



*Contributions in New World  
Archaeology 6: 83-110*

## **MODEL OF INTERREGIONAL CONTACTS BETWEEN HIGHLAND AND COASTAL GROUPS IN LATE PRE-COLUMBIAN PERIODS IN THE *LOMAS* OF THE CENTRAL COAST OF PERU**

**PIOTR KALICKI**

*Jagiellonian University, Institute of Archaeology, Kraków, Poland;  
e-mail: kalickipiotr.krak@gmail.com*

### **Abstract**

This paper concentrates on interregional contacts between highland and coastal groups during late, pre-Columbian periods in the *lomas* of the Central Coast. Due to ecological complementarity of fog oases and mountain pasturelands, transhumance developed between the Andes and the Costa. Pastoralists with their flocks of camelids descended via mountain ridges to the *lomas* to take advantage of the lush fog vegetation. At the same time, the *lomas* were controlled by coastal populations, whose economy was based on agriculture. The encounter of these two culturally different groups caused interregional exchange of products and ideas. Presumably, these contacts had the character of associated trade regulated by common, Andean cultural rules.

### **Resumen**

El presente artículo se centra en los contactos interregionales entre los grupos prehispánicos tardíos de la Sierra y de la Costa que tuvieron lugar en lomas de la Costa Central del Perú. La complementaridad ecológica de las lomas y los pastos altoandinos propiciaba el desarrollo de la práctica de la transhumancia. Los pastores con sus rebaños de camelidos descendían de las crestas andinas para aprovechar la vegetación de las lomas durante el invierno. Sin embargo, las lomas eran controladas por grupos costeños. El encuentro de estas dos poblaciones distintas permitía el intercambio de bienes y ideas entre ellas. Probablemente dichos contactos e intercambio estaban regulados por las normas culturales comunes para los Andes Centrales.

**Keywords:** archaeology, transhumance, Andes, Lomas de Lachay, Chancay

## **INTRODUCTION**

One issue which has always interested archaeologists is interregional contacts between distant societies. Studies that are focused on this matter are of special importance in the Central Andes, where cooperation and competition between various, culturally different groups are considered one of the most important factors in the development of pre-Columbian cultural processes. From the very beginning of Andean archaeology, scientists have suggested the possibility of long-range movement of people, goods and, perhaps most importantly, ideas. Since most studies were focused on the impact of interregional contacts on local society, its character and organization, rather than on Pre-Hispanic communication routes, this last issue is still poorly known.



Having in mind early colonial written sources describing Costa-Sierra transhumance and chroniclers mentioning permanent habitation sites located in the *lomas*<sup>1</sup> of the Central Coast of Peru, my investigation focuses on interregional contacts during late pre-Columbian times in the *lomas*. Due to the uncertain boundaries of the Central Coast (Segura Llanos 2001; Eeckhout 2004b), the area of investigation has been arbitrarily restricted to fog oases between the valleys of Huaura in the north and Quebrada Chilca in the south (Figure 1). Such a spatial framework guarantees an almost homogenous environment and relatively similar cultural traditions. Scholars usually consider only the Late Intermediate Period (LIP)<sup>2</sup> and the Late Horizon (LH) as late periods, but here the Middle Horizon (MH) is also included in the analysis to provide a broader context for LIP cultures, which developed from MH 3 or 4. Moreover, these chronological limits are concordant with the last, important stage of *lomas* settlement.

Due to formal restrictions of the Peruvian cultural heritage protection law (Kalicki 2010) I had to restrict my field investigation to a limited archaeological study in the Lachay-Iguanil zone, during which I was only able to make sketches of the sites and conduct photographic documentation of structures and artifacts found on the ground surface. Therefore, the results presented herein should be considered very preliminary and have to be verified by future excavations and intensive surface prospection. Nevertheless, when considered jointly with previous studies, they suggest that in late



**Figure 1.** Location of the most important Central Coast *lomas*.

<sup>1</sup> *Lomas* is the Spanish name for a special ecologic formation developed on the western coast of South America. The Spanish name means low hills, foothills. The original, indigenous name is unknown.

<sup>2</sup> I chose to use the chronology proposed by Rowe (1962) and his disciples because, despite its problem, it is the most precise and most accepted.



pre-Columbian times there were intense movements of people and artifacts between the highland and coastal areas.

Cultural processes were interpreted within a theoretical framework based on three major paradigms: vertical economy as a human adaptation to a mountain environment; anti-urban model of the Andean world with its associated type<sup>3</sup> of interregional exchange, and local agency-based perspective on past societies.

Vertical economy is a result of adaptation of Andean societies to the harsh climate and rough landscape of mountains, which created an unstable and, in some aspects, treshold environment. To assure access to all necessary resources in such conditions, one has to control the maximum quantity of ecological niches, which are situated at different altitudes. Therefore, in the Central Andes, highlanders developed a complex socio-economical system, characterized by the presence of many, sometimes multi-ethnic enclaves which, as a result, created a concept of discontinuous territoriality (Murra 2002). However, this perspective is somehow static and does not acknowledge activities which do not focus on permanent facilities. One of these ignored adaptive strategies is transhumance between highlands and the *lomas*. Having in mind Erickson's (2003) definition of cultural capital as all technical, social and ideological means by which a human group adapts to the natural environment, we can try to understand Sierra-*lomas* transhumance and interregional exchange as an important part of the cultural capital of the late Andean societies. These habits, accumulating over centuries, have proved to be a very useful adaptation to the variable climate and environment of the Andes.

The second concept is the model of the Andean world as an anti-urban civilization, proposed by Makowski (2003, 2008). In his viewpoint the axis of cultural praxis were annual rituals performed in a rhythm regulated by the ceremonial calendar. All aspects of Andean society, i.e. economy, political order, war, art, architecture and, of course, also interregional exchange were subjugated to this calendar. A wide array of various activities, often different from those known from the Old World, developed in these conditions. Instead of trade based on money, in the Andes there developed administrative trade (tribute, exchange with productive enclaves)<sup>4</sup> and associated exchange. By associated exchange, we mean the situation in which members of different groups would exchange goods, taking advantage of a meeting whose principal objective was some other economic activity like mining or herding. The last of these exchange types is of special importance for *lomas* archaeology because presumably that most of the activities performed in fog oases was of this nature. Moreover, I would like to emphasize the fact that various types of interregional exchange could coexist at the same time in a very small area. This phenomenon was discovered by Nielsen (2006) in the South-Central Andes, and lead him to the conclusion that different ways of trade should be considered more as levels, overlapping one another, than as exclusive alternatives.

The last theoretical issue that I would like to mention is the agency-based perspective in studies of pre-Columbian cultures, especially their spatial and functional aspects. This new theoretical framework is an answer to drawbacks of World System Theory, which *a priori* divides areas into a culturally and politically dominating core and subjugated peripheries. This approach overemphasizes ties between core and periphery, ignores local cultural dynamics and requires arbitrary division into "advanced" and "under-developed" areas. I decided therefore, to adopt the agency-oriented perspective proposed by Goldstein (2000, 2005) and Jennings (2006a, 2006b), which emphasizes bilateralism of interregional relations. They suggest, for instance, that the status of an object as luxurious is a result of evaluation based on local, cultural norms and as a consequence is not necessarily transmitted between different groups. This calls into question the World System Theory's assumption that the flow of prestige goods was one of the principal instruments of the core's control over the peripheries.

<sup>3</sup> Nielsen (2006) calls it *comercio incorporado*.

<sup>4</sup> For more a comprehensive discussion of this issue, see Makowski 2006.



## ENVIRONMENTAL SETTING

The Peruvian *lomas* are located on the western coast of South America, which is an active edge of the continent (Mydel and Groch 1999). As a consequence of tectonic movements the longest mountain chain of the world – the Andes, extending from Venezuela in the north, to the Cape Horn in the far south – was created. The mountains have been shaped by subsequent cycles of erosion and accretion, leading to the formation of a very dynamic landscape with great canyons, river gorges and landslides (Orme 2007). The *lomas* themselves are situated at the first, low elevations of the Andes, which are usually about 20 km from the Ocean. Despite the fact that the highest summits do not reach more than 1000-1100 m AMSL great height differences exist in fog oases, because of their proximity to the sea. Each group of hills is composed of various ridges consisting of volcanic and metamorphic rocks separated by profound *quebradas* i.e. erosion valleys formed by episodic streams, where eolic and alluvial deposits predominate (Shoobridge 2003).

