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Building ecological resistance: Late intermediate period farming in the south-central highland Andes (CE 1100–1450)

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ABSTRACT

In southern Peru near Lake Titicaca, at the Colla hillfort town of Ayawiri, archaeological data indicate that the construction of a large terrace complex and the production of agricultural staples were managed in a decentralized manner. The layout and engineering qualities of the terraces surrounding Ayawiri reveal that the construction, maintenance, and cultivation of these systems was managed through household labor rather than a central political authority. This agrarian landscape and labor regime provided households with what I term ecological resistance—human modifications to ecosystems that provide individuals with the capacity to resist the establishment of hierarchical authority and subjugation by imperial powers. The built agricultural landscape and accompanying agrarian labor regimes made the Colla difficult to subjugate by neighboring enemies and in the 15th century, when Inka forces attempted to conquer and incorporate the Colla into their empire. The Colla were only successfully integrated into the Inka Empire after the Inka employed their own ecological tactics. This case study provides key insights into the ways that humans modify their environment to build and perpetuate ecological resistance.

1. Introduction

Warfare dominated lifeways for the Colla, an ethnic group that lived in the south-central highland Andes near Lake Titicaca during the Late Intermediate Period (LIP, CE 1100–1450). The Colla lived in hillforts called *pukaras* and built their communities around the need for defense (Arkush, 2011, 2018; Langlie and Arkush, 2016). The recovery of military artifacts such as sling stones (Arkush, 2011) and the identification of physical trauma in the osteological record (De la Vega et al., 2005; Juengst et al., 2015) provide direct evidence that violent conflict was widespread in the region. Intense conflict can be a powerful motivator to boost cooperation within groups (Arkush, 2018; Ikehara, 2016; Spencer, 2013; Turchin, 2010). Additionally, in risky situations such as times of conflict, communities may more readily accept or yield to absolutist forms of authority (Spencer, 1993). Leaders who rise to positions of power during times of conflict often transform their military status to long-lasting authority by establishing control over productive land and, in turn, the local economy (Kirch, 1980). The Colla, in contrast, did not have strongly centralized authority during the LIP. Ethnohistoric sources tell us that local warlords, referred to as *sinchis,* temporarily held powerful roles in coordinating Colla warfare (Cieza de León, 1985 [1553]); however, it seems their power was limited and short-lived. These findings challenge traditional notions that conflict necessarily breeds and legitimizes authoritarian rule.

How did the Colla defy hierarchical rule? I argue that, in the LIP, the Colla crafted a farming strategy anchored in a newly constructed agricultural landscape that resisted the local and extra-local development of long-lasting hierarchical leadership. This agricultural strategy centered on extended household-organized labor regimes evident in the construction and layout of terraces, and the production, processing, and distribution of crops. This new agrarian landscape and labor organization acted as a form of "ecological resistance" that ensured that aspiring local leaders or encroaching enemies could not establish lasting authority. Later, this agrarian strategy played a key role in the Colla's defiance of an extra-local aggressor, the Inka Empire.

My research on a large monumental terrace system in the western Titicaca Basin indicates that it was constructed and maintained throughout the LIP when there was no state polity to mandate the construction of field systems, manage agricultural labor and production, or authorize the distribution of surplus (Langlie, 2016). Prior to this research, others have proposed that Colla *pukara* dwellers abandoned plant agriculture in favor of pastoral strategies so that they could adapt to the harsh climate of the era and avoid conflict (for example see Stanish, 2003). My findings that terraces were built during the LIP challenges this characterization (Langlie, 2016). There is no doubt that the Colla people kept camelid herds; however, it appears they were grazing on cultivated terraces (Langlie, 2016; Langlie and Arkush, 2016).

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In this paper, I asses how Colla living at Ayawiri, one of the largest *pukaras* in the Lake Titicaca basin, transformed their environment in a way that produced ecological resistance. I draw on archaeological data including an analysis of the terrace complex surrounding Ayawiri and its construction within the context of the local culture history. I assess the layout of the terraces, qualities of the masonry, lack of irrigation, and other features revealed through archaeological excavations to shed light on the underlying labor regimes that built and managed this landscape. In turn, I assess how the built landscape dictated labor regimes and social relations for those living at Ayawiri.

2. Monumental agricultural landscapes

Prior to describing ecological resistance, I begin with a review of a few traditional models for how those in power use monumental agricultural landscapes to produce hegemony. Following the tradition of Wittfogel's hydraulic empire hypothesis (Wittfogel, 1956), these models typically focus on the need for an imperial or other strongly centralized authority to organize the labor required to construct and maintain monumental field systems. To Wittfogel, despotic leadership was essential to efficiently organize the construction of new irrigated field systems, manage cultivation, schedule labor, and effectively redistribute agricultural surplus. Although his work has faced much criticism (for example Carneiro, 1970; Price, 1994), the idea that a despotic ruler, or at least some sort of centralized authority, is required to oversee large-scale agricultural earthworks has endured amongst archaeologists and historians alike. In deference to this special issue's theme of Empire and Environment, I will focus particularly on how imperial modification to ecologies reinforce imperial authority. As we shall see, these imperial strategies are directly relevant to understanding how ecological modification can also serve to resist the control of empires.

Crosby (1986) presents a general model on how empires modify ecosystems to control people through imperial tactics. He calls this idea *ecological imperialism.* In this paper, imperialism refers broadly to an ideology that legitimates the domination of a culture (Dietler, 2005:53). Ecological imperialism, then, is the coeval domination of ecosystems by a dominant culture that accompanies an imperial strategy (see Crosby, 1986). For example, Crosby (1986) believes that European colonists of the Americas were so successful, in part, due to their domination of New World ecosystems with Old World biota including crops, animals, and diseases. Through their imperial action, Europeans brought new crops for consumption and animals for traction to plow up lands, which also introduced invasive weed populations and deadly zoonotic diseases to susceptible populations. The consequences of transformed and weakened ecosystems and peoples aided Europeans in their conquest.

Recently, archaeologists have been exploring the political power of material culture and in turn how material culture makes subjects, suggesting a feedback loop between the two (Crumley, 1995; Janusek, 2008a; Janusek and Kolata, 2004; Pauketat, 2000; Silliman, 2001). Along these same lines, agricultural systems are built into the landscape and biota through the everyday actions of farming. Once constructed, the agrarian system makes, or rather, perpetuates a certain strategy or citizen. In the case of ecological imperialism, then, ecological transformations produce new relationships between people and their environments. As much as a new ecosystem is produced through the construction of state-sponsored agricultural projects, so too are docile subjects (sensu Foucault, 1977). This kind of human-landscape relationship is what we would expect if terraces or large field systems were constructed by an imperial entity.

In the mold of ecological imperialism, researchers have traditionally speculated that the terrace systems in the Andes were built and maintained by the large hierarchically-organized polities, such as the Inka, that periodically dominated the ancient Andes (Erickson, 2000). Indeed, most research projects that have targeted Andean terraces argue they were initially constructed during time periods of political consolidation (for example Albarracin-Jordan, 1996; Branch et al., 2007; Brooks, 1998; Donkin, 1979; Sandor, 1992; Treacy, 1989). Through terrace construction, and the associated increase in crop yield predictability, a centralized power could more confidently feed a dependent population of non-farming urbanites during eras of political integration. Leaders, in turn, retained their status by successfully managing the food supply and their subjects. Similar arguments have been made to explain the construction of raised fields in the southern Lake Titicaca Basin (Kolata, 1993; Ortloff and Kolata, 1993).

Expanding on this idea, it has been suggested that conflict and warfare, like that of the Andean LIP, breeds hierarchical leadership and social stratification (Kirch, 1980; Motyl, 1999; Spencer, 1993). Building on their military authority, leaders then become economic and agrarian managers, further boosting their status (Kirch, 1980). As a result, these leaders begin to organize all aspects of intensive agricultural systems, from their conception to the allocation of surplus. For example, Kirch (1980) found that, in Hawaii, communities fought over access to agricultural land for shifting cultivation. As a result, leaders emerged because they gained eminence in battle and then transformed their renown into authority over the agrarian system. In this model, durable and stratified leadership emerges from warfare and is subsequently central to managing large-scale farming systems.

