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# *Community Labor and Laboring Communities within the Tiwanaku State (C.E. 500–1100)*

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## ABSTRACT

Understanding how work was managed and who participated in state-level societies can help elucidate daily activities as well as community development within an emerging complex society. Tiwanaku, with multiethnic neighborhoods in the Titicaca Basin, Bolivia and colonies near present-day Moquegua, Peru, provides a comparison of labor between groups. Specific skeletal evidence of activity (i.e., musculoskeletal stress markers and osteoarthritis) was evaluated to infer how habitual activity varied within this state. Labor rates show that laborers did not work at the behest of elites and results suggest instead, that people worked as reciprocal laborers in a guild-like system. [Organized labor, Bolivia, Peru, Musculoskeletal stress markers, Enteses, Osteoarthritis, Practice theory]

The organization of labor as part of resource management is one way to understand the development of complex societies. People in the past worked at various jobs, creating communities based around tasks, such as craft production or farming, as well as building homes and homelands for themselves (e.g., Brumfiel 1991; Costin 2004; Costin and Earle 1989; Crumley 1987, 2007; Crumley et al. 1987; D’Altroy 1992; D’Altroy and Earle 1985; Earle 1997; Kunen and Hughbanks 2003; Levy 2006; Moseley 1975). Often, these workers are defined archaeologically through the product of their labor, such as monumental architecture, ceramics, or lithic tools. While this evidence does provide information about people’s daily life, additional knowledge can be gained from a bioarchaeological methodology that uses the evidence of labor and activity on human skeletal remains, complimenting an artifactual approach, and engaging with the actual individuals who lived this lifeway. Remembering that these people were once a community is also essential. At the very least, a community involves some kind of shared background where group members recognize each other as different from others (i.e., “us” versus “them”) (cf., Barth 1966; Goldstein 2000a; Gupta and Ferguson 1992; Isbell 2000; Reycraft 2005; Yaeger and Canuto 2000).

How to evaluate group membership can become complicated when skeletal remains are the focus, as bioarchaeologists may face challenges associated with an incomplete burial record due to issues like skeletal preservation, sample representativeness, or choice of excavation location (e.g., Cook and Buikstra 1979; DeWitte and Stojanowski 2015; Gowland 2006; Halcrow and Tayles 2008; Hoppa and Vaupel 2002; Roberts and Mays 2010; Sofaer Derevenski 1994, 1997; Waldron 1994; Wood et al. 1992; Wright and Yoder 2003). In addition, questions posed by Canuto and Yaeger (2000) in *The Archaeology of Communities* on how to define past communities still stand, and must be reengaged from a nuanced perspective on how we can define “community” from skeletal remains and burial populations (see Chapter 2 of this volume by Kakaliouras for a review). Of the theoretical approaches to community Yaeger and Canuto (2000:3) describe in their introductory chapter, practice theory provides a useful way to address group labor and civic membership, as people’s lives can become inscribed on their physical bodies via their regular daily habits (Bourdieu 1977; Budden and Sofaer 2009; Merleau-Ponty 2013; Sofaer 2006). Through the repeated practice of laboring, the household tasks executed and the occupations people perform can

set them apart from others within the larger society. These jobs may have been done at the behest of leaders of their society for maintenance of their civilization, or for members of their peer group as part of their social or familial requirements. Whatever the reason, this agent-oriented approach considers the people performing these activities as part of a past community. Moreover, Yaeger and Canuto (2000:5-6) note that a within-region but supra-household pattern, along with a limited time frame of cultures studied, makes a good and flexible way to discuss community archaeologically while also avoiding reification and essentialization of this concept.

Using these ideas on societal formation, labor, and community, this chapter focuses on the Tiwanaku civilization. This culture formed a state-level society around C.E. 500 in the Andean highlands region of the Lake Titicaca Basin, and expanded (ca. C.E. 500–650) into a lower elevation colony near present-day Moquegua, Peru (Figure 4.1) before its collapse in both areas around C.E. 1100<sup>1</sup>. My research addresses patterns of habitual labor observable on the bones of people who lived in the Tiwanaku state using specific skeletal evidence of activity (i.e., musculoskeletal stress markers and osteoarthritis) in order to understand what life was like for people working within this culture. The Tiwanaku heartland and hinterland provide an ideal opportunity to compare activity between individuals from these two areas. In addition, it also provides the opportunity to examine the formation of smaller laboring “communities” within its variety of multiethnic neighborhoods<sup>2</sup> (Becker 2013; Berryman 2011; Blom and Janusek 2004; Couture 2003; Couture et al. 2008; Couture and Sampeck 2003; Goldstein 1993a, 2000b, 2005; Janusek 1999, 2003, 2005; Janusek and Blom 2006; Vallières 2010, 2012). My goals involve showing how the bioarchaeological evidence of labor can define different working communities at various levels, and to discuss how each fits within this emerging complex society.

