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Patterns of War in the Andes from the Archaic to the Late Horizon: Insights from Settlement Patterns and Cranial Trauma

Elizabeth Arkush · Tiffiny A. Tung

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Abstract Over the pre-Columbian sequence, Andean warfare ranged greatly in intensity. This review combines published information on cranial trauma and settlement patterns, which often align and clarify each other, to make an initial assessment of how severely Andean populations were affected by war over time and space. The data speak to a number of major topics in the archaeology of warfare, such as the origin of war, contrasts in state militarism, and changes in the practice of war related to social organization. Although there is considerable regional variation, two large-scale "waves" of escalated conflict that are clearly supported by the cranial trauma and settlement pattern data occurred in the Final Formative (late Early Horizon, 400 BC–AD 100) and the Late Intermediate period (AD 1000–1400).

Keywords Andes · Warfare · Settlement patterns · Skeletal trauma

Introduction

Prehistoric warfare was central to past social change (Arkush and Allen 2006; Brown and Stanton 2003; Chacon and Mendoza 2007a, b; Dye 2009; Guilaine and Zammit 2005; Nielsen and Walker 2009). Archaeologists' focus has shifted recently from demonstrating that warfare was present in non-Western precolonial contexts (e.g., Bamforth 1994) to assessing variation in warfare over time and space. Robust diachronic sequences of war and peace in North America (Haas 2001; Lambert 2002; LeBlanc 1999; Milner 1999, 2007) and early prehistoric Europe (Guilaine and

E. Arkush (✉)
Department of Anthropology, University of Pittsburgh, WWPH 3302, Pittsburgh, PA 15260, USA
e-mail: arkush@pitt.edu

T. A. Tung
Department of Anthropology, Vanderbilt University, Nashville, TN 37235, USA
e-mail: t.tung@vanderbilt.edu

Zammit 2005; Thorpe 2003; Vencl 1999) shed light on the causes and consequences of warfare over long time scales and the relationship of warfare to other aspects of society and culture. A better understanding of warfare throughout the Andean sequence has the potential to offer similar insights.

Despite ample discussion of pre-Columbian Andean warfare, however, there is little consensus on how frequent it was, how destructive it was, and what counts as archaeological evidence for warfare. Andeanists often differ on whether warfare in a given context was small in scale, strongly ritualized, and minimally destructive, or whether it involved substantial casualties, the flight or extermination of populations, the seizure of land, and/or dominion over subjects (Arkush and Stanish 2005). These different opinions are partly informed by the contemporary Andean practice of *tinku* as a model of combat. Tinku are annual formalized confrontations that occur between communities or moieties on otherwise fairly amicable terms. On the appointed day, the two sides fight with unripe fruit, slingstones, whips, or fists. Occasionally, combatants are seriously injured or killed; their deaths are taken to augur prosperity for the coming year but are not typically avenged (Bolin 1998; Orlove 1994). Some scholars suggest by analogy that some prehispanic fighting also was highly constrained and ritualized. Such fighting could have been central to the reproduction of hierarchies, boundaries, and cosmological order, but without placing populations under much threat of attack.

In this review we assess the severity or consequentiality of warfare across space and time in the Andes, in the most basic terms of causing injuries, deaths, and destruction; creating an environment of danger; and altering Andeans' way of life. The severity of warfare is related to scale (the number of combatants and helpers and their material investment in offense and defense) and intensity (the frequency and duration of hostile engagements; Solometo 2006; Webster 1998). We make no assumptions that severe war was secular or that warfare involving ritual acts did little damage. Instead, we ask the empirical question of how greatly warfare affected prehispanic Andean lives and livelihoods and attempt a preliminary answer by synthesizing the two most reliable lines of evidence on war's consequences: violence-related skeletal trauma and settlement patterns.