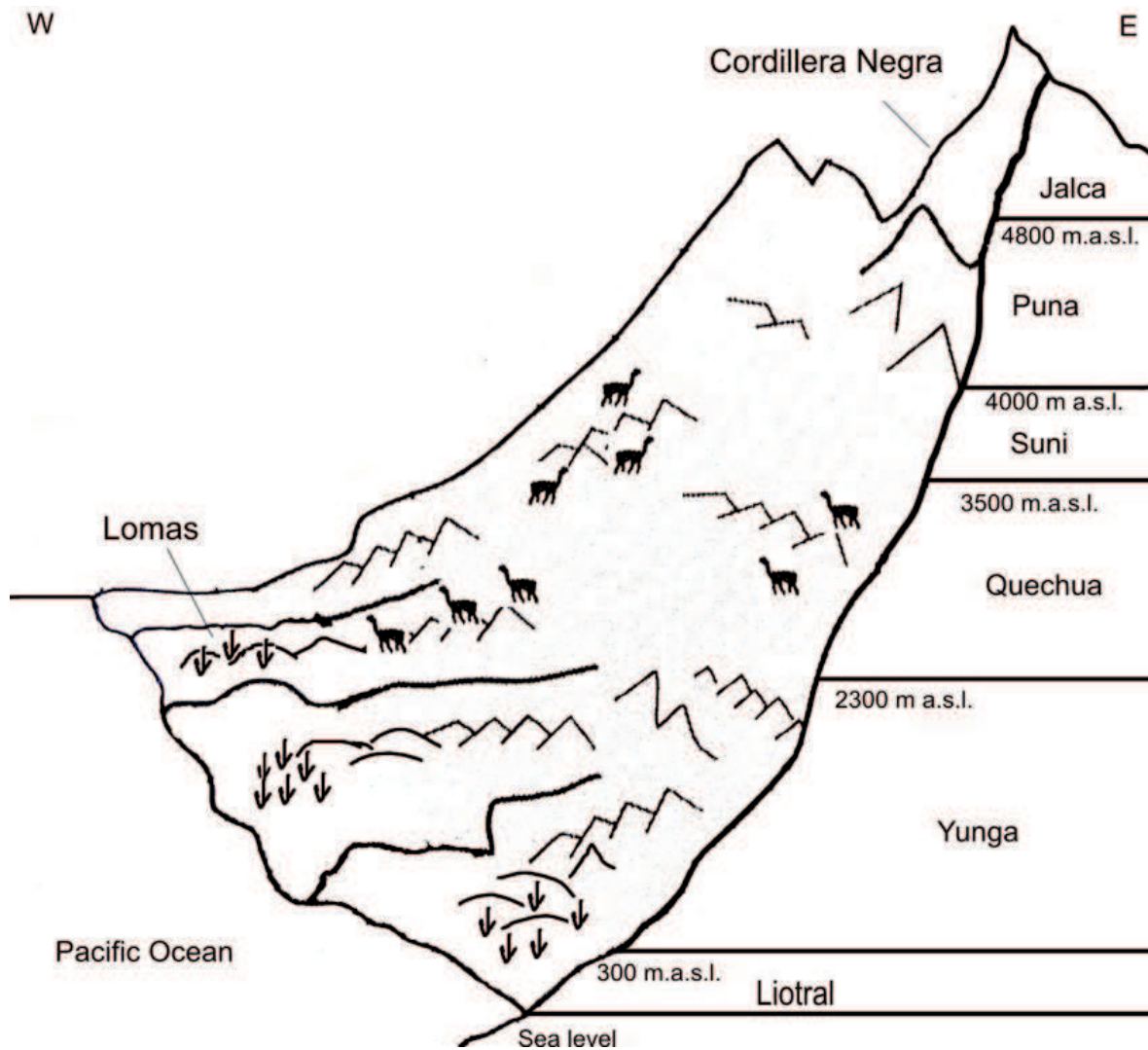
The Peruvian coast is one of the driest deserts on the Earth, which is a result of: the cumulative influence of the cold Humboldt Current; the great height of the Andes chain, acting as an obstacle blocking trade wind circulation in the tropical zone and, consequently, eliminating thick clouds with Amazonian tropical rains; and its location in the tropical and subtropical climatic zone. However, there is a pronounced difference between the dry desert on the western slopes of the Andes, the cold high-mountain *puna* plateaus, and eastern regions with tropical rains and cloud forests. The influence of these macroclimatic factors is modified by altitudinal vertical zones and orography, which have contributed to the formation of various ecological niches with their corresponding resources (Figure 2). Such a segmented world played an important role in the origins and development of Andean cultures.

The mean annual sum of precipitation in Lima, located in the middle of the Central Coast, is about 18 mm (Mydel and Groch 1999), which is almost the same as mean annual sum of precipitation for the all regions of Peruvian coast, of 22 mm (Rundel *et al.* 2007). The mean monthly temperature roughly changes and oscillates between 15° C in the austral winter and 20°C during the summer (Mydel and Groch 1999; Cabrera Carranza *et al.* 2001). These factors, together with predominating western and southwestern winds and a thick layer of *stratus* clouds (*garua*) during austral winter (June-October), create a tough, dry climate, where only river valleys offer more benign conditions.

Quite surprisingly, in the highland regions, conditions are not as hard as in the coastal regions. Thanks to seasonal rains, which usually last from December to April, the mean annual sum of precipitation can rise from 300 mm on the western slopes of the Andes to 1000 mm in high mountain basins and even as much as 3000 mm on their eastern slopes. The mean annual sum of precipitation increases as the altitude rises – for instance in the valley of Asia for areas between 800 and 2000 m AMSL it reaches 125-249 mm; areas between 2000-3000 m AMSL 300 mm, areas between 3000-4000 m about 400 mm (Comeca Chuquipul and Melendez de la Cruz 2008). However, the mean annual temperature diminishes with increasing height: between 2800-3500 AMSL it reaches 11-16°C; between 3500-4000 m AMSL 7-10°C and between 4000-4800 m AMSL 0-7°C (Sandweiss and Richardson III 2008). A pronounced daytime amplitude of temperature is also characteristic for a highland climate.

Studying archaeological processes, we must take into consideration climate changes and long-term processes that have influenced the area investigated and made its past environment quite different than it is in the present. The beginning of the first millennium (200-1700 BP<sup>5</sup>) after Christ was characterized by a prolonged drought on the Altiplano, while the climate of the coast was quite humid between 150 and 690 AD (Magilligan *et al.* 2008). Data from Nevado Quelccaya ice cap suggest a series of serious droughts (524-540 AD; 540-560 AD; 563-594 AD, 635-645 AD and 650-730 AD), which

<sup>5</sup> I have chosen to use a popular convention and by BP I mean an uncalibrated radiocarbon date and by BC/AD calendar date.



**Figure 2.** Altitudinal vertical zones of the western slopes of the Central Andes (D'Altroy 2002 changed).

probably reflects catastrophic floods associated with El Niño rains on the coast (Shimada *et al.* 1991; Schimmelman *et al.* 2003; Londoño 2008). Presumably the climate remained relatively cold, which caused a transgression of glaciers in the upper Mantaro region (Seltzer and Haastorf 1990). During this period the *lomas* were probably small, because low temperatures had lowered the condensation level of water vapor and, as a consequence, winter fogs did not reach the Andean foothills (Paulsen 1976). However, more humid conditions occurred about 760/800-1040 AD (Schimmelman *et al.* 2003; Magilligan *et al.* 2008; Londoño 2008), which could be an effect of a world-wide climatic trend known as the Medieval Warm Period (Millar and Woolfenden 1999). These changes were reflected in the *lomas* by expansion of vegetation. Around 1050 AD climatic conditions began to deteriorate once again – a series of droughts in the Altiplano (Shimada *et al.* 1991; Schimmelman *et al.* 2003) and transgression of glaciers in Sierra Central (Seltzer and Haastorf 1990) marked the beginning of the Little Ice Age, which lasted until 1850/1900 AD (Millar and Woolfenden 1999). Slightly before the



arrival of Pizarro there was a small climatic oscillation, which brought more humid conditions to the Peruvian coast (Marchant *et al.* 2004).

This short description of the natural environment of the Peruvian coast cannot omit the Southern Oscillation (ENSO) phenomenon – also known as El Niño. This anomaly brings warm sea current near the western coast of South America every 11-15 years. Warm sea water allows the formation of clouds, which are responsible for heavy, torrential rain. Despite ruinous rainfall, which triggers landslides and catastrophic flash floods, the advent of El Niño means a period of abundant vegetation and florescence of many episodic plants for the *lomas*. During the late pre-Columbian and early Colonial times there was an intensification of El Niño, with the most powerful episodes ca. 890 AD, ca. 1029 AD, ca. 1418 AD (Miraflores) and 1605 AD (Chuzas) (Schimmelmann *et al.* 2003; Keefer *et al.* 2003; Marchant *et al.* 2004; Magilligan *et al.* 2008).

The *lomas* form a particular ecosystem, existing probably for at least the last 100,000 years (Dillon *et al.* 2003), located on the western coast of South America and constituting green oases in a vast area of dry, tropical desert. Due to the presence of the nearby cold Humboldt Current, temperature inversion develops in the troposphere, preventing the formation of rain clouds. Instead, thick, low clouds flow from the ocean over the Peruvian coast and, known as a fog *garua*, deposit humidity on the first, low foothills of the Andes. This amazing phenomenon occurs only between mid-June and the end of September, leading to the growth of abundant vegetation on low hills, usually located between river valleys (Ordoñez and Faustino 1983; Garreaud and Aceituno 2007).

The *lomas* show some important characteristics, which they do not share with the rest of the Peruvian coast. First of all, they have a slightly greater annual amplitude, because the mean monthly temperature in the *lomas* oscillates between 13.2°C in August and ca. 21.6°C in March (Ordoñez and Faustino 1983; Shoobridge 2003). Moreover the annual sum of precipitation is almost three times greater than in the desert – for the *lomas*, it reaches 60 mm compared to 18 mm in Lima (Shoobridge 2003; Rundel *et al.* 2007). However, rainfall is of little importance compared to the humidity absorbed from the air by plants where, at the peak of the wet season, relative humidity reaches 90-95% (Schemenauer and Cerceda 1993). Experiments in Lomas de Atiquipa proved that during the wet season absorption is on average 40.9 l/m<sup>2</sup>/day, while in September this index reaches even 66.5 l/m<sup>2</sup>/day (Sotomayor Melo and Jimenez Milón 2008). The climate characteristics of the fog oases lead to the distinction of two seasons during the calendar year: wet, which lasts from May through November, and dry, from December through April (Shoobridge 2003; Sotomayor Melo and Jiménez Milón 2008).

Life on the Central Coast is possible only because of a few rivers, which transport water from melting Andean glaciers to the Pacific Ocean. Most of them are only seasonal or even episodic, and exist only while seasonal rains in the mountains provide water. Because the *lomas* are often located at a considerable distance from river valleys their main source of humidity are winter fogs. Engel (1970a, 1970b, 1973, 1983) also suggests the possibility of the use of ground waters, which raises the question of the origin of these waters. Engel (1973) excludes artesian water and claims that they are remains from the distant geological past or a product of the penetration of humidity from winter fogs into the earth. However, he does not present any evidence supporting his conclusions. In my opinion, we should also take into consideration heavy rains associated with El Niño as a source of water supplies for those ground waters. For instance, in the valley of Asia, all the probable supply zones of ground water associated with geological faults are located in an area where it hardly rains in normal conditions, but where heavy rains occur during El Niño episodes, i.e. below 2000 m AMSL.

Despite the relatively poor soils in the *lomas* of the Central Coast, various types of vegetation exist, which is the basis for distinguishing six *lomas* subtypes: *Tilandasia lomas*; herbaceous *lomas*, shrubby *lomas*; cacti *lomas*; *Bromelian lomas* and *lomas* with trees (Ohga 1992; Shoobridge 2003). However, vegetation of fog oases consists mainly of herbaceous species – for instance in Lomas de Lachay there are only 35 ha of tree *lomas* which is really a small area compared to 1690 ha of total



*lomas* area. Extending from 200 to 800 m AMSL the *lomas* are inhabited by various plant species, many of which are endemic (Rundel and Dillon 1998). The vegetation season is slightly delayed compared to the wet season and lasts from August through November (Ohga 1992; Schemenauer and Cerceda 1993). Lush vegetation attracts animals like white-tailed deer, desert fox, guanaco, puma, vizcacha and many species of birds, snails and insects.