## Tiwanaku’s Background and Cultural Context

Archaeological excavations have shown that the main heartland or core of the Tiwanaku state emerged around C.E. 500 in the high, flat plains of the Lake Titicaca Basin, Bolivia with the main city of Tiwanaku emerging as an important population center with growing cultural and political influence among the Titicaca Basin’s residents (Kolata 1986, 1993a). Within the city, distinct neighborhoods (i.e., *barrios*) developed around the municipality’s center, archaeologically noted as home to various peoples, such as elites, stone tool manufacturers, potters, weavers, or herders (Couture et al. 2008; Couture and Sampeck 2003; Geisso 2011; Janusek 1999, 2005, 2008; Rivera 1994;

Vallières 2012). Initially, these barrios were thought to be focused on supporting elite settlements, with influence declining the further away one was from the “center” of elite power. This idea was described as a “concentric cline of the sacred that diminished in intensity from the city core to its far peripheries . . . . Inhabitants of the Tiwanaku occupied physical space in accordance with their relative social and ritual status” (Kolata 1993a:93-94; 2003). Kolata (1997:253) also suggested that the Tiwanaku city’s whole purpose was for servicing elites and their aristocratic lineages, and that Tiwanaku urbanites and craftspeople serving the aristocracy enjoyed high status living.

More recent excavations and analyses of the Tiwanaku culture instead suggest that independent households or larger artisan collectives performed craft production autonomously or semiautonomously, especially in their social and exchange relationships (Bermann 1994; Goldstein 2005; Janusek 1999, 2004, 2008; Rivera 1994, 2003). Bermann (1994) and Janusek (1999) note that regular household activities and their associated artifacts (e.g., food processing lithics, ordinary textiles, and utilitarian hoes for agriculture) occurred in areas of focused craft production, suggesting household living more than specialist elite-production enclaves. Goldstein (2005:77) described this style of labor organization, combining urban and craft living, as “embedded in Tiwanaku’s diverse and segmentary social substructure and not dictated by the demands of patrician sponsors.” Janusek (1999) attributes these “embedded” craftspeople, who were not attached to elites but also not strictly independent, as a way the Tiwanaku state dealt with political integration without forcing assimilation or loss of corporate identity. As such, the closest parallel to these embedded neighborhoods may be the Western notion of a labor guild where work was small-scale, and social capital built through craft production seen as for the good of the larger society (Epstein 1998; Jovinelly and Netelkos 2007; Kieser 1989; Ogilvie 2004; Vardi 1988). In addition, the members of each Western guild community identified with her or his work (e.g., masons, goldsmiths, woodworkers, weavers, potters), even adopting the trade as a surname for identification. Thus, it is likely these Tiwanaku neighborhoods would have been responsible to the larger community for the production of various goods in a reciprocal environment that was not elite-driven. Instead, crafts would have been for the general public, while the crafting process also reified each local community’s barrio identity (Janusek 1999:125).

In addition to crafting, during Tiwanaku times and in association with the urban environment, pastoral and agricultural production increased, likely to support the growing population<sup>3</sup> (approximately 20,000–40,000 people). The city of Tiwanaku established control over local agricultural

