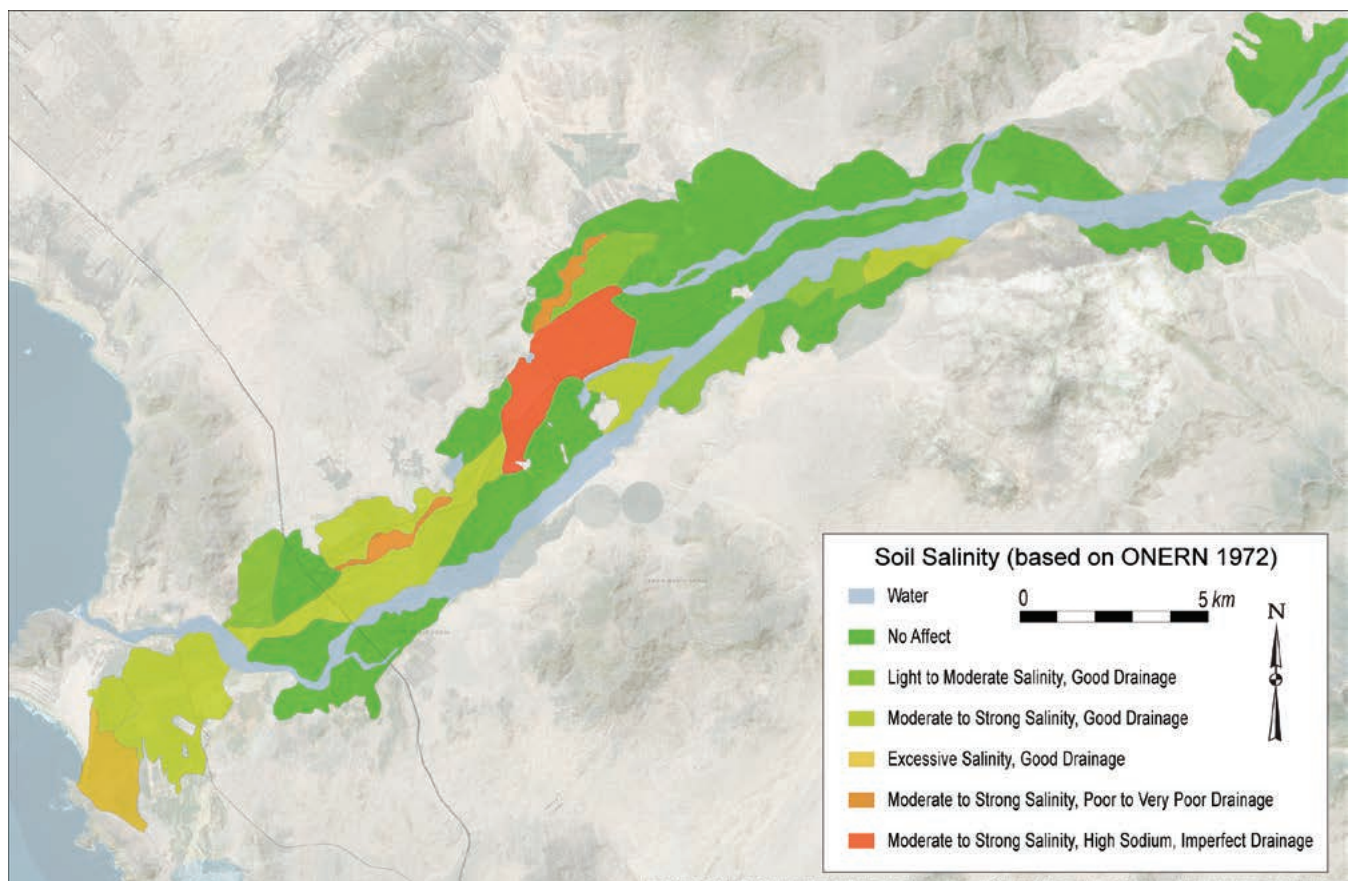


Figure 3 – Map of the Nepeña Valley showing levels of salinity based on the sampling and analysis of soils published by the Oficina Nacional de Evaluación de Recursos (ONERN 1972) (map C. McNabb).

river and do not seem associated with any of the major canal systems. As no scientific excavations have yet to be carried out at La Carbonera, settlement evidence is limited to Cerro Blanco and Huaca Partida. While it is highly probable that local farmers modified the lower Nepeña landscape during the late Initial Period (e.g., forest clearing), the absence of civic-ceremonial center near irrigation canals does not support a strong relationship between religio-political authority and the development of irrigation technologies.