In the case of the Colla, we can see military leaders emerge from moments of conflict. War leaders, referred to as *sinchis,* held sway during battle (Arkush, 2008). A great lord named Zapana may have ruled over the Colla during the LIP as part of a hereditary dynasty (Julien, 1983). His power as a leader reportedly surpassed those of contemporaneous neighboring warlords (Arkush, 2011:39). Despite this, there are indications that *sinchi* power was weak and situational. For example, in times of battle, one source recorded that Zapana did not directly control his military, but was required to solicit assistance from "subordinate and allied warlords" that were the leaders of their respective hilltop dwelling communities (Cieza de León, 1985 [1553]). Following Kirch's (1980) model, *sinchis* might have transformed their military status into agrarian management positions; however, in this paper, I argue that archaeological lines of evidence suggest that they did not. If leaders among the Colla were only situationally important, then we need to build a different theoretical framework for understanding the social organization that underpinned terrace field systems' construction and maintenance and agriculture production during the LIP.

Despite Wittfogel's model, archaeological evidence suggests that many large-scale agricultural systems were constructed before state level societies existed during periods when populations were increasing, communities and ideologies were coalescing, and farming strategies were being refined (Albarracin-Jordan, 1996; Erickson, 1999; Isbell, 1977; Stanish, 2003). In the *altiplano* archaeobotanical research indicates that agricultural intensification during the Formative period (1800 BCE–400 CE) long predated any state-level organization (Bruno, 2014). It was during this time in the northern Lake Titicaca basin that raised fields (Erickson, 1988, 1993, 1999) and *qochas* (or sunken gardens) (Craig et al., 2011) appear to have been built, but large-scale political entities had not yet appeared in the Andes. Rather, the labor of households or small collective work groups oversaw the construction and management of field systems as needed (Erickson, 1993). In this system, small groups invest a little bit of labor each year, and over decades or even centuries, the cumulative result of their labor is large-scale agricultural systems. For example, Erickson (1992, 1993, 1999) argues that centralized authority was unnecessary to construct raised fields in the Titicaca Basin. He favors a model in which communities and kin groups controlled labor during the Formative period. This is most evident in the layout of raised fields: their segmentary organization indicates that they were constructed in an incremental fashion reflecting kin-based labor management. These examples highlight the potential of non-imperial forms of labor organization to construct large-scale field systems.

Collective action is one way to model how large-scale fields systems can built through non-imperial forms of labor organization. Collective action theory focuses on understanding how individuals and communities cooperate to manage resources through time (Blanton and Fargher, 2016; Carballo and Feinman, 2016; Carballo et al., 2014). Collective action theory predicts how humans cooperate to overcome resource dilemmas, including shortages in food, shelter, land, and defense. In collective action theory, the organization of groups can be understood as the "outcomes of bargains struck between those in power and non-ruling groups" (Blanton and Fargher, 2016:211). The theory of collective action helps us understand the motives driving cooperation, and how power is dispersed within communities with various levels of cooperation. Forms of community cooperation can be examined through an analysis of agricultural systems in the archaeological record. In particular, collective actions help us to understand how field systems can be built and managed among groups with a high level of pluralism.

The idea that Andean field systems were built during the Formative period by local groups to overcome a resource dilemma parallels the model proposed by collective action theory. Collective action also explains why people cooperate (or not) to build and manage agricultural systems in other political situations as well. Near the capital city of the Aztec Empire in 15th-16th century Mexico, *chinampas*, or floating field systems, were built following military conquest of the region to feed the expanding state populace, but construction could have been managed by households with "no new hierarchical organization" imposed (Arco and Abrams, 2006:916). Whereas in northwestern Chihuahua, Mexico, some large field systems called *trincheras*, composed of rock alignments, were organized or controlled by leaders of the powerful Casas Grandes polity between CE 1150 and 1450; many *trincheras* were quite small indicating they were constructed and maintained by families (Minnis et al., 2006). These examples demonstrate that agricultural landscape construction can be the product of individuals and groups working together to cope with food and/or land shortages under an array of political conditions. Shared interest in a resource dilemma generates cooperation between individuals and groups. This collective interest is sufficient to motivate, mobilize, and organize small groups to create new field systems of monumental proportions. This shared interest and cooperation, though, does not necessarily mean that an authority figure will emerge from such endeavors.

In the Central Andes, one of the primary decision-making groups, documented in ethnohistoric sources and ethnography, are *ayllus*. Today, an *ayllu* is a named clan group that commensally and reciprocally socializes, farms, sponsors festivals, and performs public labor projects (Urton, 1993). It has been argued that *ayllus* were formulated during the LIP (Isbell, 1997). In the absence of strong leadership, negotiations between *ayllus* could have provided a locus of cooperation. If so, then the bargains struck between kin-groups, as opposed to those struck between kin-groups and leaders such as *sinchis*, should be apparent in the archaeological record.

3. Ecological resistance

In the previous section, I laid out how large agricultural systems can be built and managed by an array of social organizations. In this case study, the physical and social dimensions of the Colla's new terrace-based agricultural system freed Ayawiri residents from participation in larger, extractive economies of rulership that preceded and post-dated the LIP. In contrast to ecological imperialism, by building large field systems controlled in a decentralized manner, pluralistic communities can produce ecological conditions that enable resistance against the imposition of absolutist rulership. I call this process ecological resistance. In this study, resistance is "actions that not only reject subordination but do so by challenging the ideologies that support subordination" (Weitz, 2001:670). Scott (1985) notably challenged the idea that resistance can only take the form of highly visible and coordinated acts. He terms small-scale acts of resistance by subalterns to hegemonic authorities "weapons of the weak" (Scott, 1985:29). While warfare, like that which characterizes the LIP in the Andes, is a coordinated act of overt resistance, Scott's ideas about resistance open up the possibility that everyday routines of ordinary actions, like the daily routines of farming, can also oppose hegemonic authority structures.

By manipulating land, plants, and animals, farmers work the environment and in doing so impact the ability of others to assert hegemony over their labor and products. Through everyday farming practices and their inherent food independence, farmers can build a "culture of resistance" (Sahlins, 2005:4; Wernke, 2013:7). That is, farmers can choose whether to participate, or only partly participate, in local or regional power and exchange structures. Indeed, local practices are essential to broad regional political patterns (D'Altroy and Hastorf, 2001; Heckenberger, 2005; Kosiba, 2011). Relevant practices are evident in the residues of ancient peoples' everyday actions that modified the natural world. Ecological resistance is both intentional and unintentional in the sense that some ecological manipulations, such as terrace construction, are achieved through planned and coordinated action, while others, such as changing weed biota, are by-products of other human behaviors. The residents of Ayawiri built a new agrarian reality during the LIP that substantially differed from what came before. This can be identified in the incremental construction, layout, and masonry of Ayawiri terraced field systems, and the absence of irrigation. Through this new agricultural ecosystem, residents asserted household control over labor, and the household distribution of agricultural goods thereby suppressing power grabs by local leaders such as *sinchis*. Once constructed, the agricultural system functioned as a positive feedback loop, reinforcing decentralized labor and political organization. As such, ecological resistance is an emergent quality of the landscape and action of farmers.

The construction and management of the Colla's agricultural system functioned as a source of resistance to the establishment of durable leadership from both within the community and more broadly. Through armed conflict and habitation in defensive hillforts, the Ayawiri Colla explicitly resisted domination by extra-local groups. Other local ethnic groups, such as the Pacajes and the Lupaqa, were staking their claims over the region during the LIP (Arkush, 2011; Julien, 1983; Stanish, 2003). At the end of the LIP, the Inka aggressively fought for control over the Colla and their lands. Living in hillforts was an act of resistance, but it was only one dimension of ecological resistance. Hillforts capitalized on the natural defenses of a landscape. In creating a new agricultural system, however, the Colla also built an ecosystem of resistance that defied power grabs by incipient leaders and extra-local enemies. Through their hillforts and attached field systems, the Colla built an agrarian reality that was defensible. Their self-sustaining food system, in turn, aided in the defense of the community as a whole.

I argue that, in the case of Ayawiri, specific local agrarian practices coordinated by *ayllus* may have been as important to defying subordination by aspiring local and extra-local leaders (such as *sinchis* and neighboring enemies) as defensive living in hillforts and military operations. While this case study explains the development of ecological resistance in the *altiplano,* it can be adapted to model similar situations in other parts of the world.