## CULTURAL BACKGROUND

Since the end of the Pleistocene, human groups hunted game (white-tailed deer, guanaco) and collected edible roots and fruits. During the Early Holocene, *lomas* areas were one of the most important settlement microregions, where hunters-gatherers inhabited seasonal camps, especially during the austral winter, when natural resources were abundant. Some scientists have also suggested the possibility of transhumance between the *lomas* and river valleys (Patterson and Moseley 1969) or even between *lomas* – Sierra (Patterson and Lanning 1964; Lynch 1971). Archaeologists discovered various Archaic sites in Loma Encanto, Loma Ancón, Lomas de Lachay and Tablada de Lurín (Lanning 1963; Patterson and Moseley 1969; Jiménez 2009; Makowski 2009b). In the late Preceramic Period, human groups became more dependent on exploitation of sea resources and incipient agriculture, which resulted in abandonment of the *lomas* sites. Jiménez (2009) suggests that this process could be better understood in terms of change of exploitation strategy rather than abandonment, and that human activity in fog oases was restricted to seasonal expeditions from villages located at the valley floor, which exploited natural resources during the austral winter. This model continued to be used by pre-Columbian societies in the Initial Period and probably also in Early Horizon (Jiménez 2009).

At the turn of Early Horizon and Early Intermediate Period, we can observe a series of interesting changes in patterns of human occupation and use of the *lomas*. From approximately 200 BC to 200 AD a large cemetery in Tablada de Lurín was used by the population, which probably inhabited the middle valley section (Makowski 2009a, 2009b). Makowski's studies (2009a, 2009b) showed that this society was characterized by kinship organization and a symbolic culture privileging warriors. Metal artifacts and some ceramics document highland influences and contacts with the eastern slopes of the Andes (Makowski 2009a). In Lomas de Lachay many settlements agricultural terraces and sites with rock art, which are associated with Early Intermediate Period (EIP) (Lima culture) were discovered (Kalicki *et al.* 2014).

From the beginning of the Middle Horizon (MH) about 600 AD, the political and cultural landscape of the Central Andes was dominated by two great centers: Huari in Ayacucho and Tiahuanaco in the Titicaca Basin<sup>6</sup>. Each of them created its own sphere of influence which, in the case of Wari, encompassed the vast territory from Cajamarca to Cuzco Basin and from Lambayeque to Moquegua (Isbell 2008). Wari brought a distinctive iconography in ceramics with them (styles such as Conchopata, Robles Moqo, Chakipampa, Viñaque), textiles and metal objects; new forms of ceramics; orthogonal, cellular, stone architecture; characteristic obsidian blades and in some regions (Coast, Callejón de Huaylas) also new mortuary practices (Menzel 1964; Castillo Butters 2000; Ochatoma Paravacino 2007; Isbell 2008). In some regions, especially in the highlands, rigorously planned, ample sites, usually interpreted as administrative centers, like Honcopampa (Tschauner 2003), Pikillacta (McEwan 2005) or Viracochapampa (Isbell 2008), also appeared. Therefore, Wari was often interpreted as an expansive, centralized empire – a sort of other Tawantinstuyu (Lumbreras 2000; Isbell 2008). However, new approaches suggest that Wari could also be understood in terms of a hegemonic empire

<sup>6</sup> I decided to adopt Isbell's (2008) terminology to call the state/culture as Wari and its capital in Ayacucho as Huari. Analogically Tiwanaku is a state/culture and Tiahuanaco its main site.



(Makowski 2008) or even as a sphere of influence (Jennings 2006a, 2006b). Regardless of the interpretation, the collapse of this complex cultural horizon is dated at about 750 AD, which constitutes a boundary between MH 2 and 3 (Isbell 2008). After this turning point, a fragmentation of the socio-political landscape, often accompanied by depopulation and abandonment of great sites, marked the beginning of the Late Intermediate Period (LIP).

During the last phases of development of the Lima styles (Lima 7-9, also known as Maranga) a new type of ceramics – Nievería – appeared. It was characterized by a synthesis of Lima and Wari iconography, orange paste and distinctive bottles (Menzel 1964; Segura Llanos 2001). This kind of ceramic, collectively with the Pachacamac style (which is probably a local variation of Wari iconography), have a rather broad spatial distribution from San José de Moro in Jequetepeque (Castillo Butters 2000) to Sierra de Rimac, Sierra de Ancash (Segura Llanos 2001) and Huancavelica (Menzel 1969). Surprisingly, there are almost no traces of Wari sites in the Central Coast except the poorly understood orthogonal buildings of Socos, situated in the Chillón valley (Jennings 2006b). There is still a lot of debate about the status, function and interpretation of the Pachacamac site, which is understood as Wari's secondary center (Menzel 1964). Its quasi-independent pan-Andean oracle (Franco Jordan 2004), or even its very existence as a ceremonial site during MH, is denied (Kaulicke 2000). After the collapse of Wari, the Norte Chico region could have played a substantial role, where styles such as Pativilca, Supe, Huaura or Hucho (Makowski 2006) developed. More to the south, a new cultural phenomenon gave origin to LIP cultures: Teatino to Tricolor and then Chancay style (Krzanowski 2008) and local, domestic ceramic to Ychsma (Vallejo Berrios 2004). Unfortunately, we do not have any insight into the adjacent highland's cultural history, of which our understanding is limited almost exhaustively to the Wari orthogonal site of Wari Willka near Huancayo, often interpreted as a Wari local center (Isbell 2008).

LIP is often described as a period of constant endemic war between little, economically self-sufficient, kin-based groups dominated by local warlords, which did not have pronounced social stratification nor a well-developed network of interregional contacts (Covey 2008a; Dulanto 2008). However, adjacent to Central Coast highlands at least one important group – the Huancas, which maintained contacts with the North and Central Coast societies and Central Sierra highland neighbors – had developed. They also managed to establish a two-tier settlement pattern, where local elites who had privileged access to maize, elite ceramic and metal objects ruled their *señorios* from fortified sites with incipient public architecture (Costin and Earle 1989). Other groups, like the Yauyos living in Sierra de Huarochirí and Sierra de Rimac, the Cantas in the upper Chillón drainage, and the Atavillos in the upper Chancay and Huaura drainages, are less known. However, ruins of ample sites, such as Rupac and Chiripac (Marussi Castellán 1979) or Andamarca (Van Dalen Luna 2007), suggest that these groups also could have been organized in a manner similar to Huancas. Due to limited research, the origin of highland LIP cultures is uncertain, but it could possibly be linked with traditions of EIP.

Meanwhile, in the Costa, traditions with MH origin continued to develop. The northern part of the Central Coast (Huaura, Chancay) was occupied by the Chancay culture, which was characterized by diagnostic, Black-on-White ceramics, large sites with adobe-made, public structures known as truncated pyramids<sup>7</sup>, sophisticated textiles and abundant cemeteries with thousands of *fardos* (Krzanowski 1991a, 1991b, 1991c, 2008). Recent studies also suggest the presence of many hill forts and defensive structures (Krzanowski 2008). The Chillón valley was split into a few *curacazgos*, the most important of which was probably Collique, with a monumental fortified site acting as a capital. Ceramic material also shows some influences of Chancay wares (Dillehay 1977; Silva Sifuentes 1991, 1998). Vallejo Berrios (2010) also suggests the possible presence of recently the defined Huacho ceramic style in the valley of Huaura in the first half of LIP.

<sup>7</sup> In Spanish *piramide tronco-conica*.





The southern part of the Central Coast was dominated by the Ychsma tradition with its monumental adobe ceremonial centers like the Maranga Complex or Pachacamac, and thick, domestic ceramic with few geometrical motives (Vallejo Berrios 2004). However, despite almost 50 years of research (Stumer 1954; Kroeber 1926; 1927) the chronology of this culture still remains poorly understood (Makowski *et al.* 2008). Scientific debate still concentrates on monumental sites, especially the function of a pyramid with a ramp<sup>8</sup> (Eeckhout 1999, 2003, 2004a, 2004b; Franco Jordan 2004). In the second part of LIP the pressure of the highland groups on the Central Coast probably intensified, which led to many conflicts described in ethnohistoric sources (Dillehay 1977).

Early colonial chronicles inform us that Central Sierra was conquered by Pachacutec and Tupac Yupanqui (D'Altroy 2002). The expansion of the Inca Empire brought a new social and political order with institutions like a road system, decimal administration, state-managed deposits and an imperial cult of the sun (Covey 2008b; D'Altroy 2002). However, except for the Huanca territory, Inca influences seem limited to the construction of a road system and a few administrative or ceremonial sites, which suggest a model of indirect administration (D'Altroy 2002; Hyslop 1984). Nevertheless, due to limited research in the Central Andes future investigation could change this panorama.

Much more pronounced were Inca influences on the Central Coast. We refer here especially to the southern part, where the Inca constructed a great ceremonial center and Pan-Andean oracle in Pachacamac (Figure 3). During the Late Horizon, Pilgrims Plaza, all three perimeter walls, *acllahuasi*, the Sun Pyramid, the Palace of Tauri-Chumbi and many PCRs were built (Makowski 2003; Eeckhout 2008). Another very important Late Horizon site is a *mitmakuna* settlement – Pubelo Vieja Pucará – in the Lomas de Caringa (Makowski 2003). The introduction of new Inca ceramic styles (Inca Imperial) not only did not eliminate Ychsma potters, but on the contrary, encouraged production of local imitations of Inca wares (Inca Provincial) and provided new motifs and ceramic forms to the Ychsma ceramic style (Vallejo Berrios 2004; Makowski and Vega-Centeno 2004). Dillehay (1977) also suggests a direct Inca administration in the Chillón valley. The Chancay territory seems to have been relatively unaffected by Tawantinsuyu's expansion, and the only Inca influences are some imitations of Inca aryballos and perhaps also a few, small, intrusive administrative structures (Krzanowski 1991d, 2008).

Conquest of Peru marked the beginning of a period of intensive cultural changes. Spaniards adjusted the local socio-political structure to their needs, introduced European technology, money economy and a new religion – Christianity. Civil wars between conquistadors, European diseases and mining *mita* caused demographic collapse (Cogorno Ventura 2005). Finally, Toledo's reductions ended the cultural history of the *lomas*, which from that time have remained uninhabited (Shoobridge 2003).

## TRANSHUMANCE BETWEEN HIGHLANDS AND THE *LOMAS*

As pointed out in the description of the environmental setting, during the wet season in the *lomas* there is no rain in the adjacent highlands and, analogically, the rainy season in Sierra occurs simultaneously with a dry period in the fog oases. As a consequence, lush vegetation in the *lomas* during the austral winter can serve as pastureland for mountain groups, which descend with their flocks of camelids in the dry season to the fog oases. This practice began probably at least in MH, and perhaps even before (EIP). However, until now little was known about this phenomenon and its chronology. Some researchers deny pre-Columbian roots of transhumance and attributed it to a Colonial origin.