The Andean sequence benefits from a robust tradition of full-coverage survey, well-preserved fortifications, and the analysis of ample skeletal remains. These data can address major questions in the anthropological study of warfare. They shed light on the classic problem of the origin of war: whether there was a time before much warfare, and if so, what caused its advent. From Paleolithic and Mesolithic Europe and Africa, and Archaic North America, there are scattered instances of violence as far back in time as we have the power to see, though it is difficult to tell whether they represent warfare or intragroup violence (Guilaine and Zammit 2005; Keeley 1996; Roper 1969; Thorpe 2003; Walker 2001). Over time, the archaeological evidence for war becomes clearer and more frequent. Scholars debate whether significant warfare has always been with us (Gat 2006) or first developed with segmentary organization (Kelly 2000), increasing sedentism and territoriality (Haas 2001), or the adoption of agriculture and storable, raidable foodstuffs (Ferguson 2006). Evidence from the Andes speaks to these debates.

Andean evidence also can help explain periods of especially severe warfare. Archaeologists working elsewhere have often offered materialist explanations: environmental crisis, population pressure and resource stress (Carneiro 1970), or the impact of expanding empires (Ferguson and Whitehead 1992). For instance, Lambert (2002) documents increased warfare in North America between AD 1000 and 1400, corresponding to major climatic shifts. European contact also escalated native warfare in North America (papers in Chacon and Mendoza 2007a). Do materialist explanations of warfare find support in the Andes?

Another perspective considers intensified war to be rooted at least partly in cultural norms and values (Nielsen and Walker 2009; Pinker 2011; Robarchek and Robarchek 1998). For archaeologists, iconography and ritual are the most useful windows into cultural understandings about violence. Does severe warfare correspond with a cult focus on violent themes, warriorhood as an integral part of masculinity, or the presentation of elites as warrior-heroes? In the reductionist terms accessible to archaeology, one question is whether a strong iconographic and/or ritual emphasis on militarism is correlated with frequent and intense warfare. The Andean record of figurative iconography and violent ritual makes this an eminently testable proposition.

Another axis of variation is social complexity. Small-scale, decentralized societies wage wars of revenge, raiding, attrition, and extermination but not conquest (Carneiro 1990; Keeley 1996; Redmond 1994; Reyna 1994). War parties tend to be small, fortifications light, and tactics reliant on surprise, opportunistic assaults, and projectile fire. By contrast, complex societies sometimes wage wars for conquest, and elites may engage in war as a form of status rivalry (Webster 1998). Wars are fought with larger and more organized forces, engaging preferentially in hand-to-hand combat with specialized weapons. Larger defensive works reflect the greater scale of labor organization and of enemy attacks to be thwarted. For instance, Milner (1999) contrasts Mississippian chiefdoms' highly planned palisades of stout posts, buttressed with bastions, versus the simpler, flimsier palisades of the northeastern United States. Do complex regional polities wage war more frequently than smaller-scale societies (Haas 2001), and did these polities first emerge as the result of conquest war (Carneiro 1970, 1981; Spencer 2010)? In the Andes, a long series of complex societies offer archaeologists an excellent opportunity to examine the relationship between warfare, social hierarchy, and state origins, and to assess variation in the ways states have made war and peace.

The point of this review is to bring Andean evidence to bear on broad comparative questions about war. Some might claim that Andean cases are ill suited to address cross-cultural patterns, if such patterns even exist, and that war can best be understood in its own cultural terms, when placed within a specific Andean trajectory (Nielsen and Walker 2009). Both sides have merit because some aspects of war are patterned across cultures, whereas others are culture-specific. This general review must give short shrift to cultural context and local variations in warfare practice, but it is intended to be complementary to particularistic studies, not antithetical. We consider it useful for its comparative potential and as a framework upon which to build.

Warfare and the evidence for it

Following Ferguson (1984), Milner (1999), and Webster (1998), we define warfare as armed, potentially lethal group violence between hostile, politically autonomous communities. Warfare encompasses raids, slave raids, ambushes, battles, massacres, sieges, revolt, violent resistance, conquest, and reconquest. Violent factional struggle, civil war, and feuding between clans are classified as war because the factions are politically separate enough to plan and execute collective violent action autonomously. War also can involve the destruction of property and animals.