4. The rise, fall, and rise again of centralized Andean polities

To understand the source and perpetuation of Colla ecological resistance, it is necessary to place the Late Intermediate Period landscape within a broader political framework that includes the rise, collapse, and reconsolidation of state-level authority in the *altiplano* region. In doing so, it is not my intention to place the LIP in a neo-evolutionary framework; rather, it is to reveal the social and ecological entanglements that shaped specific agricultural systems and consider the importance of understanding local processes in shaping larger political dynamics of the era (Kosiba, 2011). The Colla were a politically fragmented ethnic group that lived during a period between the reigns of

two powerful state-level polities. Additionally, the localized sociopolitical LIP way of life was quite unique compared to what came before and after.

Before the LIP, residents in the Lake Titicaca basin shared a collective cultural identity and lived under the centralized administration of the Tiwanaku state. A dense population lived in the urban core of Tiwanaku (Kolata and Ponce Sanginés, 1992). Farmers and pastoralists throughout the Middle Horizon populated the valley bottom around the urban core (CE 400–1100) (Albarracin-Jordan and Mathews, 1990). Farmers produced staple grains such as quinoa and amaranth, numerous varieties of tubers including potatoes and oca, and sumptuary crops like maize (Hastorf et al., 2006; Wright et al., 2003). Maize was also imported from colonies as far away as the Moquegua valley (Goldstein, 2000, 2003; Hastorf et al., 2006). Maize was prized and turned into an alcoholic beverage called *chicha,* but this crop does not readily grow in the high altitude of the region, so residents coerced it to grow in microclimatic pockets near the lake or they imported it from lower elevations. Around CE 1000, Tiwanaku influence began to diminish and the state collapsed. Researchers have proposed several causes of the Tiwanaku collapse. For example, the collapse has been attributed to a major drought and the subsequent demise of large agricultural systems (Binford et al., 1997; Ortloff and Kolata, 1993). Other hypotheses involve multiple and interdependent causes of collapse such as ecological deterioration, political failure, economic breakdown, and fractures in social relations (for example Janusek, 2004).

Following the collapse of the Tiwanaku, the type site's urban core was abandoned and the material markers of imperialism disappeared (Janusek, 2004; Stanish, 2003). Cultural hegemony dissolved throughout the region, and the population dispersed across the landscape settling in small, dispersed hamlets and villages (Albarracin-Jordan, 1992; Bandy, 2001; Bauer and Stanish, 2001; Stanish, 1994). The production of crops in irrigated raised field systems also greatly declined, at least in the Tiwanaku heartland (Janusek, 2004:196). Regional cultural and political unity and hierarchical authority declined with the collapse of Tiwanaku.

Little is known about the early part of the LIP, but research indicates that the construction of fortified *pukaras* particularly intensified during the latter part of the LIP (CE 1300–1450) (Arkush, 2008, 2011a). This lag between the end of Tiwanaku and an increase in violence indicates that warfare was not simply the consequence of state collapse (Arkush, 2011; Arkush and Tung, 2013; D'Altroy, 2001; Hastorf et al., 1989). What we do know is that with the abandonment of raised field agriculture, agrarian production dictated by a central authority figure and cooperative labor regime ceased. Abandoned raised field systems can still be seen throughout the region today, reminding all those that have lived in the region since of the authority and unity that Tiwanaku once held over the region. During the early part of the LIP, cultural collapse created an opportunity for residents remaining in the *altiplano* region to reformulate authority structures and landscape use.

Before the LIP, residents in the *altiplano* region lived in Tiwanaku communities in the valley bottom. Tiwanaku, the city, was located on the southern shores of Lake Titicaca in modern day Bolivia. During the later LIP, however, the three remaining ethnic groups in the region (including the Colla, Lupaqa, and Pacajes) strategically relocated to dispersed hilltops for defense (Arkush, 2011; de la Vega, 1990; Stanish, 2003). In many LIP *pukaras*, there is evidence that life and politics were organized at the level of extended family kin groups visible in the layout of compounds and houses (Arkush, 2008). These groups appear ancestral to the historic and ethnohistorically documented kin-based social organization known as the *ayllu.* Isbell (1997) argues that the *ayllu* system originated during the Late Intermediate Period based on new architectural forms of burials that differed from earlier Tiwanaku styles in the region. Further to the north, in the Cusco region, new burial forms of the LIP are associated with kin groups or elites staking claims to lands and establishing political control (Kosiba, 2011). Today, *ayllus* are composed of ten to hundreds of individuals; these groups also communally own land (Kolata, 1993). In Urton's (1993) ethnography of modern ayllus in the central highlands of Peru, he found that the cooperation between kin groups was central to organizing communal labor required to farm cash crops. He also noted that *ayllus* today negotiate cycles of fallowing potato fields on commonly held lands.

Relocating from valley bottoms to hilltops also meant that Colla farmers occupied new ecosystems. Through their choice to live in *pukaras* at higher elevations on hilltops, the Colla no longer used or had access to irrigated and naturally inundated lacustrine ecotopes (Langlie, 2016; Langlie and Arkush, 2016); they had to reformulate their agrarian strategies to their newly occupied ecotopes. See Arkush (2018) for an analysis of how the Colla living at Ayawiri constituted new sociopolitical relationships in *pukaras* over many generations. This way of life, in densely occupied forts, continued for over two centuries. Beyond the walls of the hillfort, though, the Colla did not inherit the agricultural infrastructure built by the cumulative labor of their ancestors; they had to build new soils, new fields, and new farming systems. In occupying a new ecotope, the Colla grew new crop varieties at this higher altitude and abandoned crops that only grew near lakeshores (Langlie, 2016, 2018; Langlie and Arkush, 2016). More broadly, agrarian memory among the Colla—preserved through the presence of abandoned raised-fields and cities in the valleys below—would have reminded residents of the way life once was. It would have reminded them of the way their ancestors practiced agriculture and its associations with the unified Tiwanaku state and the constrictions that centralized political organization placed on lifeways and personal freedom.

Around CE 1450 (following Rowe, 1945:65) the tenacious Inka—an enemy ethnic group hailing from the central Andes near Cuzco, Peru—ultimately conquered and forcibly incorporated the Colla into their famed pan-Andean empire. This moment marked the start of the Late Horizon in the Titicaca Basin. Around CE 1471, the Colla rebelled against Inka subjugation, and intense conflicts purportedly ensued in the region for almost three years (Rowe, 1942; Spurling, 1992). Eventually, the Inka prevailed and the Colla were ultimately incorporated into the empire. Remaining Colla relocated to newly founded valley-bottom cities where production and surplus could be controlled by the Inka (Julien, 1983; Julien, 1988; Stanish, 2003) as it had been under Tiwanaku. I argue that this relocation was necessary for the Colla to be incorporated into the Inka Empire, because it disarticulated them from their ecological resistance built into the landscape and sociopolitical lifeways of *pukaras.*

5. Life at Ayawiri

Ayawiri is a fortified hilltop site located west of Lake Titicaca at an altitude of 4100 masl (Fig. 1). The residential sector of the site covers over 13 ha of the southern portion of a flat mesa (Fig. 2) and is surrounded by steep terraced hillsides for most of the west, south, and east sides (Fig. 3). Notably, abandoned raised fields can be seen from the fort in the valley east of the site off in the distance. Although Ayawiri is just one Colla hillfort, this case study is reflective of broader Colla lifeways. Many other Titicaca Basin hillforts are similar in layout and architecture and are also surrounded by terrace field complexes (Arkush, 2011).

Radiocarbon dates indicate that the population living in the fortress at Ayawiri during the LIP was not significant until CE 1275 (Arkush, 2015; Langlie and Arkush, 2016). This means that the rhythms of life were established at the site well after the collapse of the Tiwanaku. The establishment of lifeways , then, cannot be viewed solely as a rejection of or a reaction to Middle Horizon hegemony. Rather, life at Ayawiri was established in a preexisting context of warfare and cultural disintegration.