A preliminary archaeological survey confirmed that *lomas*-highland transhumance is a practice rooted deep in pre-Columbian times. Visits to Lomas de Iguanil resulted in the discovery of stone

<sup>8</sup> In Spanish *piramide con rampa* (PCR).





**Figure 3.** Inca sanctuary of Pachacamac.

corrals, whose shape was irregular, oval or orthogonal. They were constructed of irregular, angular blocks of local rocks without the use of mortar. The height of the walls (Figure 4) oscillates between 0.75 and 1.35 m (on average 1.2 m), while their average thickness measures between 0.6 and 1.1 m (on average 0.76 m). The entrances do not follow any orientation and their width is on average 1.66 m. The diameter of the corrals oscillates between 5 and 40 m. The majority of these structures are situated at the foot of hills or at the bottom of small, dry valleys (Figure 5). Careless stonework, the dimensions, and the fact that neither the corrals nor their entrances follow any strict orientation suggest a purely utilitarian function of corrals, while their location provides proximity to the best pasturelands of the *lomas*. Near many corrals, small, circular, stone structures were found, whose diameter oscillates between 2-5 m. They probably should be interpreted as remains of temporary, residential structures analogical to those used by contemporary *chivateros*, whose houses have a lower part made of angular stones and upper parts made of animal skin. Moreover, in Lomas de Iguanil a rock shelter with associated pre-Columbian ceramic was found, which probably also served as a residential structure (Figure 6).

The pre-Columbian dating of corrals and associated structures is confirmed by pre-conquest ceramic fragments that were found on the corrals' surface. The majority of fragments are the remains of thick, domestic wares made of reddish-brown paste. However, some pieces have red slipware or grayish color, which presumably is the effect of reduction firing. A composed rim, which is diagnostic for LIP Costa cultures was also found in one of the corrals, which suggests contacts between







**Figure 4.** Corrals located at the foot of hills in Lomas de Iguanil.

pastoralists and coastal populations. Some corn cobs were also found on the surface, but due to the lack of stratigraphical evidence, their pre-Columbian origin is uncertain. In some cases (about 40%) of the corrals, chicken bones were also found, which suggests their use by contemporary *chivateros*. The phenomenon of re-use of pre-Columbian corrals by contemporary transhumant pastoralists are also known from Santa valley (Lynch 1971).

The meticulous analysis of satellite images led to the discovery of the presence of corrals also in the desert area, between the fog oases and highlands. They are located on mountain ridges and have a diameter between 10 and 60 m. This strengthens the transhumance hypothesis, because there is no vegetation in these areas, so the only possible function of corrals could be a stopover point during the pastoralist's journey from Sierra to the *lomas*.

Remains of big, circular structures have also been found in fog oases between the valleys of Rimac and Chillón (Stumer 1954), while the presence of corrals has been confirmed in Lomas de Malanche in Lurín Valley (Mujica 1994) and in the low highlands in the upper drainage of Chillón (Dillehay 1977). At least one possible pre-Hispanic corral was also found in Lomas de Lachay. Some corrals exist also in Pueblo Viejo-Pucará and on the ridges, which served as a main communication route between Sierra and the highlands (Makowski *et al.* 2008). However, Makowski (2003) suggests that they should be interpreted as *mitmakunas*' work.

As a secondary source of information we can also use ethnohistoric sources, where authors such as father Acosta, Cieza de León and Bernabe Cobo mention the existence of pastoralism in the *lomas*







Figure 5. Wall of pre-Columbian corral.







**Figure 6.** Rock-shelter with associated late pre-Columbian ceramics in the Lomas de Iguani.

(Mujica *et al.* 1983). Remains of colonial *chivateros* have been found in PCR XIII in Pachacamac (Eeckhout 2004c).

Moreover, contemporary, highland pastoralists – *chivateros* – practice *lomas*-Sierra transhumance not only in Lomas de Lachay and Lomas de Iguanil (Shoobridge 2003), but also in Lomas de Caringa (Marussi Castellán 1979; Makowski 2003; Makowski *et al.* 2008) and in fog oases of Asia valley (Angeles Falcón and Pozzi Escott 2004). This phenomenon seems to have developed as a generalized practice from the valley of Santa in the north to the valley of Ica in the south (Lynch 1971) and even further south, where seasonal visits of highlanders from Sierra de Huancavelica, Sierra de Apurímac and Sierra de Arequipa in the coastal *lomas* (Canziani and Mujica 1997) took place.

Meticulous examination of satellite photos showed a system of trodden paths with related corrals, which connects the *lomas* and low highlands. Surprisingly, these paths use mountain ridges as natural communication routes. Such a practice is also confirmed by ethnographic studies of contemporary *chivateros*. The plausible explanation of this choice is the rough relief of the Andes, where mountain ridges are an interesting communication alternative to river valleys, which often form narrow canyons. Furthermore, the majority of LIP highland settlements are located in the summits and high part of mountain slopes, so communication via ridges minimize the effort necessary to reach the *lomas*. Having in mind that a llama can walk 15-20 km per day and that the distance between the fog oases and Sierra measures about 40-60 km, such a trip would take about 3-4 days.



Archaeologists suggest that during LIP the role of pastoralism increased (Covey 2008a; Dulanto 2008). Browman (1974) estimates that the Huancas alone had 500,000 – 700,000 animals, which is about 70 animals per household. Highland groups from mountains adjacent to the Central Coast perhaps did not have such giant flocks, but pastoralism also played a substantial role in their economy. Under such circumstances, the *lomas* offered an attractive alternative to poor, highland pastureland during the dry season. It can be estimated that one square kilometer could meet the needs of 50-125 animals. Having in mind that the surface suitable for pastoralism in Lomas de Lachay measures 1028 ha and in Lomas de Iguanil 1289.8 ha (Ordoñez Faustino 1983), we can estimate that only the Lachay-Iguanil complex could afford a flock of 6953-17,384 camelids. The ecological capacity of the *lomas* is probably underestimated due to the fact that, as a consequence of colonial exploitation and climatic changes, the surface of fog oases diminished at least six times (Sotomayor Melo and Jimenez Milón 2008).

Ecological factors and ethnographic analogies (Shoobridge 2003) suggest that pastoralists arrived at the *lomas* in August-September and left them in the end of November. This cycle is coherent with the growth of vegetation and allows full exploitation of the natural resources of fog oases. Moreover, transhumance seems to fit well with the traditional cycle of pastoralists, who during the wet season remained near their permanent settlements, while during the dry season went with their flocks to more distant regions. Furthermore, this timing is also perfectly concordant with the biology of llamas, which give birth to their young between December and April (Stahl 1996) i.e. in time when flocks were well-supported due to the wet season, and highland pastureland, so that the young animals could be prepared for the difficult trip to the *lomas*, which started in August-September.

However, it is plausible that only some kinds of animals went to the fog oases. Ethnographical analogies (Dransart 2002; Reigadas 2007) suggest that flocks in the *lomas* were basically composed of young animals, most of them llamas. They were principally kept to provide wool (especially animals called *suri*, which provided luxurious wool) and to a smaller degree were used as beasts of burden. However, it is possible that some alpacas also took part in transhumance. The location of two-three corrals near each other indicates that possibly Pre-Columbian pastoralists also used a method, common among contemporary Andean pastoralists, of dividing the flock into smaller groups according to the age, sex and destination of the camelids. Each such group had their own corral.

Unfortunately, the roots and chronology of pre-Columbian transhumance are unknown. As a preliminary hypothesis we can assume that this phenomenon should not be earlier than Early Horizon, when pastoralism was integrated into the highland societies' economy for the first time (Burger 1992). However, artifacts from a cemetery in Tablada de Lurín show a clear relationship with highlands and eastern slopes of the Andes, which together with Lima motifs from rock art of Lomas de Lachay suggest that the beginnings of transhumance could be traced to EIP.

### ACTIVITY OF THE COASTAL GROUPS IN THE *LOMAS*

Despite the presence of transhumance, highland pastoral *lomas* of the Central Coast from the beginning of MH until the arrival of Spaniards were dominated by coastal people. Nevertheless, we still do not know much about inhabitants of fog oases, because of very limited archaeological research in the *lomas*. It is unclear which model correctly describes the presence of coastal people in the fog oases: whether they exploited *lomas*' resources only during temporal visits, which lasted a few days, or took advantage of seasonal camps and/or residential sites, or perhaps they were permanent inhabitants of fog oases. The remains of big residential sites with separate sectors and thick-walled, domestic pottery; refuse-sites with shells of marine mollusks; a sophisticated system of irrigation and *andenes* and last, but not least, information from ethnohistoric sources suggest that the model of year-





round sites in the *lomas* is the most plausible (Mujica *et al.* 1983; Mujica 1994; Makowski 2003). This hypothesis is reinforced by the discovery of 11 tombs in Quebrada Malanche (Baraybar 1999). Taking into consideration the enormous social role of ancestors in the Andean world, it seems highly improbable that their mummies were abandoned in a temporary settlement. However, the presence of permanent sites does not exclude the existence of temporary sites in the fog oases.

It seems that during MH, especially its second half, sites in the northern parts of the Central Coast played a substantial role. The cemetery of Quebrada Teatino, with associated Teatino and Huaura ware and Pativilca imports, was discovered in Lomas de Lachay (Shoobridge 2003; Kalicki *et al.* 2014). Presumably, Moche and Tiwanaku imports are in fact Late Moche/Moche V and Pachacamac wares. Moreover, Engel (1970b) has found a series of Teatino sites in nearby Lomas de Iguanil, where he located not only *andenes*, but also refuse-sites, rock shelters and, what is perhaps most important, residential sites with rectangular houses made of angular stones. Jiménez (2009) also mentions human occupation with highland influences dated to the turn MH/LIP from Lomas de Atocongo.

The *lomas* were also occupied in LIP, as traces of human occupation in Lomas de Atocongo show (Jiménez 2009; Makowski 2009a, 2009b). Some archaeologists (Mujica *et al.* 1983; Mujica 1994; Baraybar 1999) suggest that fog oases situated in the neighborhood of the Lurín valley were inhabited by people associated with historical Yauyos, who migrated from the highlands. Vallejo Berrios (2004) claims that one of the three principal types of paste of Ychsma ceramic – type C, which appeared for the first time in the middle of LIP – is related to the *lomas* soils, which gave it its color (from light to dark brown), small porosity, good consistency and milky quartz as a temper. The Iguanil complex was also inhabited by Chancay populations (Engel 1983). In Lomas de Lachay there was large Chancay cemetery in Quebrada Teatino.