In contrast, sites of the following Nepeña and Samanco phases align strongly with the location of irrigation canals. During that time, and based on estimated catchment areas proportionate to the size of each ancient settlement, our analysis suggests the existence of five major irrigation communities or systems: 1. Punkurí (758 hectares) (Figure 2A), 2. Caylán (4690 hectares) (Figure 2B), 3. Samanco (1677 hectares) (Figure 2C) on the northern margin, 4. Sute (889 hectares) (Figure 2D), and 5. Huambacho (785 hectares) (Figure 2E) on the southern side.

In sum, prior to the end of the Nepeña Phase, it is unclear if major canals existed on the lower valley margins. People likely lived in small hamlets inside the arable plain and ceremonial centers were located near the river within the cultivated fields. Surface surveys and test excavations of the areas currently under cultivation will be needed to document such dispersed small-scale settlements and possible anthropogenic modifications. By contrast, at the end of the Nepeña Phase and during the following Samanco Phase, major human settlements are established on the valley margins in association with irrigation canals. This suggests that a significant boom in the extensification of the lower valley system concurred with the emergence of towns and incipient urban demographics. At that time, Caylán stood as the largest settlement of this system. In light of the botanical and pottery evidence from several sites, it is possible to hypothesize that this agrarian expansion was linked, among other things, to the intensification of maize agriculture, a high-energy crop that was crucial to the political economy and commensal hospitality of Early Horizon leaders.

MAIZE BEER, FEASTS, AND COMMENSAL ENTRAPMENTS

Early Horizon agrarian entanglements can be analyzed in terms of commensal entrapments linked to the institutionalization of maize beer production as an elite strategy to recruit supporters and gain social and symbolic capital through competitive feasting. This is obviously only one among many aspects of ancient agrarian practices, foodways and maize use (Grobman, Salhuana, and Sevilla 1961: 34-35), albeit one that is particularly visible archaeologically. Beyond the pressure put on the landscape by the extensification of irrigation canals, the intensification of agriculture activities likely impacted the

selection of crops, as well as the toolkit and soft agrarian technologies including organic (e.g., guano, fish, dung, nitrogen fixation) and inorganic (e.g., silting) fertilizing techniques. Cropping patterns, meanwhile, remain uncertain, although the diversity of nitrogen-demanding seed crop (maize) and nitrogen-restoring legumes (beans, peanuts) points towards mixed cropping strategies. It is unclear how much the intensification of maize farming translated to monoculture initiatives. At the same time, the potential selection for maize plants with larger ears would have strengthened the path dependencies of farmers and compounded both the soil nutrient and labor traps. Fuller et al. (2016) notes that the size of grain is a good way for archaeologists to evaluate levels of entrapment. In ancient Peru, the factors involved in the evolution of maize are numerous and complex, but scholars recognize a gradual increase in the diameter of maize cobs and a concomitant decrease in the number of rows, suggesting significant increases in energy input (Grobman, Salhuana, and Sevilla 1961: 60, tab. 5).