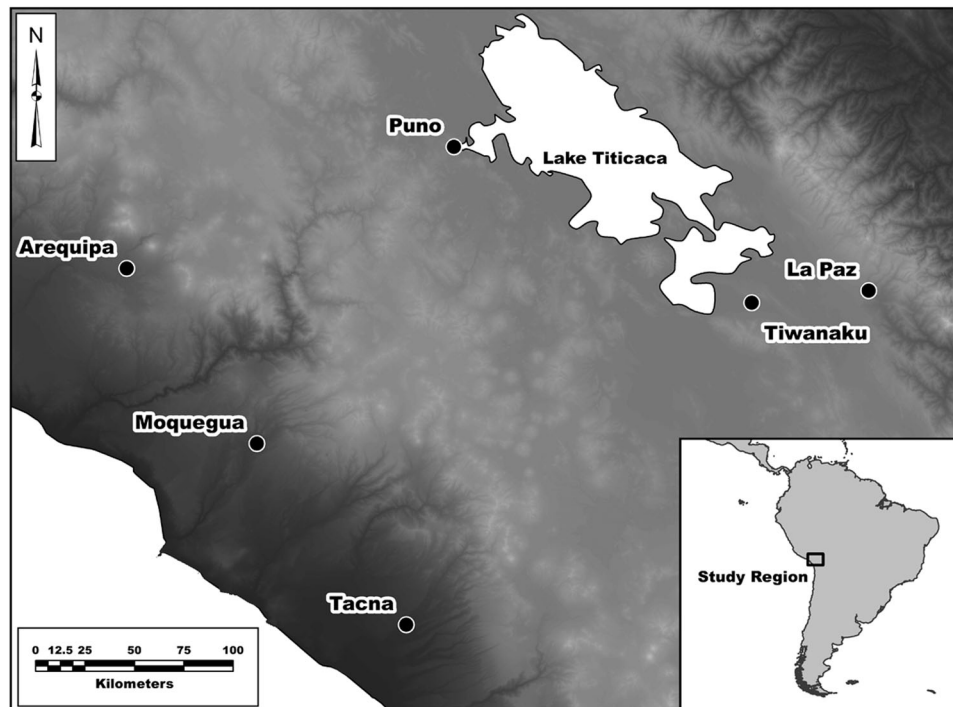


Figure 4.1. Map of heartland core Tiwanaku area in the Lake Titicaca Basin of Bolivia around the present-day town of Tiwanaku and the hinterland colony region near the present-day town of Moquegua, Peru.

production centers (i.e., raised-field agricultural beds) in the nearby Katari Valley with increasing local control of trade routes and an emphasis on an agro-pastoral lifeway (Janusek 2008:20). Bandy (2001:204) interpreted many of these changes as a successful strategy involving a system of labor management. This system increased political and ideological control with greater levels of ceremonialism and large-scale feasting, so that by C.E. 500, “Tiwanaku was a city [that] had become capable of dominating the entire Titi-caca Basin politically, economically, and militarily” (Bandy 2001:204).

After the advent of the state in C.E. 500, Tiwanaku-style material culture was also found increasingly farther away from the heartland area in the warmer, lower-elevation hinterlands. Prior to this expansion, there is very little evidence for control over lowland areas, just trade exchanges (Goldstein 1989, 2000a, 2005; Goldstein and Owen 2001). Archaeologists (Albarracín-Jordán 1999; Goldstein 1989, 2005; Janusek 2004, 2008; Kolata 1993a, 1993b) generally agree that this expansion to lower elevation areas was a political one. The Tiwanaku peoples had a wish for luxury items, such as maize or coca, which can only be abundantly grown at lower elevations and in warmer climates. Goldstein (1989:251) noted that sometime within C.E. 500–650, Tiwanaku peoples arrived in lowland valleys, such as

the Moquegua Valley of Peru, “suddenly and in force,” bringing Tiwanaku-style material culture with them<sup>4</sup>. In this region, colonization was primarily focused on riverine agro-pastoral production in three different areas (i.e., Omo, Chen Chen, and Rio Muerto). The control of these important agricultural lands would have secured the maize supply beyond levels that could have been traded for in this pre-market economy, especially as *chicha* (fermented corn beer) was important for ritual feasting to both heartland and hinterland peoples<sup>5</sup> (Berryman 2011; Goldstein 2005).

During C.E. 800–1100, increased construction around the city of Tiwanaku occurred alongside mass produced Tiwanaku-style ceramics (Janusek and Kolata 2004) and intensified agricultural production in the Katari Valley (Bermann 1994; Janusek 2004, 2008; Janusek and Kolata 2004). Janusek (2008:192-193) noted that “raised-field farming became the signature productive regime of the Lake Titicaca Basin.” Other agro-pastoral activities (e.g., herding, fishing, and rain-fed farming) would have been lower status tasks as the main push was on raised-field crops. These agricultural goods funded the cyclical feasting that helped Tiwanaku’s residents negotiate power relations (Janusek 2008:193).

The change in agriculture intensification may have had a direct impact on lower elevation colonies. After

C.E. 900, a destruction and rejection of Tiwanaku-style material culture in the Moquegua Valley coincided with the Tiwanaku state losing control of this region (Goldstein 1993b:42). In addition, the focus on agricultural intensification in the highlands had eventual negative consequences in the Titicaca Basin. The region underwent a long-term drought that started around C.E. 1000 and could have been a factor in the collapse of Tiwanaku about 100 years later (Binford et al. 1997; Erickson 1999, 2006; Kolata et al. 2000; Moseley 1997; Ortloff and Kolata 1992). Any major construction projects were discontinued by C.E. 1000, and around this time, monuments associated with elites and elite ancestors were ritualistically defaced and buried. After C.E. 1100, populations shifted from large, urban centers to small, hilltop fortress settlements (*pukaras*) (Albarracín-Jordán 1992; Arkush 2011, 2012; Stanish 2003; Zovar 2012).