Special attention must be paid to the phenomenon of a ceramic ornamented with imprinted circles. Such a type of ware is common, and known as the Quillahuaca type in the upper Huaura drainage (Krzanowski and Tunia 1991), as Lauri Impreso in Chancay (Krzanowski 1991d), as one of the types in the Cuculi substyle in the Ychsma area (Vallejo Berrios 2004). Similar ceramic was found in the Chillón valley and even in the Mantaro region (Makowski and Vega-Centeno 2004). Vallejo Berrios (2004) relates this type of ornamentation to inhabitants of the *lomas*, while Krzanowski (1991d), on the basis of more variants existing in Lauri Impreso than in Quillahuaca, suggests that it should be associated with Chancay potters. However, the very dynamic spread of such a pottery, in both the coastal and highland areas, in my opinion should be associated with transhumant pastoralists from Sierra, who as a mobile, semi-nomadic group, contributed significantly to the popularity of the imprinted circles motif during second half of LIP in Central Sierra and Costa.

During LH the Inca administration settled *mitmakuna* in some *lomas* of the Lurín valley in the southern part of the Central Coast. This location suggests that these colonists could have served the needs of a state sanctuary in Pachacamac. Excavated sites in Lomas de Malanche (Mujica 1994) and Pueblo Viejo-Pucará (Figure 7) (Makowski 2003; Makowski, Vega-Centeno 2004; Makowski *et al.* 2008) confirm that at least some of these people were of highland origin. Furthermore, the results of archaeological studies agree with ethnohistoric data, which informs us about *mitmakuna* from Huarochirí in the Lurín valley. Although we do not have much information about the northern part of the Central Coast, the diary of Miguel de Estete, who was a secretary of Hernando Pizarro during his ransom trip to Pachacamac, mentions *tambo* Pueblo de las Perdices, which probably should be identified with one of the settlements in Lomas de Lachay (Rostworowski de Diez Canseco 2005; Shoobridge 2003). Recent research done in Lomas de Lachay suggests the presence of highland groups. Four domestic sites, characterized with stone architecture, highland-type ceramic and some Inka Local pottery sherds were discovered (Kalicki *et al.* 2014).

As a consequence of the Toledan reductions, the introduction of European animal species (goat), and the drastic exploitation of the natural resources, collapse of pre-Columbian societies occurred in





**Figure 7.** Site of Pueblo Viejo-Pucará.

the area of this study. The abandoned remains of human occupation form fossil cultural landscape, which is the testimony of a Pre-Hispanic cultural development.

Due to dry climatic conditions, the most important problem of Pre-Hispanic fog oases' population was water, indispensable for the irrigation of plants and for people. The relatively large distance between the *lomas* and river valleys and the location on hills eliminates the possibility of delivering water by irrigation canals from the upper parts of river drainages. Engel (1973), on the basis of some walk-in wells found in Quebrada Chilca, claims that the *lomas*' inhabitants used ground water. This ground waters were fed by El Niño catastrophic rains (Kalicki *et al.* 2014). Water seeped from the ground into large basins and then was directed to reservoirs (Engel 1970a). However, it has never been proved that wide canals with connected reservoirs were used to store ground water.

The other plausible source is humidity originating from wet season fog. To maximize the quantity of water, which could condense in *quebradas*, stone piles which acted as a condensers of humidity were built on slopes and hilltops. This technique is quite efficient – contemporary experiments have shown that it can provide as much as 40.9 l per m<sup>2</sup> of water a day (Sotomayor Melo and Jimenez Milón 2008). Condensed water flowed through narrow canals to reservoirs (Engel 1973). Traces of trenches perpendicular to the slope, discovered in Lomas de Malanche (Mujica 1994), suggest the presence of a similar technique that is used nowadays in Lomas the Atiquipa, near Arequipa (Canziani and Mujica 1997), where such trenches serve to catch the superficial runoff and direct the water to reservoirs. Nevertheless, the source of water supplies is still unclear and this issue requires further investigation.







Water was used not only for communal tasks, but primarily to irrigate fields. Although the *lomas* have poor soils and often steep slopes, ancient groups developed many technologies to diminish the negative influence of environmental conditions on agriculture. Agricultural terraces which diminish runoff, erosion and even day-night amplitude of temperature were built in many fog oases (Stahl 1996; Pearsall 2008). The quality of *andenes* varies from relatively simple channel terraces and sloping field terraces to bench terraces. On the Central Coast they were found in Lomas de Caringa (Marussi Castellan 1979), Lomas de Malanche (Mujica *et al.* 1983; Mujica 1994); and Lomas de Iguanil (Engel 1970a, 1973, 1983). Terraces discovered in Lomas de Lachay (Figure 8) (Shoobridge 2003) are probably of earlier origin and should be associated with Lima culture (Kalicki *et al.* 2014). The exact location of terraces was probably dependent on the wind direction, slope gradient, soil quality and social factors. It is possible that, in some areas, “sunken fields” and flood-basins were also used.

Isotopic analysis of bones from Malanche 22 suggests that vegetable products, probably from nearby fields in the *lomas* predominated in the diet (Baraybar 1999). Documentary sources inform us that maize was cultivated in fog oases (Bernabe de Cobo). Modern ethnographic analogies from Costa Extremo Sur suggest that manioc and sweet potatoes were also cultivated (Engel 1973; Baraybar 1999). In pre-Columbian sites located in fog oases, traces of potatoes, *jiquima*, olluco, peanuts, lucuma and some fruits (tara, mito) were found (Engel 1973). Other economic activities of coastal groups encompassed hunting (especially white-tailed deer), gathering of wild plants and snails, pasturing of some llamas, tree-cutting and exploiting clay (Engel 1973; Mujica *et al.* 1983; Vallejo Berrios 2004; Makowski *et al.* 2008).



**Figure 8.** Andenes in the Lomas de Lachay.





Isotopic analysis of bones (Baraybar 1999) seems to confirm the social organization known from written sources, which give evidence of the organizational separation of fog oases. In Lurín, for instance, the valley population of the main fog oases was composed of members of the Caringa Ayllu, while other groups belonged to three different ayllus: the Pachacamac Ayllu, the Manchay Ayllu and the Quilcayuna Ayllu (Eeckhout 2004b). The discoveries of plant and animal remains from fog oases in ritual contexts in river valleys, together with rock art (Shoobridge 2003; Cabrel Palomares 2006), prove the symbolic importance of the *lomas*.

## CONTACTS AND EXCHANGE

During the late pre-Columbian epoch, transhumance created favorable conditions for interregional exchange in the *lomas*. Transhumant, highland pastoralists descended with their flocks of llamas from the Andes and met local, coastal populations, which controlled fog oases. These contacts were a perfect occasion to exchange goods and perhaps also ideas between those two macro groups. A similar model for fog oases of Costa Extremo Sur is also proposed by Cardona Rosas (Cardona Rosas 2002). Nielsen (2006) also suggests that in southern Altiplano different groups from northwestern Argentina, the Atacama Desert and southern Bolivia exchanged goods from their original territories while they were hunting flamingos and exploiting mineral resources in the high, extremely arid puna.

Exchange in fog oases probably had a character of associated trade, which means that it was never a principal reason for the arrival of highland groups to fog oases. In spite of the fact that the main objective of descent was transhumance, pastoralists also used this opportunity to acquire some coastal goods. It should also be emphasized that *lomas* trade was never the only and, plausibly, not even the predominant way of communication and exchange between pre-Columbian populations of Costa and Sierra.

This exchange, as all activities in the Andean world, was probably ritualized. For instance, Ruiz Estrada (2006) suggests that highlanders exchanged salt while on pilgrimage to the sanctuary of Choque Ispana, located a few kilometers from Lomas de Lachay. Ethnographical analogies from southern Peru suggest that trade partners could be hereditary. The exchange itself was regulated by traditional Andean values such as duality, complementarity and the redistribution rule. Trade in fog oases fits well with those concepts – highlanders (those from the upper parts – Hanan) would meet coastal people (those from the low parts – Hurin) and each group would exchange with the other its own resources necessary not only from the economic, but, more importantly, from the ritual point of view, contributing in this manner to the prosperity of all through cooperation.

Andean pastoralists arrived with their flocks (Figure 9) to exchange llama and alpaca wool, meat, skin and perhaps also *charqui*<sup>9</sup>. *The presence in the lomas* of other possible trade goods that may have been brought by the highlanders, like cochineal (a type of red colorant made of insects), cinnabar, used for ritual purposes in Chancay culture (Cornejo Guerrero 1991), obsidian or metal ore, have not been confirmed to date. Dried fish, salt, reed objects and other agricultural products arrived from the Coast. Research by Baraybar (1999) confirmed the secondary role of sea mollusks in the diet of the coastal population, so we can suggest that at least some of those found by archaeologists in the *lomas* were destined for exchange with highland pastoralists. Nowadays, native groups from Sierra de Huancavelica also descend to the Coast to collect sea mollusks. Presumably, prestigious goods such as fine ceramic, jungle bird's feather and semi-precious stones were objects of "administrative trade" and specialized trade rather than *lomas* exchange.

Frequent contacts between highland and coastal groups resulted in cultural diffusion. Presumably, a wide spatial distribution of stamped circle motifs, so common in utilitarian ceramic of the second

<sup>9</sup> Dried meat of camelids.







**Figure 9.** Andean domesticated camelids.

part of LIP, is related to contacts between highland and coastal populations in the *lomas*. Contacts with highland groups contributed also to the presence of llama-form pottery vessels in Chancay Black-on-White style. Written sources suggest the possibility of religious syncretism – for instance, during the so-called *extirpación de idolatría* in the Choque Ispana sanctuary, located in Playa Chica near Lomas de Lachay, cult chambers with statues wearing Sierra and Costa clothes were found by Spaniards (Ruiz Estrada 2006). Special attention must be given to the fact that highlanders worshipping Choque Ispana associated this deity with abundance and fecundity of their flocks (Ruiz Estrada 2006), which strongly suggests a relation to transhumance in nearby fog oases.

Despite the fact that the proposed model is applicable to all late epochs, it seems that contacts in the *lomas* were of particular importance in the period of political balkanization and cultural fragmentation, i.e. second part of MH (MH 3-4) and LIP. In addition to the above-mentioned social factors, climate change associated with the start of the Little Ice Age around 1400 AD also had an important role. Regional societies, therefore, were seeking economic autonomy, which enabled them to control access to those natural resources which were considered culturally necessary. One of the instruments used in the broader scheme of vertical economy was transhumance between Sierra and the *lomas*. This activity not only guaranteed good pastures for the animals, but also promoted the development of interregional exchange. This type of contact with the coastal group allowed further stabilization of the subsistence economy and provided access to prestigious objects indispensable for local elites to articulate and maintain their social position.