In addition to anthropogenic modifications to fields and irrigation canals, Early Horizon entanglements and commensal entrapments are visible in the chainworks and processing technologies related to the preparation, and consumption of maize, in particular beer. Numerous studies in ancient Peru point to the increasing importance of maize during the first millennium BC (Burger and Van der Merwe 1990; Seki and Yoneda 2005; Tykot, Burger, and Van der Merwe 2006). In Nepeña, based on starch grain analyses of residues from ceramic vessels at Cerro Blanco, Ikehara, Paipay, and Shibata (2013) document a shift from manioc-based fermenting beverages to maize beer. In this paper, we suggest to approach this shift in brewing traditions in terms of both the productive and constraining aspects of the *chaîne opératoire* of both crops. In terms of production rate, maize matures as much as three times faster than manioc, and can be malted. The malting techniques can replace the need for chewing and increase the scale of production, and accelerate the pace of brewing. Malted corn ferments faster than manioc which, as pointed out by Ikehara, Paipay, and Shibata (ibid.: 227), appears tied to a shift in fermenting vessels from large open basins (*baldes*) to pots with smaller openings relative to their volume. Pottery data confirm the popularity of neckless jars (or *ollas sin cuello*), as this vessel form represents on average more than 65% of the rim sherds recovered at Caylán (~69%), Samanco (~70%), and Huambacho (~58%). While it is possible that neckless jars were first developed as fermenting vessels, their ubiquity and high density at Early Horizon point to their use in multiple domestic tasks and functions including storage, boiling, and even service, as suggested by ollas with pouring spouts (Figure 4). Volumetric analyses of Early Horizon neckless ollas, published elsewhere, suggest they were used in the preparation of food and drink for festive gatherings (Sutherland et al. 2020).

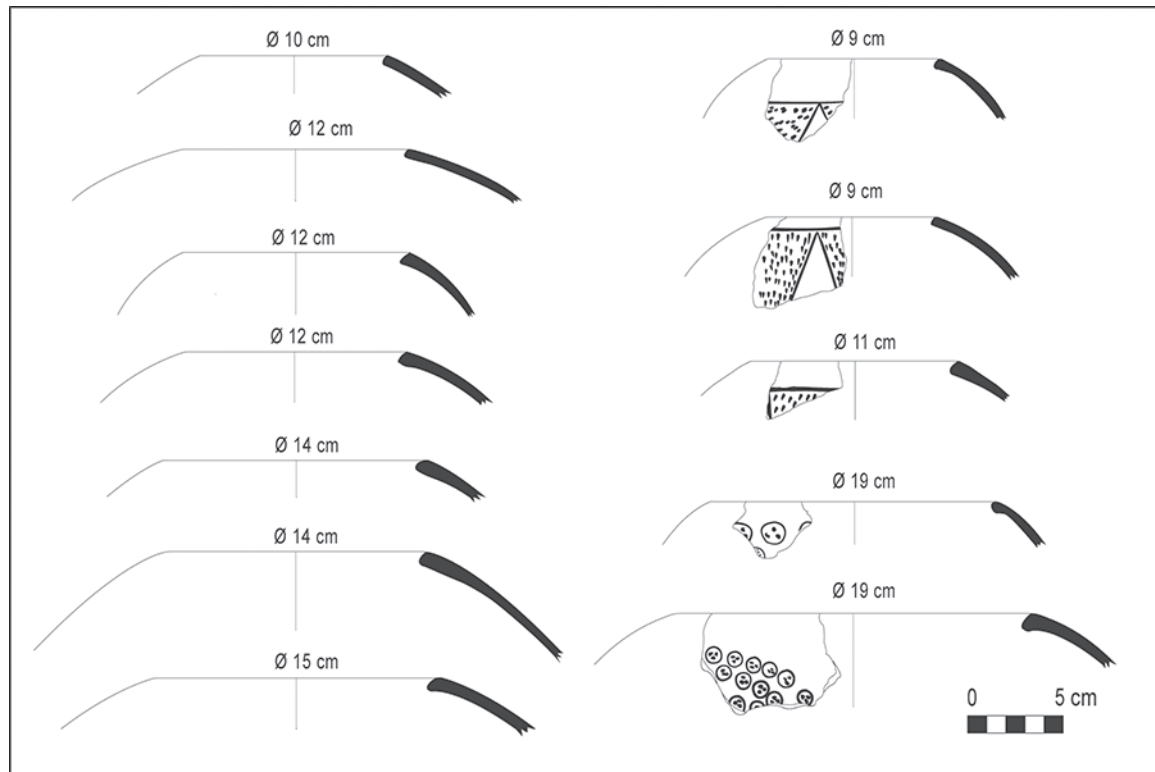


Figure 4 – Drawings of neckless jars (or *ollas sin cuello*) from Huambacho, including plain (left) and decorated ones (right) (DAO D. Chicoine).