## Materials and Methods Used to Study Labor and Activity

To examine activity differences within different areas of Tiwanaku society, I compared 1,235 adults from the two areas: the heartland in Bolivia, which had 452 individuals, and the hinterland colony in Peru, which had 783 people. I evaluated all individuals for two skeletal measures of physical activity: musculoskeletal stress markers (sometimes referred to as entheses) and osteoarthritis. Because bones and muscles work in conjunction with each other while tasks are performed, my primary interest was in patterns and levels of activity in order to understand the social structure of labor in the various laboring communities of the Tiwanaku state. In order to do this, I looked at labor in the Tiwanaku state from four different spatial perspectives: (1) heartland versus hinterland colony; (2) heartland Tiwanaku Valley versus the Katari Valley; (3) between each of the three hinterland colonial settlements; and (4) within each highland valley (i.e., within the Katari Valley, and within the Tiwanaku Valley). The fourth objective was especially important in this research per the previously reported multiethnic communities of laborers and possible elite peoples, which could provide bioarchaeological evidence of neighborhood-based work groups.

In order to estimate labor, I first evaluated the evidence of musculoskeletal stress markers within Tiwanaku skeletal populations. Prior medical and bioarchaeological research (e.g., Bridges 1989; Churchill and Morris 1998; Yu et al. 2011) has shown that certain tasks, like farming, show an increase in muscle mass over an individual's lifetime. Since muscles work like bony levers for the underlying skeleton, and where the muscles attach to bone as a person increases muscle mass, so too can the connection points on bone grow

and strengthen. The attachment points, or musculoskeletal stress markers, can help identify directional movement in kinds of activities people did as well as levels of physical labor such as workload. Overall, I looked at 37 muscle attachment points and sorted them into five groups according to location on the body: upper arm (i.e., shoulder movement), lower arm (i.e., forearm movement), mid-body (i.e., hip movement), lower body (i.e., knee movement), and feet (i.e., ankle and foot movement). For each point, a score of present or absent was assigned.

Osteoarthritis (OA) was the second activity indicator I used. Osteoarthritis shows injuries helpful in determining repetitive movement as it can measure the same motion used over and over again, such as grinding grain or weaving textiles. I looked at 24 joint surfaces within seven joints: shoulder, elbow, wrist, sacroiliac, hip, knee, and ankle. For each individual, the multiple surfaces within each of the seven joints were noted as present or absent for the evidence of osteoarthritis.

Data were analyzed using generalized estimating equations (GEE), a population-averaged method accounting for correlation among measures within subjects (Agresti 2007; Ghislatta and Spini 2004). GEE works well for this type of data because it models estimates of population parameters that are calculated using individually recorded data points, allowing for the largest possible sample size. However, each of these data points remains linked to the individual, thus preserving individual level information (Ghislatta and Spini 2004). The GEE procedure retains the categorical dependent variable while keeping the data points linked (for example, for each of the different joint surfaces), and does not bias the data even though there are multiple data points within each joint. It also accommodates variables that are not normally distributed, small sample sizes, and randomly missing or unobservable variables, which is especially useful in bioarchaeological studies, and social science research in general (Becker 2012, 2013; Gagnon and Wiesen 2013; Nikita 2014, 2015). GEE can also evaluate any number of nominal or quantitative predictor variables that cannot be assessed using bivariate analysis, such as controlling for age-at-death and sex, as has been previously performed for these datasets (Becker 2013). All data were evaluated for significance at .05 level using the chi-square statistic.

## Results and Discussion of Laboring Communities

### *Comparisons between the Heartland and Hinterland*

When looking at the muscle marker scores between the heartland and hinterland, four out of five areas are

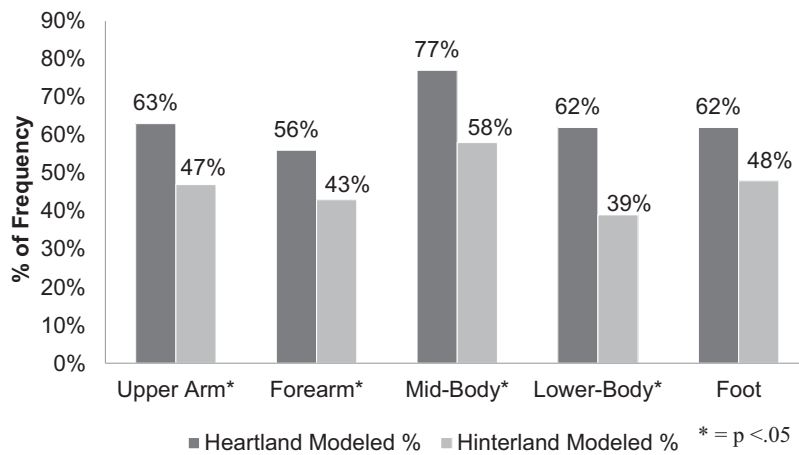


Figure 4.2. Results of heartland and hinterland comparisons for musculoskeletal stress markers.