## FINAL CONCLUSIONS

The archaeological survey in Lomas de Lachay and Lomas de Iguanil confirmed the Pre-Hispanic origin of highland-*lomas* transhumance. It developed at least from MH and may even be rooted in cultural processes in the last centuries before Christ. Highland pastoralists descended with their camelid flocks to fog oases using mountain ridges. From August-September until the end of November they used lush vegetation growing in the *lomas* during the wet season, while at the same time highland pasturelands were barren due to the dry season in the Andes. These seasonal migrations were concordant not only with social organization and cultural patterns of highland groups, but also with the physiology of camelids (Figure 10).

Despite the presence of transhumant pastoralists from Sierra, the Central Coast's *lomas* were controlled by populations associated with coastal cultures. Some of their settlements might be permanent. Traces of sophisticated network of irrigation canals, andenes, and perhaps also sunken fields were found in the *lomas*. Other activities performed by coastal groups encompassed white-tailed deer hunting, gathering of wild plants, breeding of llamas and exploitation of mineral resources, especially clay used in ceramic production. Limited archaeological research in fog oases confirms written sources' information about social organization of the *lomas*' populations, which formed separated ayllus.

Interregional exchange had the character of incorporated trade, because it was practiced only as a secondary activity during visits of transhumant, highland pastoralists (Figure 8). Presumably, it was dominated by common and subsistence goods, such as camelid wool, meat, skin and perhaps also whole animals exchanged for coastal products like salt, dried fish, sea mollusks and reed objects. Trade was probably ritualized and regulated by traditional Andean rules of duality, complementarity and redistribution.

Interregional exchange could be understood in terms of a specific adaptive strategy to the tough conditions of the Andes. In conjunction with transhumance, it suggests that in the Central Andes, like in many other dry and mountainous ecosystems, a human response to the fragile and unstable environment was an increase of mobility and exchange of products with groups from other areas, which permitted minimization of the negative effects of natural hazards such as drought or catastrophic rains which could easily cause famine in such a marginal environment. Moreover, trade in the *lomas* should be considered one of the instruments of a vertical economy. Literature often emphasizes the static dimension of this phenomenon, with institutions such as colonists and productive enclaves. However, we should not ignore dynamic aspects of a vertical economy, where such flexible instruments like transhumance and interregional exchange allowed exploitation of natural resources from other ecological zones, which diminished social tensions associated with natural risks in the Andes. Such a function was especially important in times of political balkanization and cultural fragmentation, like second part of MH and LIP, when each polity tended to political autonomy and economic self-sufficiency. The use of both of the strategies of vertical economy, static and dynamic, permitted local elites to fund their social position and helped them in managing new regional, cultural traditions, which emerged in the second part of MH and were fully articulated in LIP.

Preliminary results of this research suggest that the proposed model of interregional exchange in the *lomas* developed during late pre-Columbian times. However, still very little is known about its characteristics, so further investigation is necessary to verify this hypothesis and clarify cultural processes in fog oases. Research should cover issues such as relations between human activity and climate changes, highland-*lomas* transhumance, permanent occupation of fog oases and interregional contacts in the *lomas*. Results will not only permit us to better understand the particular developments of the Central Andes, but also are of general importance as an example of adaptation to a fragile, unstable ecosystem.



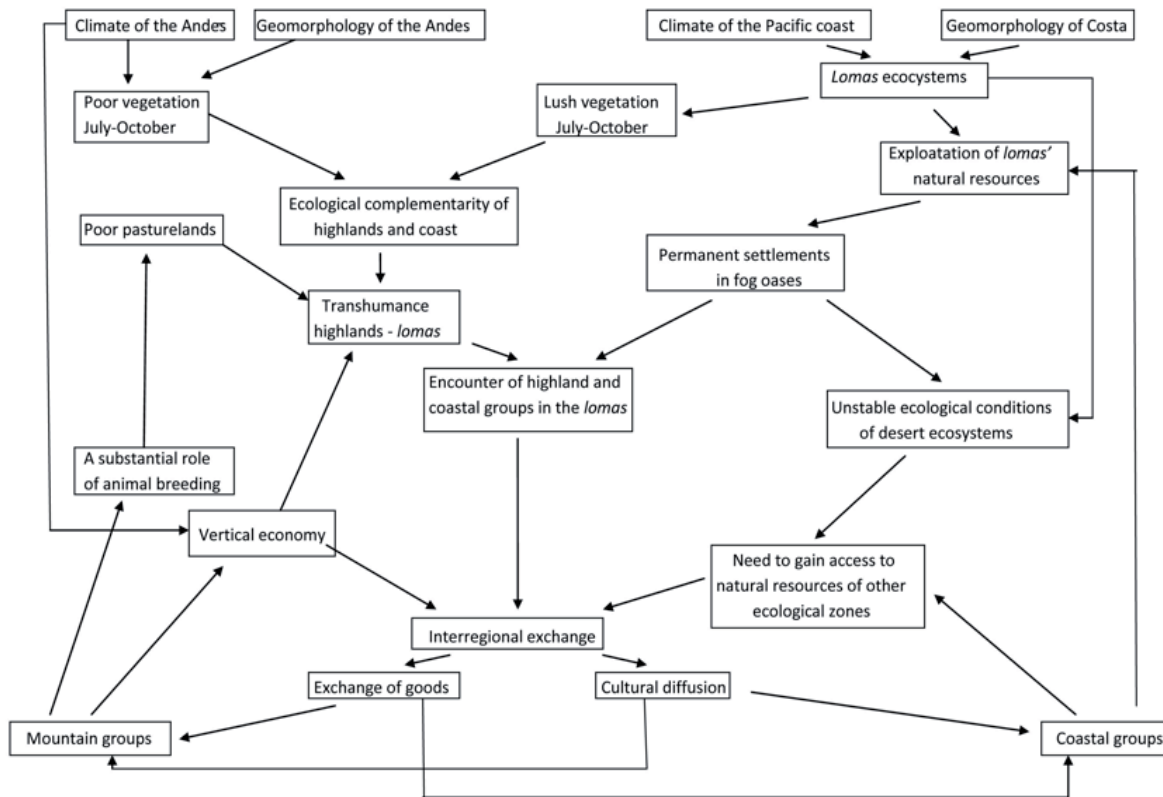


Figure 10. Model of interregional exchange in the *lomas*.

## ACKNOWLEDGEMENTS

Research carried out in Lomas de Lachay was financed by Polish National Center of Science (Narodowe Centrum Nauki) on the basis of contract no. UMO-2011/03/N/HS3/01151 as a part of project "People of the fog – a human response to climate change in the late pre-Columbian Andes. A case study from Lachay-Iguanil region".

## REFERENCES

- ANGELES FALCÓN, ROMMEL POZZI ESCOT AND DENISE POZZI ESCOT  
 2004 Del Horizonte Medio al Horizonte Tardío en la Costa Sur Central-el caso de Valle de Asia. *Boletín del Instituto Francés de Estudios Andinos* 33(3): 861-886.
- BARAYBAR, JOSÉ PABLO  
 1999 Diet and Death in a Fog Oasis Site in Central Coastal Peru: A Trace Element Study of Tomb 1 Malanche 22. *Journal of Archaeological Science* 26: 471-482.
- BROWMAN, DAVID L.  
 1974 Pastoral Nomadism in the Andes. *Current Anthropology* 15(2): 188-196.
- BURGER, RICHARD L.  
 1992 *Chavin and the origins of Andean civilization*. London: Thames and Hudson.

CABREL PALOMARES, DANIEL

2006 *Inventario de sitios con manifestaciones rupestres en la Reserva Nacional de Lachay, Lima*. Lima: Instituto Cultural Ruricancho.

CABRERA CARRANZA, CARLOS, ROGELIO VILLANUEVA, MARCO ESPINO, CARMEN YAMASHIRO, MILAGROS BARETO AND JORGE RODRIGUEZ OJEDA

2001 Análisis integrado de trabajo de campo aplicado de la cuenca media y baja del río Chillón. *Revista del Instituto de Investigaciones de la Facultad de Ingeniería Geológica, Minera, Metalúrgica y Geográfica* 4(7): [http://sisbib.unmsm.edu.pe/bibvirtual/publicaciones/geologia/v04\\_n7/an%C3%A1lisis\\_integra.htm](http://sisbib.unmsm.edu.pe/bibvirtual/publicaciones/geologia/v04_n7/an%C3%A1lisis_integra.htm) [Accessed: May 29<sup>th</sup>, 2014]

CANZIANI, JOSÉ AND ELÍAS MUJICA

1997 Atiquipa: Un caso prehispanico de manejo sustentable en ecología de lomas. In *Perú: El problema agrario en debate. Seminario Permanente e Investigación Agraria VI. Lima-Perú* edited by E. González, B. Revesz, A. Tapia, pp. 503-527. Lima: SEPIA.

CARDONA ROSAS, AUGUSTO

2002 *Arqueología de Arequipa. De sus albores a los Incas*. Arequipa: Centro de Investigaciones Arqueológicas de Arequipa.

CASTILLO BUTTERS, LUIS JAIME

2000 La Presencia de Wari en San José de Moro. In *Los dioses del antiguo Perú* edited by K. Makowski, pp. 103-135. Colección Arte y Tesoros del Perú-Banco de Crédito del Perú, Lima.

COGORNO VENTURA, GILDA

2005 Tiempo de lomas: Calidades del medioambiente y administración de recursos en Lima, 1535-1601. In *Lima en el siglo XVI* edited by L. Gutierrez Arbulu, pp. 19-102. Lima: Fondo Editorial de la PUCP IRA.

COMECA CHUQUIPUL, MIGUEL ÁNGEL AND JUAN FELIPE MELÉNDEZ DE LA CRUZ

2008 Estudio integral geográfico de la Cuenca del río Omas (Asia). *Revista del Instituto de Investigaciones de la Facultad de Ingeniería Geológica, Minera, Metalúrgica y Geográfica* 10(20): 87-97.

CORNEJO GUERRERO, MIGUEL

1991 Patrones funerarios y discusión cronológica en Lauri, valle de Chancay. In *Estudios sobre la cultura Chancay, Peru* edited by A. Krzanowski, pp.83-114. Kraków: Universidad Jagelona.