Beyond its utility in brewing, maize is a high energy-demanding plant that has the potential to lock cultivators and fields into labor and soil nutrient traps, respectively. Combined, increases in the production capacity of brewers and the shorter amount of time needed to process the grains could have led to an escalation of brewing volumes and patterns of consumption. Finally, malted corn needs to be at least mildly ground in order for the exocarp to be broken and allow the conversion of the endosperm and its sugar into alcohol (Jennings et al. 2005: 278). From that technical standpoint, one can surmise the entanglement of malted maize beer making with processing tools such as groundstones. While groundstones have been used in ancient coastal Peru since the inception of agriculture, Early Horizon groups in Nepeña likely increased their dependency on such tools. At Caylán, for instance, pedestrian surface survey has revealed 237 groundstones including large grinding platforms (*batanes*) (n = 36), two-hand portable grinders (*chungos*) (n = 166), and smaller one-hand pestles and/or hammers (*manos*) (n = 35) (Figure 5) (see Chicoine and Whitten 2019: 92, fig. 6.6). Although based on surface survey and hence fragmentary, the data suggest an imbalance between the numbers of surface *batanes* and *chungos*. Considering that those tools that are typically used in conjunction, one could surmise that grinding platforms might have been shared between community members, most likely at the house compound or neighborhood level. This has important implications for understanding the organization of food processing and production. It suggests, for

instance, that households shared some food processing facilities and potentially collaborated in the brewing of maize beer and the hosting of feasts.

At Caylán, *batanes* are typically made of large blocks of dark-colored igneous rock detached from the adjacent hills and carried over relatively short distances (less than one kilometer). *Chungos* and *manos*, on the other hand, are made of lighter colored granitic river cobbles carried from distances of over 3 km. They were likely more difficult to obtain. Also tied to the increased needs for plant processing, Early Horizon people developed other grinding tools including grater bowls (Figure 6). Made out of fired clay, and found in abundance in refuse deposits,



Figure 5 – Photograph of a grinding platform (*batán*) and two-hand grinder (*chungo*); two of the 237 surface groundstones documented at Caylán (photo D. Chicoine).



Figure 6 – Photograph of fired clay grater fragments from Huambacho (photo D. Chicoine).

these objects could have represented alternatives to the larger and heavier groundstones. More research is needed on the graters and their place within the chainworks related to food processing. Most fragments have their grooves filled with white-yellowish residues which future analyses should help characterize. At this point, and in conjunction with botanical evidence, it is possible that the graters were used to process manioc, maize, achira and/or other starchy plants.

DISCUSSION

In order to discuss ancient Andean coastal agrarian entanglements, one needs to consider the needs and demands of ancient crops, their cultivating and processing, as well as economic and social uses. This paper presents an initial attempt to provide such a framework for the lower Nepeña Valley of coastal Peru. Departing from a summary of the published literature, we have attempted to estimate the extent of irrigation networks and evaluate their location and time of construction based on their spatial relations to ancient archaeological sites. To summarize the argument and evidence integrated in this paper, archaeobotanical remains from the lower Nepeña indicate that a variety of crops were cultivated, processed, and consumed during the Early Horizon. Maize is ubiquitous and found in abundance in refuse deposits associated with various types of commensal activities, including feasts. Settlement pattern data combined with the distribution of irrigation canals suggest an extensification of irrigated farming that began in the Nepeña Phase and likely reached unprecedented levels during the following Samanco Phase and beyond. Shifts in pottery shapes, in particular the increased propensity of neckless *ollas* and disappearance of *baldes* points towards a transition in the brewing of alcoholic beverages from manioc to maize beer. Preliminary data from coprolites excavated at Caylán align well with this scenario

and suggest that corn kernels were not eaten whole. A likely possibility is that maize was grinded and/or consumed in the form of malted beverage and/or flour.