significant at a .05 level with only foot musculature not significantly different between these two regions (Figure 4.2). Frequency results show that labor levels in musculoskeletal stress markers are higher in the heartland than the hinterland colony. For osteoarthritis, the only significant results were in the sacroiliac joint between these two regions, with people from the heartland Titicaca Basin area showing higher rates (Figure 4.3).

Overall, the regional comparison between the heartland and hinterland shows that activity levels were higher in the heartland than in the hinterland colony in the Moquegua Valley of Peru and these results may represent differences

in agricultural practice. As noted in modern reconstructions of prehistoric agricultural practice (Erickson 1988, 2006; Erickson and Candler 1989), raised-field agriculture in the highland Titicaca Basin may have taken more effort than riverine farming. In addition, it is also likely that the higher rates in the heartland are about labor reciprocity in the Andes, a practice still common today. It may have been that during the Tiwanaku state, calling on local neighbors to labor for you and promising to work for them in return was easier than convincing colonists to come back (approximately a four-week walk) to the highlands for reciprocal obligations. The archaeological evidence of increasing intensity

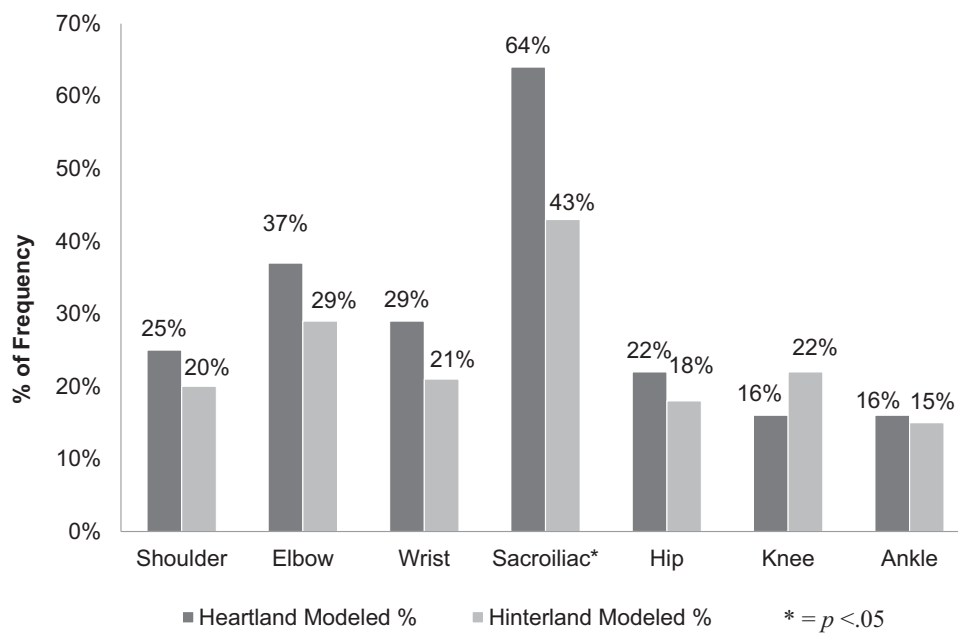


Figure 4.3. Results of heartland and hinterland comparisons for osteoarthritis.

of raised-field farming post-C.E. 800, a possible heavier labor load in order to perform this style of farming, and increased labor sharing in the Titicaca Basin may explain heartland levels of labor.

The high rate of osteoarthritis in the sacroiliac joint also deserves some attention, especially as the sacroiliac joint is not extremely flexible. In researching clinical literature, I found a link between osteoarthritis in this joint and people running or walking with heavy backpacks on (Chosa et al. 2004; Whiting and Zernicke 2008:281). As such, these results may represent people in the highlands using *aguayo*—a cloth backpack that is tied across the sternum and clavicle (i.e., collar) bones (Figure 4.4)—to carry heavy loads. This type of backpack is used by modern Andean people to carry any number of objects (e.g., babies, dogs, cases of beer, food). In other studies (Becker 2013, 2016a, 2016b; Becker and Goldstein 2015), I found evidence of osteoarthritis on the lumbar vertebrae of individuals from the heartland, which could support the idea that these peoples carried heavy loads on their backs. In addition, there were two cases (both from the Moquegua colony) where the sacrum was fused to the os coxa, but only on one side of the body. This could be indicative of transporting loads that were predominantly carried on one side of the body or the other, and that labor during the Tiwanaku state may have included goods transport using *aguayos*.