COSTIN, CATHY L. AND TIMOTHY K. EARLE

1989 Archaeology status distinction and legitimation of power as reflected in changing patterns of consumption in late prehispanic Peru. *American Antiquity* 34(5): 691-714.

COVEY, R. ALAN

2008a Multiregional Perspectives on the Archaeology of the Andes During the Late Intermediate Period (c. A.D. 1000–1400). *Journal of Archaeological Research* 16(3): 287-338.

2008b The Inca Empire. In *Handbook of South American archaeology* edited by H. Silverman, W. Isbell, pp. 809-830. New York-London: Springer.

D'ALTROY, TERENCE N.

2002 *The Incas*. Oxford-Malden: Blackwell Publishers.

DILLEHAY, TOM

1977 Tawantinsuyu integration of the Chillón Valley, Peru: A case of Inca geo-political mastery. *Journal of Field Archaeology* 4(4): 397-405.

DILLON, MICHAEL O., MIYUKI NAKAZAWA AND SEGUNDO LEIVA GONZALES

2003 The lomas formation of coastal Peru: composition and biogeographic history. In *El Niño in Peru: Biology and Culture over 10,000 years* edited by J. Haas, O.M. Dillon, pp.1-9. Botany New Series no 43. Chicago: Field Museum of Natural History.

DRANSART, PENELOPE Z.

2002 *Earth, water, fleece, and fabric: an ethnography and archaeology of Andean camelid herding*. London-New York: Routledge.



## DULANTO, JALH

2008 Between Horizons: Diverse configurations of society and power in the late Pre-Hispanic Central Andes. In *Handbook of South American archaeology* edited by H. Silverman, W. Isbell, pp.761-782. London-New York: Springer.

## EECKHOUT, PETER

1999 Piramide con rampa N III, Pachacamac, nuevos datos, nuevas perspectivas. *Boletín del Instituto Francés de Estudios Andinos* 28(1): 169-214.

2003 Diseño arquitectónico, patrones de ocupación y formas de poder en Pachacamac, Costa central del Perú. *Revista Española de Antropología Americana* 33: 17-37.

2004a Relatos míticos y prácticas rituales en Pachacamac. *Boletín del Instituto Francés de Estudios Andinos* 33(1): 1-54.

2004b La sombra de Ychsma. Ensayo introductorio sobre la arqueología de la Costa Central del Perú en los periodos tardíos. *Boletín del Instituto Francés de Estudios Andinos* 33(3): 403-423.

2004c Pachacamac y el Proyecto Ychsma. *Boletín del Instituto Francés de Estudios Andinos* 33(3): 425-448.

2008 El oráculo de Pachacamac y los peregrinajes a larga distancia en el mundo andino antiguo. In *Adivinación y oráculos en el mundo andino* edited by M. Curatola Petrochi, M. Ziolkowski, pp.160-180. Lima: Fondo Editorial de la PUCP-IFEA.

## ENGEL, FÉDÉRIC ANDRÉ

1970a *Las lomas de Iguanil y el complejo de Haldas*. Lima: Universidad Nacional Agraria.

1970b Exploration of the Chilca Canyon, Peru. *Current Anthropology* 11(1): 55-58.

1973 New Facts About Pre-Columbian Life in the Andean Lomas. *Current Anthropology* 14(3): 271-280.

1983 Prehistoria y oceanografía. *Zonas Áridas* 3: 25-31.

## ERICKSON, CLARK L.

2003 Agricultural landscapes as World Heritage: raised field agriculture in Bolivia and Peru. In *Managing Change: Sustainable Approaches to the Conservation of the Built Environment* edited by J.M. Teutonic, F. Matero, pp. 181-204. Los Angeles: Getty Conservation Institute.

## FRANCO JORDAN, RÉGULO G.

2004 Poder religioso, crisis y prosperidad en Pachacamac: del Horizonte Medio al Intermedio Tardío. *Boletín del Instituto Francés de Estudios Andinos* 33(3): 465-506.

## GARREAUD, RENÉ D. AND PATRICIO ACEITUNO

2007 Atmospheric circulation and climate variability. In *The Physical geography of South America* edited by T.T. Veblen, K.R. Young, A.R. Orme, pp. 45-59. Oxford: Oxford University Press.

## GOLDSTEIN, PAUL S.

2000 Exotic Goods and Everyday Chiefs: Long-Distance Exchange and Indigenous Sociopolitical Development in the South Central Andes. *Latin American Antiquity* 11(4): 335-361.

2005 *Andean diaspora: the Tiwanaku colonies and the origins of South American empire*. Gainesville: University Press of Florida.

## HYSLOP, JOHN

1984 *Inka road system*. New York: Academic Press.

## ISBELL, WILLIAM H.

2008 Wari and Tiwanaku: International Identities in the Central Andean Middle Horizon. In *Handbook of South American archaeology* edited by H. Silverman, W. Isbell, pp.731-760. London-New York: Springer.

## JENNINGS, JUSTIN

2006a Core, peripheries, and regional realities in Middle Horizon Peru. *Journal of Anthropological Archaeology* 25: 346-370.

2006b Understanding Middle Horizon Peru: hermeneutic spirals, interpretative traditions and Wari administrative centers. *Latin American Antiquity* 17(3): 265-285.





## JIMÉNEZ, MILAGRITOS DEL ROCÍO

2009 Ocupaciones tempranas de lomas en el valle de Lurín. In *Arqueología del Período Formativo en la Cuenca baja de Lurín. Colección Valle de Pachacamac. Tomo I* edited by R. Burger, K. Makowski, pp. 281-312. Lima: Fondo Editorial de la PUCP.

## KALICKI, PIOTR

2010 Ochrona dziedzictwa archeologicznego w Peru. *Ochrona Zabytków* 2/2009: 75-90.

## KALICKI, PIOTR, TOMASZ KALICKI AND PIOTR KITTEL

2014 Influence of El Niño on settlement patterns in Lomas de Lachay, Central Coast, Peru. *Interdisciplinaria Archaeologica Natural Sciences in Archaeology (IANSa)*, in press.

## KAULICKE, PETER CLAUS

2000 La sombra de Pachacamac Huari en la Costa Central. *Boletín de Arqueología PUCP* 4: 313-358.

## KEEFER, DAVID K., MICHAEL E. MOSELEY AND SUSAN D. DeFRANCE

2003 A 38 000-year record of floods and debris flows in the Ilo region of southern Peru and its relation to El Niño events and great earthquakes. *Palaeogeography, Palaeoclimatology, Palaeoecology* 194: 41-77.

## KROEBER, ALFRED LOUIS

1926 Culture Stratifications in Peru. *American Anthropologist* 28(2): 331-351.

1927 Coast and Highland in Prehistoric Peru. *American Anthropologist* 29(4): 625-653.

## KRZANOWSKI, ANDRZEJ

1991a Chancay una cultura desconocida? In *Estudios sobre la cultura Chancay, Peru* edited by A. Krzanowski, pp.19-36. Kraków: Universidad Jaguelona.

1991b Observaciones sobre la arquitectura y patrón de asentamiento de la cultura Chancay. In *Estudios sobre la cultura Chancay, Peru* edited by A. Krzanowski, pp.37-56. Kraków: Universidad Jaguelona.

1991c Influencia Inca en los valles de Huaura y Chancay. In *Estudios sobre la cultura Chancay, Peru* edited by A. Krzanowski, pp.189-214. Kraków: Universidad Jaguelona.

1991d Sobre la cerámica Chancay del tipo Lauri Impreso. In *Estudios sobre la cultura Chancay, Peru* edited by A. Krzanowski, pp.215-242. Kraków: Universidad Jaguelona.

2008 *Kultura Chancay: Środkowe Wybrzeże Peru u schyłku epoki prekolumbijskiej (X-XVI w.)*. Kraków-Warszawa: Uniwersytet Jagielloński-PTSL.

## KRZANOWSKI, ANDRZEJ AND KRZYSZTOF TUNIA

1991 Cerámica Cayash del tipo Quillahuaca. In *Estudios sobre la cultura Chancay, Peru* edited by A. Krzanowski, pp.243-262. Kraków: Universidad Jaguelona.

## LANNING, EDWARD P.

1963 A Pre-Agricultural Occupation on the Central Coast of Peru. *American Antiquity* 28(3): 360-371.

## LONDOÑO, ANA C.

2008 Pattern and rate of erosion inferred from Inca agricultural terraces in arid southern Peru. *Geomorphology* 99: 13-25.

## LUMBRERAS, LUIS G.

2000 *El imperio Wari. Las formas históricas del Perú vol. 8*. Lima: Lluvia Editores.

## LYNCH, THOMAS F.

1971 Preceramic Transhumance in the Callejon de Huaylas, Peru. *American Antiquity* 36(2): 139-148.

## MAGILLIGAN, FRANCIS J., PAUL S. GOLDSTEIN, G. BURCH FISHER, BENJAMIN C. BOSTICK AND REBECCA B. MANNERS

2008 Late Quaternary hydroclimatology of a hyper-arid Andean watershed: Climate change, floods, and hydrologic responses to the El Niño-Southern Oscillation in the Atacama Desert. *Geomorphology* 10: 14-32.

## MAKOWSKI, KRZYSZTOF

2003 El urbanismo en los Andes Prehispanicos. In *Il Mondo dell'Archeologia vol. 1*, s.v. Roma: Istituto de la Enciclopedia Italiana.