This definition excludes violence that takes place within one coherent political community. Nonwar violence includes intrahousehold abuse (i.e., domestic violence and child abuse), intracommunity violence against low-status individuals, brawls, controlled violent conflict resolution, the injuring and execution of criminals or "deviants," violent sport and martial training exercises, and the sacrifice of natal community members. However, those forms of nonwar violence can co-occur with warfare. Indeed, modern Western warfare often corresponds with an uptick in domestic violence and other nonwar violence (Nordstrom 1998). In ancient times, war captives incorporated into the home community as servants, slaves, or wives may have been targeted for violence more frequently than natal members (Tung 2012, see also Cameron 2008). Young men also might train for warriorhood with violent "games" that resulted in serious injuries. Yanomamo communities could be simultaneously engaged in domestic abuse, brawls, violent conflict resolution, and warfare (Chagnon 1983). Given that war training and experiences of war can shape beliefs and behaviors about aggression and violence (Tung 2012), different kinds of war and nonwar violence may well occur in the same context.

This review is restricted mostly to the central Andes and examines the Archaic to the end of Inka rule in the 16th century (Table 1). We draw on two kinds of evidence from the broader corpus that could speak to warfare (see overviews by LeBlanc 1999; Redmond 1994; Vencl 1984; Wilcox and Haas 1994). We do not rely on iconography and warlike spectacles or performances as primary evidence for warfare, since one aim is to evaluate how well they correspond to other data. Documentary sources are deemphasized; their time depth is limited and they have been expertly discussed elsewhere (D'Altroy 1992, 2002; Julien 2003; Rowe 1946). Weapons illuminate modes of fighting, but their presence and abundance are not usually good indicators of the intensity of warfare (LeBlanc 1999; Vencl 1984). Instead, we rely on violent skeletal trauma and settlement evidence to document the extent to which Andean populations were threatened or suffered harm during times of war. Since both lines of evidence suffer from problems of equifinality, they can be interpreted more securely in combination.

Violence-related skeletal trauma

Skeletal and soft tissue trauma is the only reliable archaeological evidence of violent injuries (Walker 2001). The analysis of wound type (blunt force trauma, projectile, etc.), lethality (antemortem or perimortem), location on the body, wound frequency per person and per population, and demographic structuring of trauma

Table 1 Andean chronology[a]

Time period	Dominant traditions	Dates
Late Horizon (LH)	Inka	AD 1450–1532
Late Intermediate period (LIP)	Regional polities	AD 1000–1450
Middle Horizon (MH)	Wari and Tiwanaku	AD 600–1000
Early Intermediate period (EIP)	Regional polities	AD 100–600
Final Formative	Regional polities	400 BC–AD 100
Middle and Late Formative	Chavín/Cupisnique	800–400 BC
Early and Middle Formative		1500–800 BC
Archaic		8000–1500 BC

[a] This paper uses Kaulicke's (1998) chronology for the early part of the sequence, and lumps his proposed Final and Epi-Formative periods into "Final Formative."

aids in distinguishing between accidental versus violent injury (see Galloway 1999; Lovell 1997; Tung 2012). These data also can elucidate the contexts of violence, whether warfare, domestic abuse, or physical conflict resolution, among others (Tung 2007b, 2012). This is not a trivial issue; intracommunity violence leaves traces on the skeleton that can be difficult to untangle from injuries sustained in war. Table 2 lists some of the skeletal and archaeological correlates we might expect from different violent practices. A key point is that intracommunity violence is *not* associated with defensive settlement, fortification, or, usually, the destruction of property. In this review, we do not attempt to distinguish which wounds were sustained in warfare but, instead, evaluate how adult cranial trauma frequencies correspond with settlement pattern data.