#### *Within the Heartland and within the Hinterland Comparisons*

In addition to the heartland and hinterland comparison, I looked at activity rates between the heartland Tiwanaku Valley and Katari Valley. This comparison yielded no significant differences and likely means that both workload and repetitive labor were generally equal between these communities. In the comparison between the three hinterland settlement areas in the Moquegua Valley of Peru, colonists buried at Omo and Rio Muerto had similar labor levels, possibly indicating they worked similar tasks, while those buried at Chen Chen had lower levels. These results may indicate differences in occupation or a different style of agricultural work performed at Chen Chen. Exploring the data from these three areas when separated into stylistic differences, Omo-style versus Chen Chen-style, prior research has shown that labor levels relate to ease of access to riverine farmland areas. People who were last to settle in the Moquegua Valley were farthest away from good farmlands and show the highest levels of labor (Becker 2016a; Becker and Goldstein 2015).



Figure 4.4. Woman demonstrating proper placement and usage of an *aguayo* (Drawing by Kathleen Huggins).

#### *Comparisons within the Katari Valley and within the City of Tiwanaku*

Finally, my fourth comparison was to understand labor within the smaller communities of each highland valley. Within the Katari Valley, labor rates were highest from the urban site of Lukurmata, with its varied communities of farmers, crafters, and local administrators. In comparison, labor levels were equal between the two agriculturally oriented sites in the Katari Valley. This may again indicate

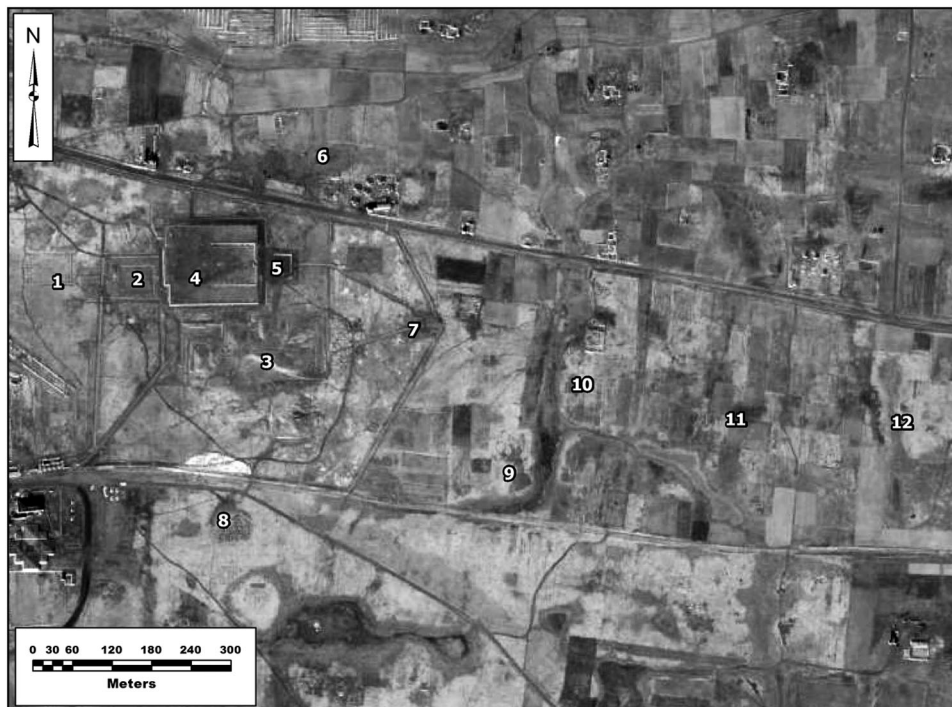


Figure 4.5. Differing areas within the city of Tiwanaku: (1) Kerikala, (2) Putuni, (3) Akapana, (4) Kalasasaya, (5) Subterranean Temple, (6) La Karaña, (7) Kantatallita, (8) Mollo Kontu, (9) Akapana East 1, (10) Akapana East 2, (11) Marka Pata, and (12) Ch'iji Jawira.