At Ayawiri, like many *pukaras* in the Colla region, there were concentrations of house and storage structures scattered across the hilltop within the defensive walls and separated by stacked stone compound

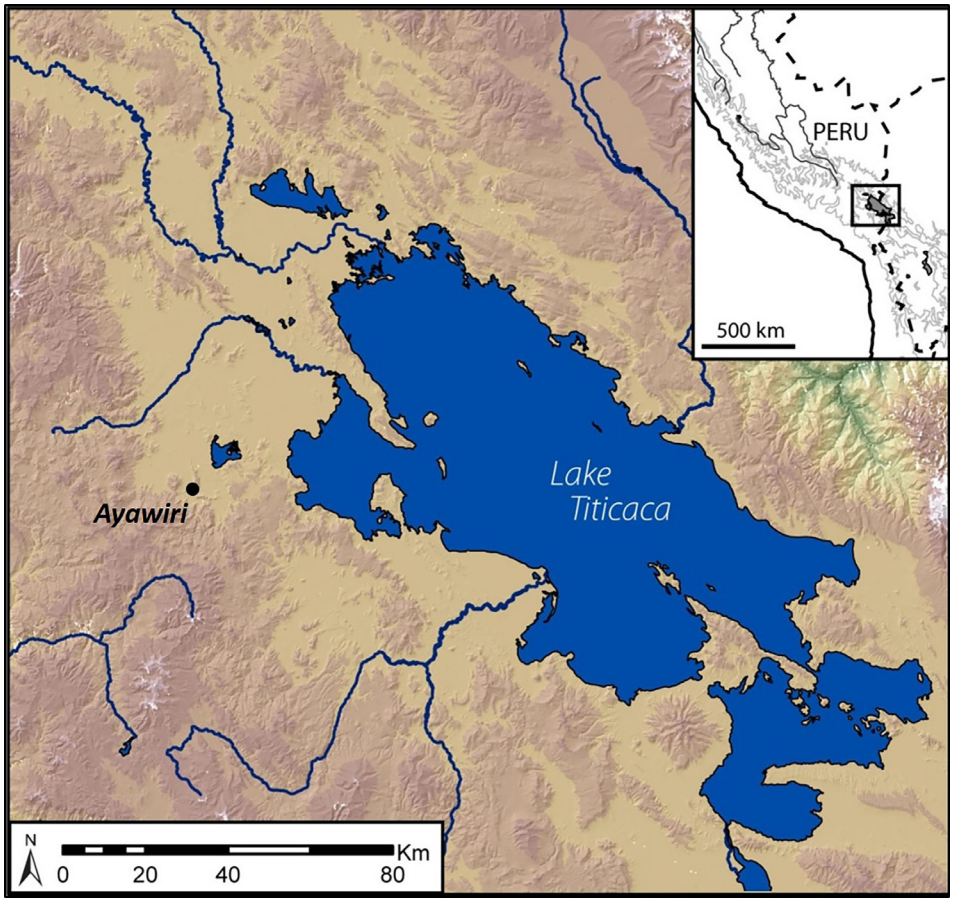

Fig. 1. Location of Ayawiri in relation to the *altiplano* and Lake Titicaca (map rendered by E.N Arkush).

walls (Arkush, 2008, 2011a) (Figs. 3 and 4). Research carried out by Proyecto Machu Llaqta, directed by Elizabeth Arkush from 2010 to 2012, documented approximately 120 compounds, within which there are at least 670 houses and 450 small storage structures (Arkush, 2011, 2014; Arkush and Eyzaguirre, 2012, 2013). Residents built this community and their lifeways in an intentional manner. This is evident in both the architecture, site layout, and occupancy (Arkush, 2018). For example, houses, storage structures, and kitchen structures are similar in form across the site. The layout of structures in each compound is also similar with houses and kitchens on the southern and western portion of each compound and storage structures on the northern and eastern side surrounding an open patio. Residents clearly had a preconceived understanding of how Colla domestic life should look and function (Arkush, 2018). Furthermore, this lifestyle was intentionally reproduced over centuries, evident in residents' choice to stay in this location generation after generation.

While the residents were integrated as a community by proximity of habitation and logistics of defense, an analysis of the organization of houses and storage structures at Ayawiri indicates that the politics of daily life were managed at the household level. Small groups residing in each compound managed craft production, food processing, crop storage, and consumption (Arkush, 2018). Except for small differences in the numbers of houses and storage structures within each compound, there is very little evidence that any one compound was more economically or socially elite than any other (Arkush, 2015, 2018). Based on the number of houses and kitchen structures, more than one nuclear family resided in each compound, probably extended kin groups or possibly *ayllus* (Arkush, 2011:114, 2018). For further information on the layout of houses, kitchen structures, storage structures, and artifacts in each compound see Arkush (2018) where she details these findings. In light of these data, this paper views Ayawiri extended family households, each of which occupied a compound or group of compounds, as equivalent to an extended kin-group, and possibly an *ayllu*. The terms households, kin-groups, and *ayllus* are understood to encompass equivalent groups of people at Ayawiri in the narrative that follows.

6. Terraces as ecological resistance

With this background in mind, I turn my attention to the agricultural terraces flanking the hillside surrounding Ayawiri. The hillfort itself provided residents with defensive areas to live. It is located on a hilltop that is a half-hour's walk from the tree-less valley bottom, making it difficult to access without being detected by those that lived there (Fig. 5). Hillforts in and of themselves could be considered a form of ecological resistance to hegemonic authority. However, living on a hill does not necessarily involve establishing ecological resistance. Rather, it is in the Ayawiri residents' farming activities that they defied domination by one another and neighboring ethnic groups.

Little previous archaeological research has directly targeted terraces in the *altiplano* (but see Chávez, 2012; Plourde, 2006). Instead, researchers have generally speculated about the date and cultural context of terrace construction and farming based on cross-cultural models and regional culture histories. Some researchers have argued that terraces were first constructed and farmed during the *altiplano* Formative period and then expanded during the Middle Horizon based on their close proximity to sites from these time periods (Albarracin-Jordan, 1996; Isbell, 1977; Stanish, 2003) and the recovery of ceramics (Chávez, 2012; Plourde, 2006). If so, terrace construction and use would have coincided with other markers of agricultural intensification, such as increases in the incidence of crop weed complexes (Bruno and Whitehead, 2003), that accompanied the rise of regional social