Major shifts in settlement patterns and human impact on coastal landscapes towards the end of the Nepeña Phase suggest that canal irrigation became a focus of innovation. Primary canals carrying water from the river were likely built in association with the major lower valley settlements in particular Caylán, Sute Bajo, Huambacho, Samanco and Punkurí Alto. These primary canals in turn would have supplied secondary canals, leading water into field furrows (Denevan 2001: 21). By the Samanco Phase, we hypothesize the existence of various hydraulic communities in the lower valley.

The extensification of irrigation fields in the lower Nepeña needs to be understood in terms of its entanglement with human activities and tasks in the field as well as beyond it. As pointed out by Denevan (*ibid.*: 148), early canals in ancient coastal Peru were likely built by gradual accretion over time and through trial and error. Indeed, water is needed to test the flow of a canal and adjust the canal gradient (Kus 1984: 409). Following their initial construction, canals must be regularly maintained to clean out silt and windblown sand. Collapsed or eroded sections need to be repaired. Canal arrangements can also be remodeled to improve efficiency. Overall, this suggests that the lower Nepeña irrigation system might be the result of successive episodes of canal expansion leading to a gradual shift from “wetland” or “flood receding” cultivation to more irrigation-based “fixed fields” agriculture (see Scott 2017: Chapter 1 for comparative perspectives from the Middle East and Mesopotamia).

Approached from the standpoint of the amount of energy and coordination needed, the extensification of irrigation networks and associated potential for the intensification of cereals and legumes farming does not appear inevitable. This is particularly so before the development of infrastructures that made intensive irrigation farming an efficient and attractive food production strategy. The investment into such infrastructures demanded significant labor commitment and should be understood in terms of delayed return strategies. This is quite different from maritime foraging economies which tend to emphasize immediate returns.

In Nepeña, the vacuum left from the waning of the Chavín and Cupisnique influences combined with internal factional competition, led to a climate of political fragmentation (Chicoine 2010a, 2011; Chicoine et al. 2017; Ikehara 2016). This balkanization not only fueled armed conflicts, but also bolstered competitive feasting as a major tool of status and coalition building (Ikehara and Chicoine 2011). Alliances relied more than ever before on commensal politics and especially communal libations. We suggest that local political economies, including land tenure, agrarian arrangements extraction strategies and supply networks, were historically situated within the flow of these entanglements. We further

hypothesize the entrapment of Nepeña leaders, their families and supporters in ever demanding irrigation infrastructures, agrarian labor, and associated chainworks of food processing tools and facilities.

Commensal politics, and in particular the strategic endowment of alcoholic drink and other festive food-stuffs, were central in the relationships between Early Horizon people, their fields, canals and associated social institutions. As pointed by Hodder (2016: 1): “The human dependence on things is productive, but it also draws humans more fully into a dependence on and care for things that is entrapping.” At Caylán and its satellites, social competition as seen in festive events carried out at residential compounds entrapped households and broader political economic strategies into favoring the cultivation of maize, a particularly energy demanding crop. In turn, such a soil nutrient trap would have favored an increased reliance on soft technologies including the use of organic fertilizers and inorganic soil additives (Denevan 2001: 34-39). The displacement of populations from the rural hinterlands to incipient towns, in particular Caylán, also likely played a major role. Demographic growth within the settlement and escalating social and political competition as expressed in the renovation of monumental buildings likely put even more pressure on socioeconomic arrangements.

More broadly, changes in patterns of plant exploitation and cultivation can in turn be “enmeshed in longer-term regional traditions [such as] cooking, acquired tastes, and the metaphorical connections of these wider-world and belief systems” (Fuller et al. 2016: 167). In Early Horizon Nepeña, such ideological trajectories can be tracked in shifts in public art and religious symbolism. For instance, clay friezes ornamenting feasting halls at Huambacho and Caylán depict geometric designs (e.g., zigzags) that appear to mimic the shapes and index the qualities of canals and field furrows. These contrasts markedly with the emphasis on feline and therianthrope imagery found at previous ceremonial centers such as Cerro Blanco and Huaca Partida (see Helmer et al. 2018 for a detailed description of plaza settings in Nepeña).