Andean bioarchaeology offers a rich source of information on the frequency of violence, patterns of violence across society (e.g., males vs. females), and practices of violence (e.g., weapon choice, defensive vs. offensive wounds). This evidence has limitations, however, and must be used carefully. Data are sparse for early time periods and semitropical regions where bone preservation is poor. Looting at cemeteries is also a pervasive problem. Because most studies focus on skeletonized remains, soft tissue injuries go undetected, so skeletal evidence alone may systematically underrepresent violent injury, especially where projectile points were the weapons of choice. In addition, the mortuary practices of past populations structure the representativeness of the samples. For example, warriors who die on the battlefield may never receive proper mortuary rites, and their bones may never enter the bioarchaeologist's database. Finally, not all bioarchaeologists employ identical recording and reporting systems, so comparisons between studies can be problematic, although concerted efforts to standardize methods (Buikstra and Ubelaker 1994) have helped ameliorate this problem.

This review bases comparisons on reported rates of cranial and facial trauma on adults in "normal" burial populations (Appendix A). Skeletons that appear to represent mass or ritual killings (i.e., not "normal" burials) are described but not included in quantitative comparisons. Although they are revealing about how warfare was waged, the ratio of injured to uninjured is unknown because only the massacre victims or sacrificed individuals are in the sample. Craniofacial trauma is

Table 2 Bioarchaeological correlates of different violent practices

Kind of violence	Likely victims	Skeletal correlates	Other correlates
Intrahousehold (domestic) violence	Women	Sublethal trauma on skull (Walker 1997); rib and hand fractures. Injury recidivism. Patterned wound locations among women	Demographic profile with more females than males if cowives are fighting (Webb 1995)
Child abuse	Children	Sublethal trauma on skull; periostitis on arm from sudden, forceful arm grabs. Injury recidivism	
Slave/servant abuse	Low-status persons	Sublethal trauma; poor health and nutrition. Injury recidivism	Hierarchy observed in burial treatment and other arenas
Intracommunity violence ("bar brawls")	Men and women, though modern accounts indicate men more common	Sublethal or lethal trauma on skull; rib and hand fractures	
Ritual battles	Mostly men	Sublethal head trauma; rib, hand, and parry fractures	Ritual battles not associated with fortifications or property destruction. Elaborate weaponry for "show"
Physical conflict resolution	Mostly men	Sublethal trauma on anterior of skull from squaring off with opponent; clavicular fractures. Highly patterned wound locations	No defensive armor (e.g., no helmets, shields)
Ritual violence/ sacrifice	Men, women, children	Perimortem trauma, cut marks, dismembered body parts, trophies, pattern of missing skeletal elements	Deposition in ritual structures
Violent sports	Men, women, though men more common	Sublethal trauma on crania and postcrania. Patterned bodily injuries	Iconography depicting sports-like activities. Artifacts used in sports
Warfare			
Raids/ambush	Men, women, children	Raiding victims: posterior head wounds, perhaps lethal on men, sublethal on women; fewer females than males in victim community, resulting from female abductions. Raiders: more females than males in aggressor community (abducted females who also have sublethal trauma). Biodistance and/or strontium isotope data that show females are foreign, especially when coupled with sublethal trauma (Cameron 2008; Kohler and Turner 2006)	Defensive sites for victim communities; weaponry and defensive gear at aggressor and victim sites
Massacres	Men, women, children	Perimortem trauma among large segment of population	Site destruction; mass graves
Battles and routs (decentralized societies)	Mostly men	Mix of lethal and sublethal trauma; skull, rib, hand, and parry fractures	Military iconography; weapons; protective gear; defensive sites

Table 2 continued

Kind of violence	Likely victims	Skeletal correlates	Other correlates
Battles and routs (centralized societies)	Mostly men	Sublethal and lethal trauma on skull from projectile and shock weapons; rib, hand, and parry fractures	Military iconography; weapons; protective gear; defensive sites

the focus because it is commonly associated with violence, not accidents, and it can be compared between different studies. We consider adult injury only; across the board, juveniles have far lower injury rates than adults, reflecting their unlikely participation in war, and many studies report adult trauma only.