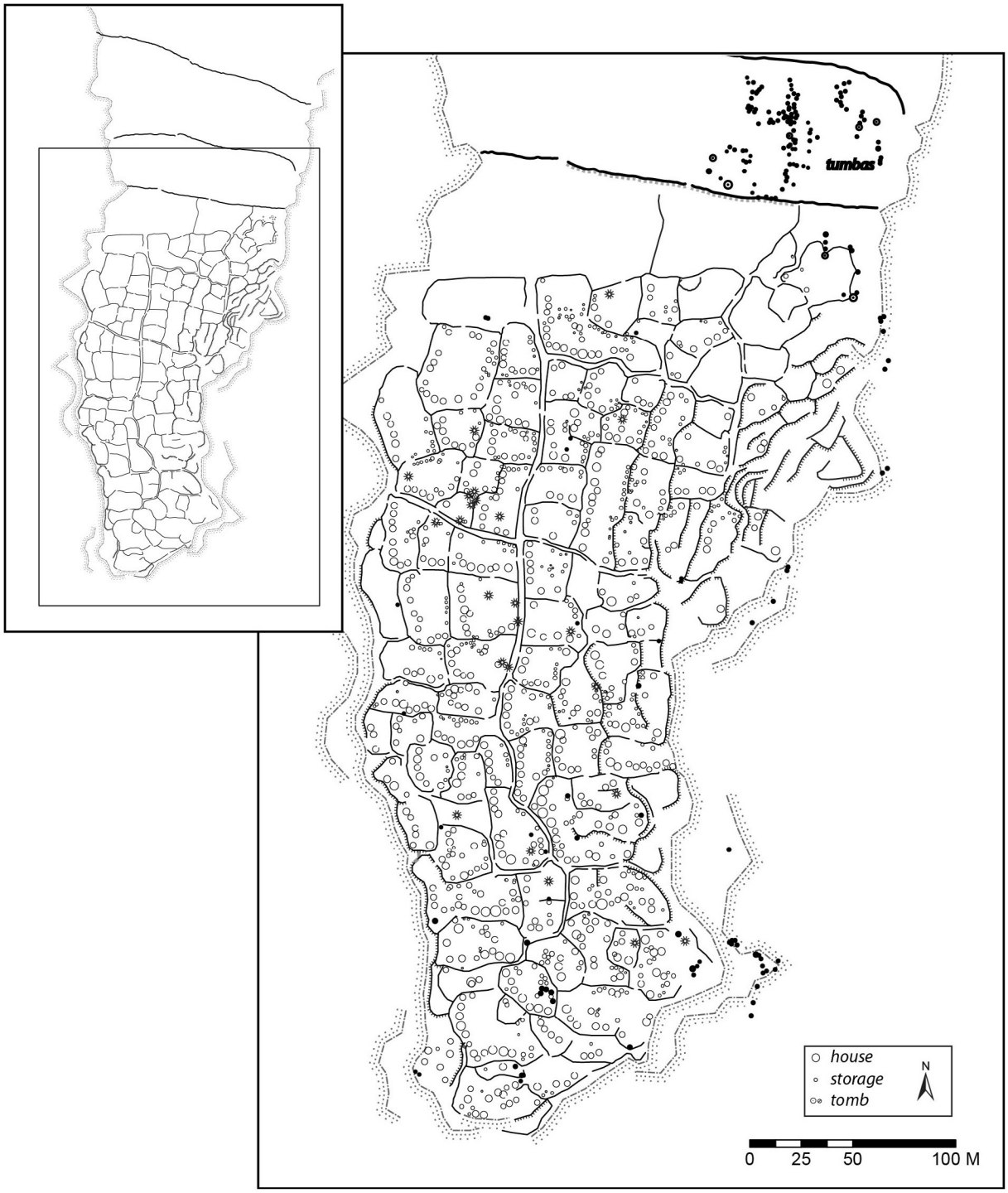

Fig. 2. Map of the fortified residential area at Ayawiri. Created by Proyecto Machu Llaqta and rendered by E.N. Arkush.

complexity and the centralization of political authority in the hands of hegemonic elites. Other scholars posit that the Inka were responsible for most terrace construction in the region (e.g. Janusek, 2008b) because only at that time was there a centralized political authority strong enough to organize construction, oversee labor, and schedule production.

What can be discerned about the prehistory of terraces at Ayawiri? The construction of this terrace system would have required massive labor inputs to build and operate. The terrace complex at Ayawiri was so massive it could have easily been seen by approaching enemies more than a day's walk away (Fig. 5). The hillfort itself would not have been visible from the valley bottom, but the terraces signaled the presence of the large community living there. In their monumentality, an aggressor would have seen the potential might of the Ayawiri Colla evident in their ability to transform hillsides into agricultural lands.

The terrace complex at Ayawiri was built during the LIP and then continued to be farmed and maintained throughout the LIP to the modern day based on AMS radiocarbon dating, ceramic *terminus-post quem* dates, and optically stimulated luminescence (Langlie, 2016). Even today, the community living at the base of the hillside uses the terraces as their primary land for growing crops and grazing livestock. The native crops grown there today include numerous varieties of

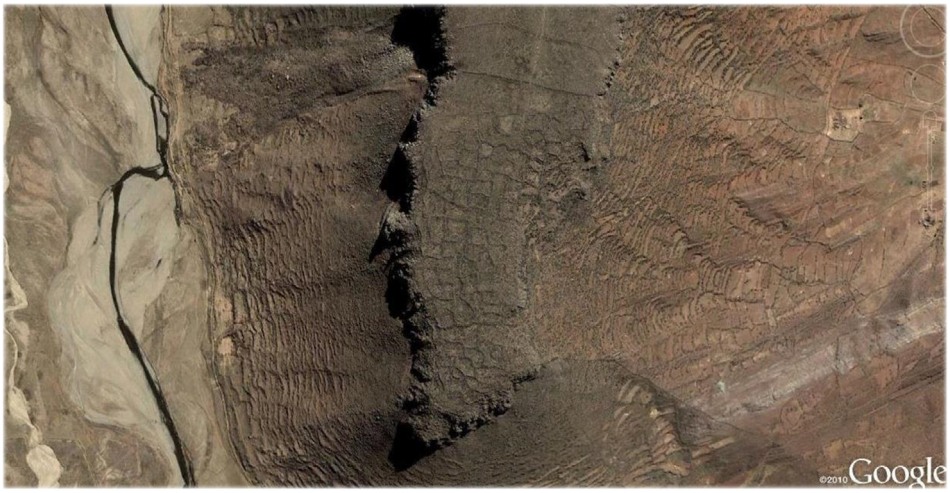

Fig. 3. Aerial image of the terraces that surround Ayawiri.

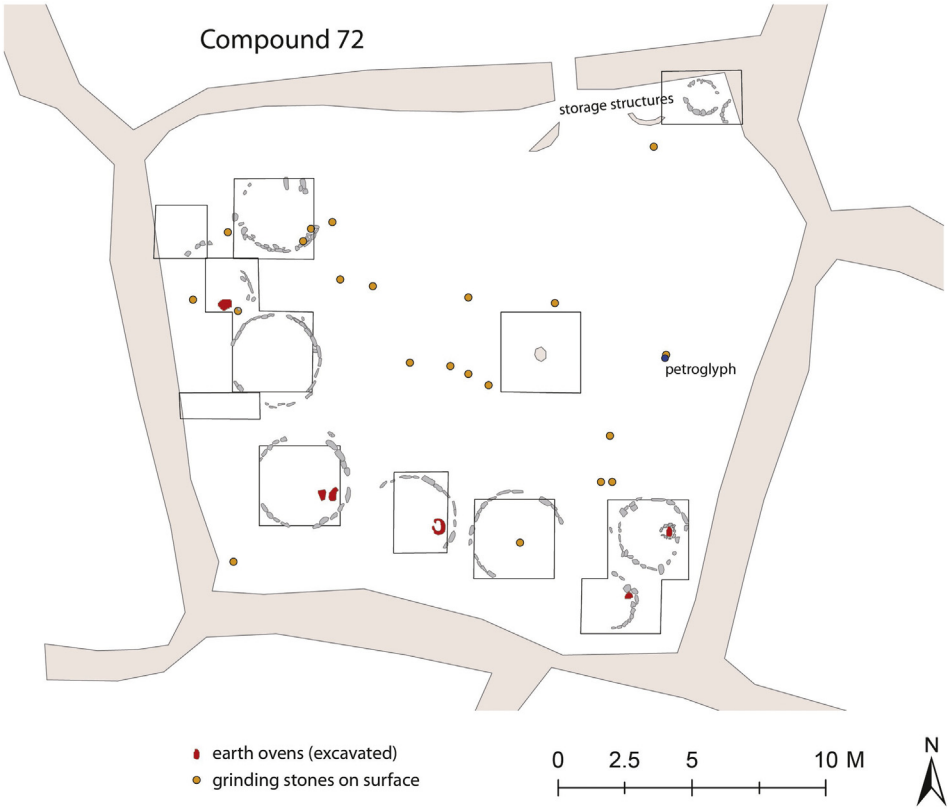

Fig. 4. Maps of a compound at Ayawiri that depicts the typical arrangement of house structures, storage structures, and "kitchen structures" (identified based on presence of small earth ovens and other quotidian cooking artifacts).

tubers including an array of potatoes, oca, and ulluco, as well as the grains quinoa and kañawa. Similar crops were grown and consumed there during the LIP (Langlie, 2016, 2018; Langlie and Arkush, 2016). Given the absence of evidence for hierarchical authority at the site or throughout the region during the LIP, it is likely that these terraces were also not constructed under the mandate of a centralized form of leadership. Rather, they were constructed by a community that cooperated for defensive reasons (see also Arkush, 2018; Ikehara, 2016; Roscoe, 2013).

The design of the terrace system also sheds light on the nature of authority at Ayawiri. If constructing the terraces was an activity sponsored by a central authority figure, we would expect planning and the direction of labor to result in overall uniformity in design and layout; whereas, decentralized labor organization often results in irregular field design (Donkin, 1979; Erickson, 1988; Kolata, 1993; Rodriguez, 2006). For example, the discernible linearity, remarkable masonry, and dimensions of high prestige Inka terraces reflect a high-degree of centralized planning (Niles, 1982). The Inka Empire is famed for having some of the most technologically refined masonry and architecture in the ancient world, which is also reflected in their agricultural systems. This can be seen in entire flights of terraces in Pisac, Peru that have walls enclosing stone stairways indicating they were planned as a whole (Donkin, 1979) or in the phenomenally sculpted Inka terraces of Moray (Fig. 6).