At the same time, the path dependencies created by the hypothesized commensal entrapments appear to have led to the growing symbolic importance of maize as a food crop, and a nexus of religious ideology and ritual practice (see Gumerman 1994; Johanessen and Hastorf 1994). Not only does the place of maize in north coast foodways and the scale of irrigation projects reach unprecedented levels during the subsequent Early Intermediate Period (200 BC-AD 800), it also became “good to think.” This appears more saliently in the importance of maize in Moche mortuary rituals (Gumerman 1994). At Huambacho, the discovery of a Moche style bottle with a human figure dressed in maize cobs confirms the importance maize symbolism in ritual libations and burial rites during the Early Intermediate Period (Figure 7).

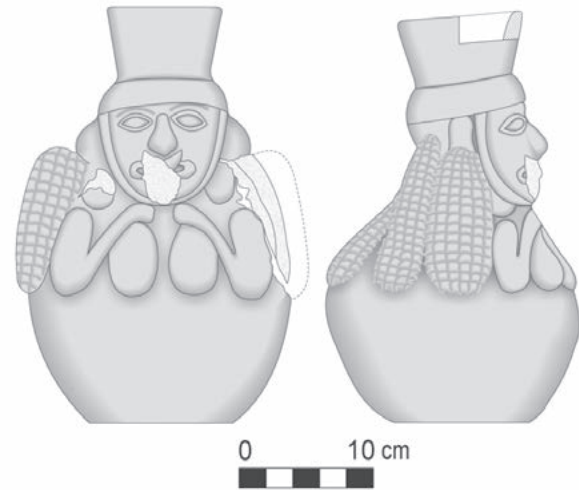


Figure 7 – Drawing of a Moche phase pot depicting an anthropomorphic figure dressed in maize cobs (Huambacho, Nepeña Valley)

(DAO J. Navarro and M.L. Eggart, used with permission).

In light of the argument presented in this article, the development of “hydraulic” societies such as the Moche and Chimú on the north coast of Peru should be seen as anchored in irrigation infrastructures developed generations and even centuries earlier. The scale and complexity of this palimpsest of irrigation projects were tied to commensal entrapments that put pressure on agrarian production, resulting in both the extensification of irrigated areas and the intensification of cultivation, including maize. Broader structural transformations were also at play in the process of incipient urbanism which might have contributed to a distantiation between the urban and rural social spheres.

CONCLUDING THOUGHTS

This article has explored the entanglement between ancient foodways, chainworks of agrarian and culinary productions, and ancient Andean coastal geographies. We summarized published archaeological data from Nepeña, a small coastal drainage in north-central Peru, as well as laid the foundation to ground-truth the timing and extent of ancient irrigation canals. The lower section of the drainage is attractive today to agro-industries mainly because of modern anthropogenic modifications including the implementation of inter-valley irrigation infrastructures in the last three decades (e.g., Proyecto Especial CHINECAS). We have argued that the lower Nepeña Valley experienced an analogous, and radical transformation of its agrarian fields during a period of endemic armed tensions, urban nucleation and heightened sociopolitical competition during the Early Horizon, between approximately 2,600 and 2,200 years ago. Escalating competitive feasting and the need of commensal politics, among other things, entrapped co-resident factions, communities and

whole settlements into a spiral of agricultural intensification and irrigation extensification. One of the major and long-lasting results of these entanglements appear to have been the transformation of a small coastal oasis into an economically productive agrarian system; one that would later become attractive to expansionist polities such as the Moche and Chimú. This process likely involved the drying up of wetlands leading to increased availability of quality land, the formalization of lagoons as reservoirs, and finally the construction of ever more durable and permanent irrigation canals and infrastructures.

To conclude, it is still unclear if Early Horizon agrarian developments and the extensification of irrigation networks were mainly accretional (bottom-up, stable developments entangled in long-term risk management) or if some kind of centralized authority was also involved in a more concerted expansion (top-down). Local corporate groups, perhaps aligned with the irrigation user groups postulated in this article and organized at the supra-household level could have been responsible for canal building and maintenance. These communities would have been further entangled in inter-community interactions in which Caylán leaders may have played a preponderant role. Future fieldwork in Nepeña, and in particular the coring of canals, lagoons and fields, should help provide key data to reconstruct the evolution of ancient fields and canals and their significance for human-plant relations and their trajectories.

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