2006 Late Prehispanic Styles and Cultures of the Peruvian North Coast:Lambayeque, Chimu, Casma. In



- Weaving for the afterlife vol. 2* edited by K. Makowski, A. Rosenzweig, M.J. Jimenez Diaz, J. Szemiński, pp. 142-197. Hedzrliya Pituach: Ampal-Merhav.
- 2008 Andean Urbanism. In *Handbook of South American archaeology* edited by H. Silverman, W. Isbell, pp. 628-652. London-New York: Springer.
- 2009a Poder y estatus social a fines del Periodo Formativo: los cementarios del valle bajo de Lurin. In *Arqueología del Periodo Formativo en la Cuenca baja de Lurin. Colección Valle de Pachacamac. Tomo I* edited by R. Burger, K. Makowski, pp. 207-246. Lima: Fondo Editorial de la PUCP.
- 2009b Tablada de Lurin: aspectos cronológicos de la ocupación de lomas costeras de Atocongo. In *Arqueología del Periodo Formativo en la Cuenca baja de Lurin. Colección Valle de Pachacamac. Tomo I* edited by R. Burger, K. Makowski, pp. 247-280. Lima: Fondo Editorial de la PUCP.
- MAKOWSKI, KRZYSZTOF AND MILENA VEGA-CENTENO
- 2004 Estilos regionales en la Costa Central en el Horizonte Tardío Una aproximación desde el Valle de Lurin. *Boletín del Instituto Francés de Estudios Andinos* 33(3): 681-714.
- MAKOWSKI, KRZYSZTOF, IVÁN GHEZZI, DANIEL GUERRERO, HÉCTOR NEIFF, MILAGRITOS DEL ROCÍO JIMÉNEZ, GABRIELA ORÉ AND ROSABELLA ÁLVAREZ-CALDERÓN
- 2008 Pachacamac, Ychsma y los Carings: Estilos e Identidades en el Valle de Lurín Inca. In *Arqueología de la Costa Centro-Sur Peruana* edited by O. Pinedo, H. Tantaleán, pp.267-307. Lima: Avqui Ediciones.
- MARCHANT, ROBERT A., HENRY HOOGHMESTRA AND GERALD A. ISLEBE
- 2004 The rise and fall of Peruvian and Central American civilizations: Interconnections with holocene climatic change – a necessarily complex model. In *Monsoon and civilization* edited by Y. Yasuda, pp. 351-379. New Delhi: Lustre Press-Roli Books.
- MARUSSI CASTELLAN, FERRUCCIO
- 1979 Rupac: Análisis urbanístico de una ciudad prehispánica. *Boletín del Instituto Francés de Estudios Andinos* 8(1-2): 1-33.
- McEWAN, GORDON F.
- 2005 *Pikillacta. The Wari empire in Cuzco*. Iowa City: University of Iowa Press.
- MENZEL, DOROTHY
- 1964 Style and time in the Middle Horizon. *Ñawpa Pacha* 2: 1-105.
- 1969 New data on the Huari empire in Middle Horizon Epoch 2A. *Ñawpa Pacha* 6: 47-114.
- MILLAR, CONSTANCE I. AND WALLACE B. WOOLFENDEN
- 1999 The role of climate change in interpreting historical variability. *Ecological Applications* 9(4): 1207-1216.
- MUJICA, ELÍAS
- 1994 Las lomas de Malanche. Sociedades complejas en un medio ambiente frágil. *l'Imaginaire* 1(3): 61-70.
- MUJICA, ELÍAS, MARIA ROSTWOROWSKI DE DIEZ CANSECO AND IDILIO SANTILLANA
- 1983 *Poblaciones de lomas: análisis histórico del caso Pachacamac*. Lima: Paper presented at Seminario de investigaciones subsidiadas por AMIDER.
- MURRA, JOHN V.
- 2002 *El mundo andino. Población, medio ambiente y economía*. Lima: Fondo Editorial Pontificia Universidad Católica del Perú-Instituto de Estudios Peruanos.
- MYDEL, RAJMUND AND JERZY GROCH (EDITORS)
- 1999 *Przeglądowy Atlas Świata. Ameryka Południowa*. Kraków: Fogra.
- NIELSEN, AXEL
- 2006 Estudios internodales e interacción interregional en los Andes circumpuneños: teoría, método y ejemplos de aplicación. In *Esféricas de interacción prehistóricas y fronteras nacionales modernas: los Andes sur centrales* edited by H. Lechtmann, pp. 29-62. New York-Lima: Instituto de estudios Peruanos de Lima-Institute of andean Research.



- OCHATOMA PARAVACINO, JOSÉ  
2007 *Alfareros del imperio Huari. Vida cotidiana y areas de actividad en Conchopata*. Lima: Facultad de Ciencias Sociales, Universidad Nacional de San Cristóbal de Huamanga.
- OHGA, NOBUHIKO  
1992 Buried seed population in the herbaceous lomas on Loma Ancon in the coastal desert of central Peru. *Ecological Research* 7: 341-353.
- ORDOÑEZ, JORGE L. AND JORGE FAUSTINO M.  
1983 Evaluación del potencial hídrico en lomas costeras del Perú (Lomas de Lachay-Iguanil). *Zonas Áridas* 3: 32-50.
- ORME, ANTONY R.  
2007 Tectonism, climate and landscape change. In *The Physical geography of South America* edited by T.T. Veblen, K.R. Young, A.R. Orme, pp. 23-44. Oxford: Oxford University Press.
- PATTERSON, THOMAS CARL AND EDWARD P. LANNING  
1964 Changing settlement patterns on the central Peruvian coast. *Ñawpa Pacha* 12: 113-123.
- PATTERSON, THOMAS CARL AND MICHAEL E. MOSELEY  
1969 Late preceramic and early ceramic cultures of the central coast of Peru. *Ñawpa Pacha* 6: 115-133.
- PAULSEN, ALLISON C.  
1976 Environment and Empire: Climatic Factors in Prehistoric Andean Culture Change. *World Archaeology* 8(2): 121-132.
- PEARSALL, DEBORAH M.  
2008 Plant domestication and the shift to agriculture in the Andes. In *Handbook of South American archaeology* edited by H. Silverman, W. Isbell, pp. 105-120. London-New York: Springer.
- REIGADAS, MARÍA DEL CARMEN  
2007 El espacio productivo en las economías pastoriles. Expectativas arqueológicas. *Cuadernos - Revista de la Facultad de Humanidades y Ciencias Sociales, Universidad Nacional de Jujuy (Argentina)* 32: 187-209.
- ROSTWOROWSKI DE DIEZ CANSECO, MARIA  
2005 *Recursos naturales renovables y pesca siglos XVI-XVII*. Lima: Instituto de Estudios Peruanos.
- RUNDEL, PHILIP W. AND MICHAEL O. DILLON  
1998 Ecological patterns in the *Bromeliaceae* of the lomas formations of Coastal Chile and Peru. *Plant Systems and Evolution* 212: 261-278.
- RUNDELL, PHILIP W., PABLO E. VILLAGRA, MICHAEL O. DILLON, SERGIO ALBERTO ROIG-JUÑENT AND GUILLERMO DEBANDI  
2007 Arid and semi-arid ecosystems. In *The Physical geography of South America* edited by T.T. Veblen, K.R. Young, A.R. Orme, pp. 158-183. Oxford: Oxford University Press.
- RUIZ ESTRADA, ARTURO  
2006 Exploraciones arqueológicas en la huaca Choque Ispana, valle de Huaura. *Investigaciones Sociales* 10(16): 151-169.
- SANDWEISS, DANIEL H. AND JAMES B. RICHARDSON III  
2008 Central Andean Environments. In *Handbook of South American archaeology* edited by H. Silverman, W. Isbell, pp. 94-104. London-New York: Springer.
- SCHEMENAUER, ROBERT S. AND PILAR CERCEDA  
1993 Meteorological conditions at a coastal fog collection site in Peru. *Atmosfera* 6(3): 175-188.
- SCHIMMELMANN, ARNDT, CARINA B. LANGE AND BETTY J. MEGGERS  
2003 Palaeoclimatic and archaeological evidence for a 200-yr recurrence of floods and droughts linking California, Mesoamerica and South America over the past 2000 years. *The Holocene* 13: 763-780.
- SEGURA LLANOS, RAFAEL  
2001 *Rito y economía en Cajamarquilla. Investigaciones arqueológicas en el Conjunto Arquitectónico Juli C. Tello*. Lima: Ediciones Pontificia Universidad Católica del Perú.





SELTZER, GEOFFREY O. AND CHRISTINE A. HAASTORF

1990 Change and its effect on prehispanic agriculture in the Central Peruvian Andes. *Journal of Field Archaeology* 17(4): 397-414.

SHIMADA, IZUMI, CRYSTAL BARKER SCHAAF, LONNIE G. THOMPSON AND ELLEN MOSELEY-THOMPSON

1991 Cultural impacts of severe droughts in the prehistoric Andes: Application of a 1,500-year ice core precipitation record. *World Archaeology* 22(3): 247-270.

SHOOBRIDGE, DIEGO

2003 *Lachay National Reserve Park Profile*. Peru-USA: Parks Watch.

SILVA SIFUENTES, JORGE E.

1991 *Patrones del poblamiento en el valle del Río Chillón*. Lima: FOMCIENCIAS.

1998 El curacazgo de Quivi: Arqueología y Etnohistoria. *Investigaciones Sociales Universidad Nacional de San Marcos* 2(2): 39-60.

SOTOMAYOR MELLO, DIEGO A. AND PERCY JIMÉNEZ MILLÓN

2008 Meteorological conditions and vegetal dynamics of the Atiquipa lomas (Caraveli-Arequipa) coastal ecosystem, in the south of Peru. *Ecología Aplicada* 7(1-2): 1-8: [http://www.lamolina.edu.pe/ecolapl/Articulo\\_1\\_vol\\_7\\_Ecologia\\_aplicada.pdf](http://www.lamolina.edu.pe/ecolapl/Articulo_1_vol_7_Ecologia_aplicada.pdf) [Accessed: May 29<sup>th</sup>, 2014].

STAHL, PETER W.

1996 Holocene Biodiversity: An archaeological perspective from the Americas. *Annual Review of Anthropology* 25: 105-126.

STUMER, LOUIS M.

1954 Population Centers of the Rimac Valley of Peru. *American Antiquity* 20(2): 130-148.

TSCHAUNER, HARTMUT

2003 Honco Pampa: Arquitectura de elite del Horizonte Medio en el Callejón de Huaylas. In *Arqueología de la Sierra de Ancash. Propuestas y perspectivas* edited by B. Ibarra Ascencios, pp.193-220. Lima: Instituto Cultural Runa.

VALLEJO BERRIOS, FRANCISCO

2004 El estilo Ychsma: características generales, secuencia y distribución geográfica. *Boletín del Instituto Francés de Estudios Andinos* 33(3): 595-642.

2010 Evidencias arqueológicas de un nuevo estilo cerámico en el valle de Huaura para el periodo Intermedio Tardío: El paso del Horizonte Medio al Intermedio Tardío. In *Arqueología en el Perú. Nuevos aportes para el estudio de las sociedades andinas prehistóricas* edited by R. Romero Velarde, T. Pavel Svendsen, pp. 229-248. Lima: Universidad Nacional Federico Villareal.

VAN DALEN LUNA, PIETER

2007 Reconocimiento arqueológico en la cuenca alta del río Chancay-Huaral: margen izquierda (distritos de Atavillos Alto, Santa Cruz de Andamarca y Pacaraos). Nuevos datos para comprender los procesos socio-culturales Atavillos. *Kullpi - Investigaciones culturales en la provincia Huaral y Norte Chico* 3(3): 57-148.