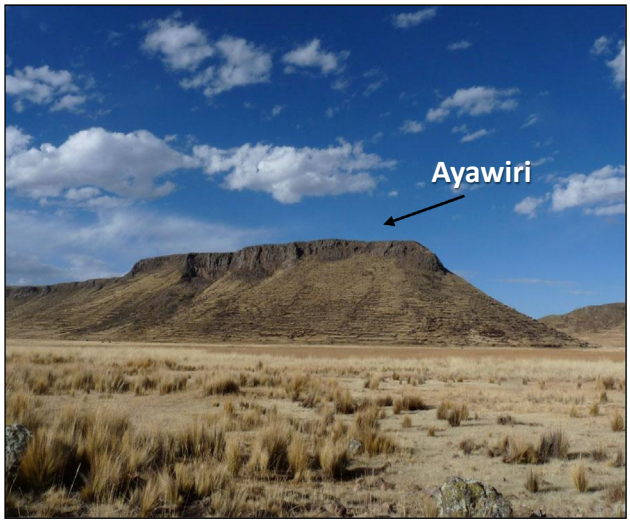

Fig. 5. Image of Ayawiri and the surrounding terrace complex from across the valley (image courtesy of E.N. Arkush).

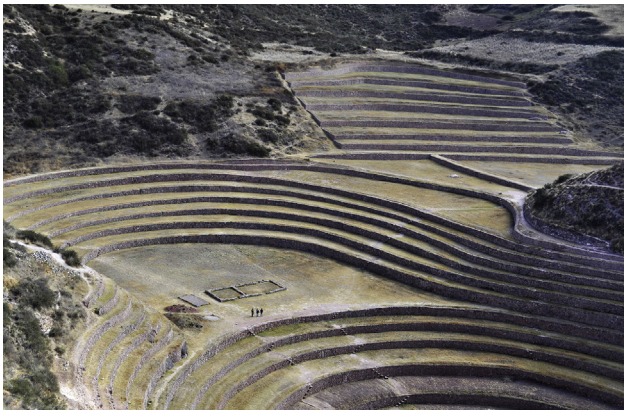

Fig. 6. Image depicts the uniform layout and masonry of planned Inka terraces at Moray, Peru.

Fig. 7. Image depicting the terraces that surround the entire mesa at Ayawiri. Also, note the vertical walls that radiate from the mesa to the valley-bottom.

However, the engineering of the Ayawiri terraces does not reflect uniformity. The terraces at Ayawiri are mostly of a type referred to as bench terraces (Fig. 7). Constructed on slopes that are steeper than a 20% gradient (FAO, 2000), bench terracing involves farmers building vertical stacked-stone riser walls horizontal to the declivity of hillsides

Fig. 8. Image of the face of a stacked stone riser wall cleaned of modern vegetation. Note the unworked stones that are irregularly and loosely stacked in various orientations.

and then embanking soil behind and atop risers (Spencer and Hale, 1961). This technique creates leveled land tracts that are congenial for crops. The lack of uniformity in Ayawiri terraces is evident in the fact that those adjacent to one another were quite variable in height. The tallest retaining wall measured over 5 m, while the smallest wall measured only 0.5 m tall. Similarly, the orientation of the terraces follows the curves and undulations of the hillside rather than a rectilinear layout characteristic of Inka terraces. There are also no enclosing stone staircases, like those in Pisac that would have facilitated easy movement by laborers from field to field. Some terraces at Ayawiri are so tall that you have to take a meandering path to access them. The riser walls were built using uncut, stacked fieldstones that are locally abundant (Fig. 8). This would have been much more expedient than quarrying and cutting riser stones. There is no uniformity in the size, placement, or orientation of the riser stones, and I have not observed evidence of clay or mortar used to consolidate the walls. These features indicate that there was no common blueprint to which terrace builders adhered. The irregularity in terrace spacing, architecture, size and masonry points to incremental, expedient, and small-scale labor regimes.

Excavation data indicate the Ayawiri terraces were gradually and incrementally built during the LIP, rather than in one massive episode like that of centrally planned field systems. One terrace in particular contained evidence of three LIP construction and maintenance events. Excavations uncovered two earlier LIP riser walls buried within the latest version of the terrace (Fig. 9) (dating methods reported in Langlie, 2016). This indicates that farmers built new terraces on top of and downslope of the old ones, likely to replace retaining walls compromised by erosion. These renovations were probably undertaken over several generations and demonstrate that individual or small groups of actors were responsible for the continued maintenance of the Ayawiri terraces.

In addition, stacked stonewalls radiate from the fortress down the slope to the valley bottom (visible in Figs. 3 and 7). Local farmers informed me these walls are used today to demarcate familial property ownership. If so, they could have been associated with divisions

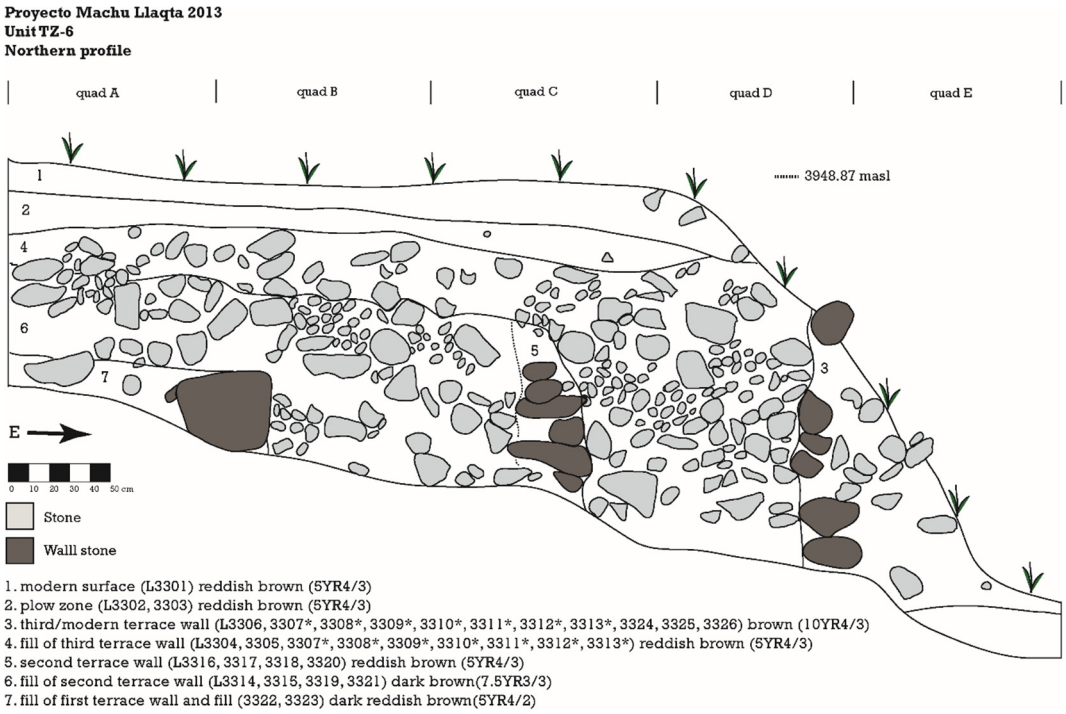

Fig. 9. Rendering of a terrace excavation profile illustrating earlier buried terrace walls. All wall constructions date to the Late Intermediate Period (see Langlie, 2016 for further details).

between lands controlled by different *ayllus* in the past. Other researchers have suggested that these walls also mark sectorial fallowing regimens (Erickson, 2000). Marking household and extended family possession of agricultural landholdings seems to be a long-held cultural feature in the Andes that was also documented in other terrace complexes (Arkush, 2011; Erickson, 2000) and abandoned raised field systems (Erickson, 1993). The marker walls that transect the terraces are comparable in architectural style, form, and composition to compound walls within the fortified residential sector of Ayawiri (described by Arkush, 2011, 2018), but there is no apparent correlation between compound groups and terrace walls that would indicate correlated ownership. The terraces run the length of the mesa, while the fortress is only located on the southern end. It is possible that each *ayllu* had designated tracts of land along the mesa. Nonetheless, both the compound walls in the fortress and the terrace walls that radiate down the slope consist of uncut locally available fieldstones loosely stacked upon one another, possibly indicating that residents marked ownership of space in the same way in the residential sector as they did on the terraces. These data reinforce the idea that extended Ayawiri households, possibly *ayllus*, delineated ownership of tracts of their terraces.