The kinds of cranial trauma observed in the Andes are fairly consistent. Small, round depression fractures, often healed, testify to impacts from slingstones, thrown rocks, or glancing weapon blows. Perimortem injuries (likely lethal) were rarer and include blunt force trauma that often dislodged portions of the cranial vault; these were likely caused by close-proximity assault with handheld weapons. Nasal fractures are sometimes observed among well-preserved samples, and those "broken noses" may be related to armed combat or fistfights. Males nearly consistently exhibit more trauma than females.

Reported frequencies of adult cranial trauma in the Andes range from zero to 30–40 %, with a few outliers above that. Averaging all of the cranial trauma studies reviewed for this article (Appendix A), 20.5 % ($N = 3{,}448$) of adults exhibit skull trauma, antemortem and perimortem combined. This may overestimate trauma, for we draw only on studies that explicitly discuss the presence or absence of head injuries. Some researchers omit trauma results if none was observed, or skeletal samples with no trauma may go unpublished. To reiterate, not all injuries summarized in Appendix A necessarily resulted from warfare.

Archaeological settlement patterns and fortification

Across cultures, settlement location, nucleation, and fortification consistently indicate the threat of attack or the absence of threat (Keeley et al. 2007; LeBlanc 1999; Vencl 1984; Wilcox and Haas 1994). Defensive sites and fortifications are numerous in the Andes (Table 3) and have been recognized since the first regional studies (e.g., Willey 1953). The simplest defensive measure was to move settlements into inaccessible locations, especially hills and ridges, and to move away from enemies, leaving buffer zones. Walls and ditches might be built around settlements or across routes of access, such as ridgelines or gully mouths. Where most settlements are nondefensible, strategic forts and refuges may serve a population's defensive needs. Refuges are strongholds for occasional escape; other special-purpose forts can control strategic access points to pockets of settlement (a shift from protecting individual sites to protecting larger geographic areas, indicative of political integration [Haas 2001]). Or they may control travel routes and garrison hostile territory. Great wall systems likewise fortify areas rather than individual settlements. Destruction episodes also provide clues to warfare. Victors

Table 3 A basic typology of Andean defenses

Defensive settlement location	Defensive site location on hills or in hidden/inaccessible places
	Sites located far from enemies, leaving unoccupied buffer zones
Fortified settlements	Fortified villages (walls and/or ditches, including partial fortification across finger ridges)
	Walled quebradas with protected settlements
Strategic defenses (without significant settlement, or in areas where most settlement is non-defensive)	Fortified refuges, where people living in nondefensive settlements can flee
	Fortified outposts placed strategically to monitor and protect larger settled areas, to control routes of traffic, or as bases for offensive strikes
	Fortified temples
	Great wall systems

may indiscriminately destroy settlements or specifically target ceremonial structures and elite residences.