some kind of labor reciprocity, with a higher labor obligation placed on those in the urban area than those already working in the rural farming communities. In addition to the Katari Valley, I was able to compare labor between five different barrios (i.e., Putuni, La Karaña, Akapana East, Ch'iji Jawira, and Mollo Kontu) in the Tiwanaku city (Figure 4.5). The lowest labor rates were noted for the site of Putuni, and the second lowest was La Karaña. Both of these sites were noted archaeologically as likely home to elite people (Couture and Sampeck 2003; Escalante 2003; Portugal Ortíz 1988). The reasoning for elite settlement is that there were various higher status goods (e.g., lapis lazuli, obsidian, high quality ceramics), as well as spatial separations (i.e., walled compounds or decorated walls at Putuni), access to freshwater and waste removal canals, and storage for agricultural products (Couture and Sampeck 2003; Escalante 2003; Portugal Ortíz 1988). There was, however, some evidence of labor and activity, which does indicate that the people buried here, if elite, were working elites who participated in some manual labor, as opposed to aristocratic individuals who were waited upon by those around them, as was suggested by Kolata (1997:253).

At the Akapana East site, individuals buried here were actively working the muscles of their arms, especially

when compared to other sites. A prior study (Berryman 2011) on the diet of the Tiwanaku people in the highlands indicates up to 70 percent of the diet of these Akapana East peoples may be attributed to maize, likely in the form of *chicha* (corn beer). Along with the archaeological evidence of ritual paraphernalia in burials (Janusek 2008:148) and isotopic evidence of high maize-based diets (Berryman 2011:39, 290–291), it seems likely that the Akapana East people were *chicha* brewers who developed heavy upper arm musculature required to stir the pots and possibly, the lower body musculature required to hoist and move large containers of the brewed corn beer.

At the site of Ch'iji Jawira, residents' upper arm and forearm musculature indicated that these people performed tasks that were different from other people within the Tiwanaku Valley. Ch'iji Jawira peoples had significantly high modeled rates of osteoarthritis in the elbow and wrist joints. Along with the archaeological evidence of Ch'iji Jawira as a ceramic production center (Janusek 2004; Rivera 1994, 2003), and as forearm musculature is generally active in more precision tasks, these results support the idea that Ch'iji Jawira's residents were craft specialists, likely potters working within the city of Tiwanaku (Becker 2016b). In



addition to physical labor defining community boundaries, Janusek (2004:147) argued that there were social, political, and economic impacts to Ch'iji Jawira people as semiautonomous embedded craft specialists and not elite-sponsored attached crafters. Ch'iji Jawira residents were ceramic manufacturers who were "not directly controlled by or conducted [production] for ruling elites . . . rather conducted and managed in a local residential context" (Janusek 2004:158) and ceramics produced at this site were likely for the Tiwanaku public (Janusek 1999, 2004, 2008). Stone cores at the site also support Janusek's theory as they indicate that these people maintained and reconstructed their own lithic tools instead of obtaining them from lithic production specialists, as would be expected for specialists attached to elites (Geisso 2011; Janusek 1999). Thus, these semi-autonomous labor groups can go beyond simple spatially designated borders and exhibit community as loci of power relationships.

Mollo Kontu people had high mid-body, lower body, and foot rates of musculoskeletal stress markers and high rates of OA throughout the lower body joints. This suggests that residents performed heavy labors, repetitive activities, and were highly mobile. In addition, Mollo Kontu peoples' diets contained a high percentage of meat (Berryman 2011; Berryman et al. 2007; Berryman et al. 2009) and zooarchaeological evidence from this site shows evidence of butchered camelids (versus camelid remains as offerings) indicating a higher prevalence of these animals at this site than others (Vallières 2010, 2012). My activity pattern data reinforce the dietary and archaeological evidence of the Mollo Kontu people as *llameros*, herding their llamas and possibly transporting the maize from the colony in Moquegua.

Scholars (Browman 1978, 1981; Janusek 1999, 2004; Rivera 1994, 2003) have noted that archaeologically distinct areas of craft specialization within Tiwanaku could be described as embedded producers, family groups working together at various types of production. My current and prior labor research (Becker 2013, 2016b) supports this idea of a local, guild, family-based labor force, as the many sites within the city of Tiwanaku reflect significantly different levels of labor and activity. In addition, along with evidence of laboring Tiwanaku elites at the sites of La Karaña and Putuni, this research supports the idea that the various barrios were not elite-serving neighborhoods. Instead, these embedded laborers likely worked as part of a multi-tiered community, functioning locally within each of the barrios, regionally in their social and exchange relationships within the larger city of Tiwanaku, and nationally within the state—building social capital and working for the common good of the larger society.