There is no evidence of extensive irrigation networks at Ayawiri. In the Colca valley, it is believed that prehistoric terrace construction, including irrigation networks, was planned and coordinated. Interconnected irrigation networks that cut through and underlie vertical and horizontal sections of terraces suggest that they were put in place during construction of the terrace complex (Treacy, 1987). To maintain constant water flow, each adjacent terrace would have to have been built in a precise orientation to facilitate water flow between terraces and through irrigation networks to adjacent field systems. This would have required much forethought and planning to build, and high degrees of cooperation and coordination between neighboring farmers. In contrast, the Ayawiri terraces are rainfed. This means that farmers on neighboring terraces were not required to cooperate with one another to access essential water for their crops. Unlike irrigated terraces, the productive capacity of each individual plot is independent from every other terrace field plot.

Maintaining irrigation systems also requires higher degrees of cooperation than non-irrigated fields. Today, in an annual ritual, Colca valley farming communities come together to muck out irrigation channels. In this way, the irrigation system entangles farmers socially and politically in “day-to-day logistics of water distribution… [and] seasonal and annual irrigation system management and operations” (Wernke, 2013:276). Incorporating irrigation in terraces might have raised crop yields during the LIP. Regional annual precipitation varies greatly from year-to-year, from approximately 500 mm to over 1500 mm (Roche et al., 1992:87). Furthermore, during the LIP climate proxies indicate there was an extended drought (Abbott et al., 1997; Baker et al., 2009; Thompson et al., 1998, 1985) that would have made rainfed field systems a rather risky endeavor. Nonetheless, Ayawiri farmers constructed terraces that were rainfed. This suggests that they prioritized agronomic independence over hydrological features that would guard against crop loss due to drought.

At Ayawiri, households also apparently controlled the allocation of crops post-harvest. The location of storage structures, processing equipment including grinding stones, and kitchen structures within delineated compounds indicate that extended family kin groups were responsible for the storage and preparation of their own food (Arkush, 2018; Langlie and Arkush, 2016) (see Fig. 4). This contrasts with the strategies of the later imperialist Inka, for whom one-third of individual farmers’ crops were given as a tax to the state, stored in collective silos, and redistributed to residents during state-sponsored activities (D'Altroy and Hastorf, 1984). By managing their own agrarian production, food storage, and preparation, extended family households did not need to rely on their neighbors for basic sustenance, nor shackle themselves to an imperial agricultural system of subjugation, enforced redistribution, or taxation. Because production was controlled by securely situated kin-groups, control over food could not be used by aspiring hegemons as a source of power.

Collectively, the terraces at Ayawiri form a monumental landscape feature. Nonetheless, evidence from the design and construction of the terraces indicate that they were built expediently by small social units, probably extended families or even *ayllus* residing in compounds at the hillfort. The undulating design and layout, as well as the dissimilarity in size, height, masonry, and the fact they were not irrigated indicate that

there was a lower degree of planning that went into their construction than that of other terrace systems in the Andes, or even the raised field systems that characterized the earlier Tiwanaku agricultural strategy in the region. Once built, the fixed features of the terraces served to perpetuate the newly established decentralized authority structures of the Colla. Individually acting farmers worked to incrementally build and rebuild sections of terraces, as evident in excavation profiles with multiple construction events. Vertical wall markers radiating from the mesa to the valley signaled and reminded farm families of their individual landholdings and their responsibility for their own subsistence. The lack of irrigation ensured farmers or farming households working on each individual plot could work independently or autonomously; in other words, after the initial allocation of land, the Ayawiri agricultural landscape did not necessitate the strong cooperation, coordination, or leadership evident in other agricultural field systems.

7. Discussion

Drawing on these data, it is evident that residents at Ayawiri engaged in two scales of ecological resistance: they resisted the establishment of hierarchical leadership at the local level and they resisted external subjugation. To resist hierarchical leadership, residents built an agricultural system that depended on the labor organization of small social units. Extended family Colla households were able to function much as any smallholder farmer; that is, they acted in their own self-interest as "homologous magnitudes" (Marx, 1963 [1852]:124). When farmers produce the goods that are biologically necessary for survival, they are less inclined to succumb to any hegemonic authority. Drawing on collective action theory, it has been established that when disparate interest groups control and maintain resources, access to public good and services are negotiated more equitably, whereas when interest groups control and maintain few resources, leaders hold the upper hand and do not allocate goods and services equitably (Blanton and Fargher, 2008, 2010). This means that when commodities are created and controlled by a wide set of actors, there is a fairly equitable distribution of goods. The self-sufficiency of the Ayawiri Colla provided an autonomy of action because they were not reliant on larger political institutions or exchange networks to meet their basic nutritional needs. In the case of Ayawiri households, their agrarian autonomy was a choice made by local residents that prioritized the suppression of status difference and, in turn, resisted centralizing tendencies towards despotic and imperial rule. Through its very existence of its decentralized economic organization, Ayawiri opposed the reconstitution of a Tiwanaku-like state entity.

The *ayllu*-like social structure evident within the fortress layout of Ayawiri also seems to form the organizing principles for the construction of agricultural terraces or vice versa. During the LIP, Ayawiri households probably began to build the terrace complex using household labor as a means to ensure food security. Food, after all, is a biological necessity. Residents could have chosen to cooperate and coordinate their labor. More hands make nimble work, so building terraces would have been more expedient with a coordinated labor force. However, the organic layout of the terraces and the incremental construction indicate that construction coordination was limited to small coordinated groups.

The community chose extended kin-group autonomy in both the construction and maintenance of terraces over intergroup entanglement that may have buffered against risk of inter-annual food shortages for the entire community. Along these same lines, the radiating walls demarcating ownership of vertical tracts of terraces could be a commonly observed form of field scattering, where farmers plant crops in various elevations that correspond to varying microclimates to buffer against crop loss (Browman, 1997; Bruno, 2011; Marston, 2011). Furthermore, the Ayawiri community chose to produce, process, and store food among these same small groups. If there were a food shortage, residents would have had to rely on their neighbors. As such, managing the risks of food shortages would have taken place among and between extended kin groups. These risk reduction strategies stand in contrast to more integrated and formalized forms where the governance can act as a safety net providing for those in need when there is a food shortage. Examples of this include pooling of labor, land, and/or crops (see Marston, 2011; Zori and Brant, 2012). In these more integrated and formalized forms of risk reduction, individuals and groups give up their autonomy in exchange for food security. However, the Ayawiri community chose risk reduction strategies that prioritized extended kin-group autonomy.

Once the terrace complex was built, the landscape produced a positive feedback loop that perpetuated labor regimes of *ayllu*-like small social units. These intertwined social and economic structures diminished the ability of state-level entities to coercively institute administrative control over people and material goods (Motyl, 1999:135–136). Once built, the terraces were physically organized in a way that facilitated continued cultivation and maintenance by decentralized household-led labor groups. As such, there was no preexisting agricultural administrative unit that outside entities could co-opt to control Ayawiri's food production and distribution. Additionally, by structuring labor around small social units, the terraces continued to suppress local aspiring leaders' ability to rise to positions of permanent power. In this manner, the terraces functioned as a tool of ecological resistance when they were built and later in time.

In contrast to the decentralized organization of agrarian fields and labor, Spanish chroniclers who visited the region during the 16th century recorded that there was at least periodic centralized leadership among the Colla. In heterarchical societies, temporary hierarchical leadership arises in necessary situations, but when the situation ends, so too does the status of leadership (Crumley, 1995:4). For example, the Adena-Hopewell of the Middle Woodland period in Eastern North America were largely an egalitarian kin-based society where leadership was fluid and situational (Henry and Barrier, 2016). Among the Colla, *sinchis* came to power to organize and ready communities for battle (Arkush, 2008). There is a paradox here between ethnohistoric data and our archaeological understanding of the Colla. Even though warlords were able to coordinate community activities for militaristic activities, there is no architectural or material wealth differences between households at most hillforts that would be indicative of warlord status at these sites (Arkush, 2011, 2018). We see no evidence of *sinchis* archaeologically at Ayawiri.

Furthermore, it is thought that warfare was only seasonal in the Andes. It is thought that warfare in the prehistoric Andes was carried out only during the dry season after fields were harvested (D'Altroy, 2002; Rostworowski de Diez Canseco, 1999). With low labor needs on the home front between planting cycles, farmers transformed themselves into warriors, and *sinchis* temporarily harnessed their power to lead a season of battles. With the onset of the rains in August that marked the planting season in the *altiplano*, warriors probably put down their weapons to focus on tending their fields. Thus, the idea that conflict breeds durable leadership and subsequent intensive agricultural regimes is rejected in the case of the Ayawiri Colla. Leadership, then, was strictly situational. *Sinchis* were never able to turn this status into economic authority (contrast Kirch, 1980).

How did the community prevent *sinchis* from permanently maintaining status and leadership? They did this by maintaining an agricultural landscape and labor force managed by small heterarchical social units. Fieldstones marked agricultural lands likely possessed and managed by *ayllu* or at least *ayllu*-like household groups. Then, crops were stored in privatized storage units within household compounds at the site. The Colla's long-term farming practices may be seen as a kind of weapon of the weak (sensu Scott, 1985). The Ayawiri fields were managed and crops were produced and distributed through household labor every day, every year, every generation. The long-term effects of these repeated actions undermined the aspirations of even famed local *sinchis* to achieve durable leadership.

As a separate, more traditional act of resistance, the Colla engaged in militaristic activity to defend against subjugation. In support of their militarism, they built a defensible food system that ensured that they never had to depend on other groups for basic sustenance. Macrobotanical evidence indicates that trade networks broke down and all crops were locally produced at Ayawiri (Langlie, 2016; Langlie and Arkush, 2016). Copious stores of quinoa, kañawa, and potatoes were recovered from the residential area of the site. Unlike earlier times in the region, very few lacustrine or riverine plants were found at Ayawiri, so the Colla living there appear to have been using the landscape in a new and novel way. No corn or other exotic goods were found in macrobotanical samples. The Ayawiri community was not dependent on imported grains, unlike previous generations living in Middle Horizon Tiwanaku. Extended families living in compounds produced, processed, stored, and consumed all the food they needed. In this manner, each extended family household functioned independently from others living at the site, much like how the terraces were rain fed, maintained, and cultivated independently from every other terrace on the adjacent hillside. The Ayawiri community detangled themselves from extractive imperial power of earlier periods in the region through their new agricultural strategy.

By moving from valleys to hilltops during the LIP, the Colla could more readily defend themselves, and their food, from an aggressive enemy. Ayawiri residents built their fields near their homes, and rarely ventured further for economic reasons (Langlie, 2016; Langlie and Arkush, 2016). Their fields extended from steps outside the fortress walls to no more than 300 m downslope. The close proximity of fields to the hillfort ensured that during a violent assault, hillfort residents could defend the food growing in their fields from attack, raids, or looting. Based on macrobotanical analysis, Ayawiri residents were quite successful quinoa and potato farmers (Langlie, 2016), and could easily withstand a siege by relying on their food stores. Excavation data indicate that the terraces were maintained over several generations during the LIP, suggesting that the decisions to build and live on the land in this specific way continued for several centuries. In building a defendable food system, and a food system that aided defense, Ayawiri residents created the conditions to ensure long-term community autonomy and resistance to external subjugation by aspiring enemy conquerors such as the Lupaqa, Pacajes, Inka, or even other needy Colla hillforts.

Even if a local or extra local enemy wanted to conquer the Colla, they would have had a hard time doing so. When there is a hierarchical authority figure, toppling the leader allows an enemy to easily take control of the subordinate group. For example, history tells us it took only about 180 Spanish soldiers to conquer the pan-Andean Inka Empire because the Spanish were able to quickly take the Inka leader Atahualpa hostage. However, Colla warlords did not possess despotic or even durable power. Due to the loose affiliation between hillforts and household management of agrarian labor, production, storage, and processing the Colla would have been extremely difficult to conquer. If an enemy subdued one Colla community, other hillfort communities would not be likely to acquiesce to the new authority regime. An enemy would have had to topple hillfort after hillfort, and household after household in order to take control of the Colla. Even if an enemy had seized Ayawiri, Colla people living at other hillforts would not have to surrender because their economies were not interdependent.

When the Inka took interest in incorporating the *altiplano* into their empire in the 15th century, the Colla were one of their fiercest enemies. Ethnohistoric sources indicate that it took the Inka three years of bloodied battles to finally conquer the Colla (Rowe, 1942; Spurling, 1992). Why were the Colla so difficult to overthrow? Not only did the Inka have to undertake military conquest and cultural imperialism of the Colla, they also had to take an ecological approach to overcome the resistance entrenched in their landscape and economy. To do this, there is evidence the Inka rapidly displaced the Colla from their hillforts (Arkush, 2017), thereby toppling the ecological resistance built into their landscape. Remnant populations moved (or were moved) to valley-bottom villages located strategically on Inka trade routes where imperial authority could monitor and manage labor, production, and the distribution of surplus (Arkush, 2011; Julien, 1983; Stanish, 2003). Surviving Colla people and their offspring participated in the *mit'a* system by provisioning the Inka with surplus foods and labor (Murra, 1986:52). The capital city of the Colla region, called Huatuncolla, gained prominence as a way station and center of empire-wide trade located on the main highland Inka road (Hyslop, 1984; Julien, 1983).

The prestige that the Colla once held in the *altiplano* was said to have been honored in the name for the entire southern quarter of the Inka Empire: Collasuyo or "quarter of the Colla" (Stanish, 2003). Socially, politically, economically, and ecologically the Colla people were integrated into the centralized authority structures of the Inka Empire until the Spanish conquered the Andes approximately 90 years later. Through the relocation of their settlements and the reorganization of their labor force, the Colla people were subject to the ecological imperialism of the Inka Empire.

8. Conclusions

In the case of Ayawiri, the built agrarian landscape and farming practices were central to subverting local and extra-local leadership. At first, the terraces were probably built during the LIP to aid food production for those defensively living in the hillfort. Notably, these residents were occupying a new ecotope during the LIP than their ancestors who lived in valley bottoms under the united rule of the Tiwanaku state. In doing so, they broke ties with previous agricultural landscapes and entangled economic relationships of the Tiwanaku. Nonetheless, the relic raised fields would have reminded the Colla living in hillforts of hierarchical leadership and extractive relationships of bygone eras.

Ethnohistoric sources tell us situational and seasonal power was important to militaristic activities during the LIP. A *sinchi* could have used his charisma or status from militaristic activities to claim lasting status. As of yet, we have not been able to detect any significant evidence of elites in archaeological household data or burials in the region. This not surprising, because the Colla living at Ayawiri worked daily and generationally in their agricultural to reject the development of concentrations of authority among residents. To suppress any one household or individual from gaining status or maintaining military prestige, farmers locally produced and managed their own foodstuffs and did not enter into any relationships of agrarian interdependence. Constructing a new agricultural landscape and farming strategy was also central to their resistance at the local and supra-local scale. Once built, this landscape perpetuated a certain type of decentralized labor organization that reinforced local autonomy of the Ayawiri people.

In the absence of irrigation networks or other features that would have environmentally linked neighboring farmlands, there were fewer demands on residents living at Ayawiri to cooperate with one another or acquiesce to a local leader compared to other types of field systems. In their daily activities, the Ayawiri Colla acted to suppress authority figures from achieving lasting leadership roles within their community. While the community was brought together for defensive reasons, the household-level organization of their agrarian system helped the Colla, for a time, powerfully resist Inka subjugation. Overt military operations and the construction of hillforts could have increased the community's defenses, but these strategies are only successful as long as the community in the hillfort can sustain itself. To effectively defy supra-community hegemony by aspiring leaders or enemy groups, Ayawiri residents built a terraced landscape that facilitated the production of food for defense and defendable food.

Envisioning terrace agriculture functioning as a form ecological resistance stands in contrast to traditional models on the construction and maintenance of monumental-scale agricultural field systems. This case study demonstrates how landscape transformation into

agricultural field systems facilitates and perpetuates ecological resistance. More broadly, studying ecological resistance has the potential to shed light on an alternative reason driving humans to build new agrarian landscapes and systems of production on daily, annual, generational, and monumental scales.

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Conflict of interest

The author has no competing interests to declare.

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