## Conclusions

Societal formation, labor, and community have been the focus of this chapter on the Tiwanaku culture (C.E. 500–1100). This research addressed labor patterns and levels of activity using musculoskeletal stress markers and osteoarthritis evidence on the skeletal remains of people from this prehistoric polity in order to understand group membership and daily life among its inhabitants. By applying practice theory to address the idea that physical differences can be noted on the human skeleton through the routine of daily living (Bourdieu 1977; Budden and Sofaer 2009; Merleau-Ponty 2013; Sofaer 2006), these results reflect the variety of communities within the larger Tiwanaku culture. Thus, I have been able to look bioarchaeologically at community, spatially scaling from regional comparisons between heartland and colony, to more minute, neighborhood contrasts within the city of Tiwanaku, demonstrating the within-region, but supra-household approach called for by Yaeger and Canuto (2000:5-6).

Overall, results in the heartland versus hinterland colony comparisons show that living in the highlands meant higher levels of activity, possibly from a heavier workload no matter where in the heartland a Tiwanaku resident lived. These prehistoric labor levels may be similar to work group reciprocity practices used by the modern Aymara people of highland Bolivia (Carter 1967; Hardman 1981; Mitchell 2003; Murra 1968). These Andean people work for relatives in a reciprocal kin network, forming labor groups and creating community obligations to each other in a communal network. Hence, this practice of community membership and labor sharing may have been something established early on by Andean peoples. In addition to the results from the highlands, Tiwanaku colonists had lower labor levels and significantly different results between the three colonial communities. Initial information suggests higher labor rates in the colony were associated both with when people migrated to the Moquegua, Peru area, and proximity to good, riverine farmlands (Becker 2016a; Becker and Goldstein 2015). I have also been able to address community membership within smaller enclaves in the city of Tiwanaku, adding to the information we have on these multiethnic cooperatives of laborers living in each barrio, whether they were home to *chicha* brewers, pottery producers, or *llameros*. These results from the heartland and hinterlands likely indicate a variety of tasks performed, more localized control, and possibly a regionally based labor collectives with reciprocal maize obligations between the regions, but minimal exchange of laborers.

Tiwanaku people distinguished themselves through various occupations and differing levels of labor, setting

themselves apart as communities, all while still participating in this pan-Andean, multiethnic state. Through the helpful lens of practice theory, I have been able to document a corporeal record of the daily contributions on the bones of the Tiwanaku people, expanding our scientific and contextual knowledge of peoples in the past. In addition, group membership concerns have also been addressed when analyzing skeletal remains by using a large sample size with good preservation and strong statistical methods to document bioarchaeological changes, as have been called for by various scholars (e.g., Agarwal and Glencross 2011a, 2011b; Buikstra 1991; Buikstra and Beck 2006; Buikstra and Pearson 2006; DeWitte and Stojanowski 2015; Klaus 2014; Knudson and Stojanowski 2008; Sofaer 2006; Stodder and Palkovich 2012). This research supports the evidence of laboring communities within the Tiwanaku civilization, and our ability as bioarchaeologists to identify these types of communities using activity estimation and reconstruction techniques.

### *Acknowledgements*

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### *Notes*

1. While the Tiwanaku culture dates to C.E. 500–1100 and is usually referred to as the “Tiwanaku period,” it does overlap with part of the chronology referred to in the Andes as “Middle Horizon” (C.E. 600–1000). However, the Middle Horizon period and its dates are based around cultures from Peru.

2. The sites are not currently dated radiometrically, and the chronological context stretches over the whole Tiwanaku period (C.E. 500–1100). However, stratigraphically, it is likely that the sites in this study were used contemporaneously.

3. Reports on the size of the Tiwanaku population vary, but recent estimates suggest that the city's population has been underestimated (Stanish 2013).

4. In addition to the artifactual evidence of similar ceramic assemblages, textiles, and stone tools, the architecture, especially the replica of a highland temple at Omo M10, has direct reference to highland Tiwanaku (Goldstein 2005). Additionally, many isotopic studies have been performed using these collections, along with biodistance data, to show that the Moquegua colonists were originally from the Titi-caca Basin and that highland Tiwanaku people continued to migrate to the Moquegua Valley throughout the settlement period (C.E. 500–900) (Blom and Knudson 2007; Knudson 2004, 2008; Knudson and Blom 2011; Knudson et al. 2004; Somerville et al. 2015).

5. Berryman (2011) saw high isotopic rates of maize consumption in the Tiwanaku heartland, thus noting its importance in Tiwanaku ritual feasting and possibly as payment to labor groups.

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