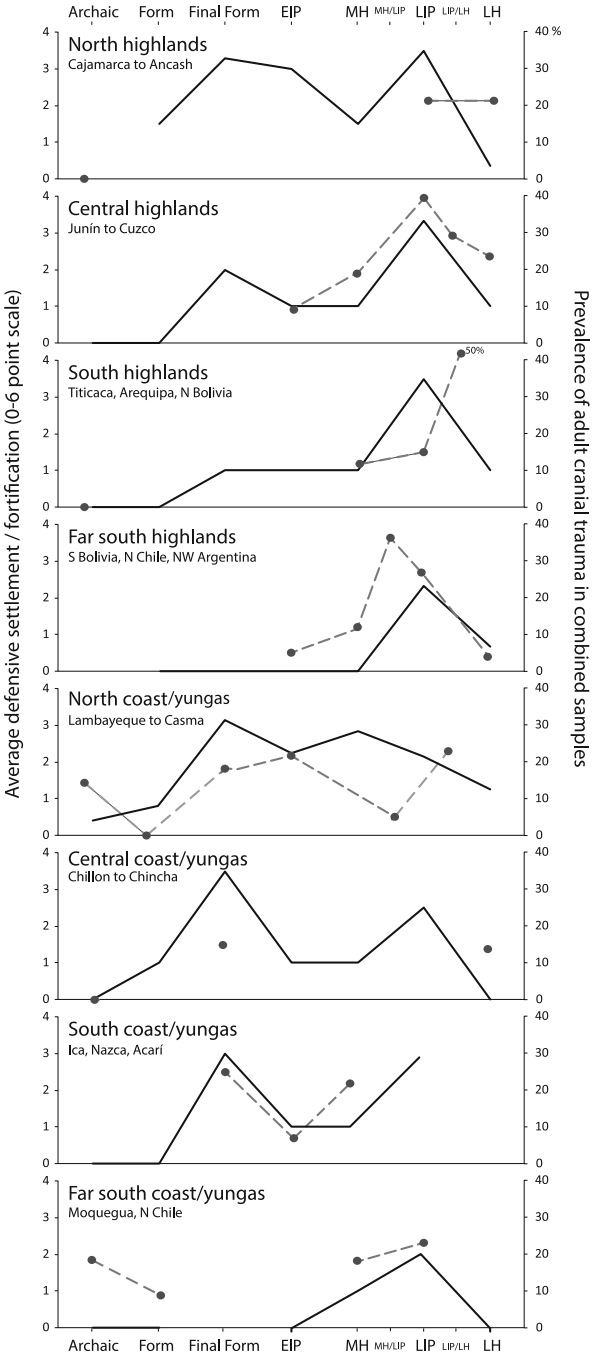
Andean settlement evidence is not without problems. The geographic coverage is uneven, though it is broader than for bioarchaeology, and many surveys are not reported in depth or published. Variable field methods and reporting can make it difficult to compare settlement patterns. Where there has been no full-coverage survey, reconnaissance reports indicate the presence or absence of hillforts but often do not convey whether small settlements are defensible. Poor chronological control is a major problem, especially for early periods; we have attempted to use the most up-to-date understandings of chronology and, where possible, we have aligned evidence based on recalibrated carbon dates. Finally, defensive settlement patterns are harder to describe and compare with quantitative measures than skeletal trauma. For this reason we include a qualitative description of settlement patterns in Appendix B, as well as a simple numerical coding in Appendix C.

As with skeletal trauma, equifinality is an issue in assessing warfare from settlement evidence. There are other possible explanations for hilltop settlement, high terraces, walls, and destruction events, although a good archaeological context can distinguish among these possibilities (Arkush and Stanish 2005). The converse is also true: an absence of defensible settlements does not necessarily demonstrate peace (Keeley 1996; Vencl 1984). Violence-related skeletal trauma provides an important independent line of evidence.

Ideally, information from archaeology and bioarchaeology from the same contexts can be combined to document warfare and clarify its nature and severity. Because of spotty coverage and poor chronology, this is not possible for all of the Andean sequence. But there is enough evidence available now to warrant bringing the two bodies of data together, drawing some conclusions about the distribution and severity of warfare in time and space, and applying these conclusions to broader questions.

Overall patterns of war in the Andes

Combining settlement evidence and data on adult cranial trauma shows that they often correspond (Figs. 1 and 2). Although the data are too patchy to establish a



a. Defensive settlement score for each region is the average of totals per line from Appendix C.
b. Adult cranial trauma is combined for each region from Appendix A.

Fig. 1 Defensive settlement[a] (solid black line) and adult cranial trauma[b] (dashed gray line) over time for different Andean regions. If no gray dot is present, cranial trauma data are absent

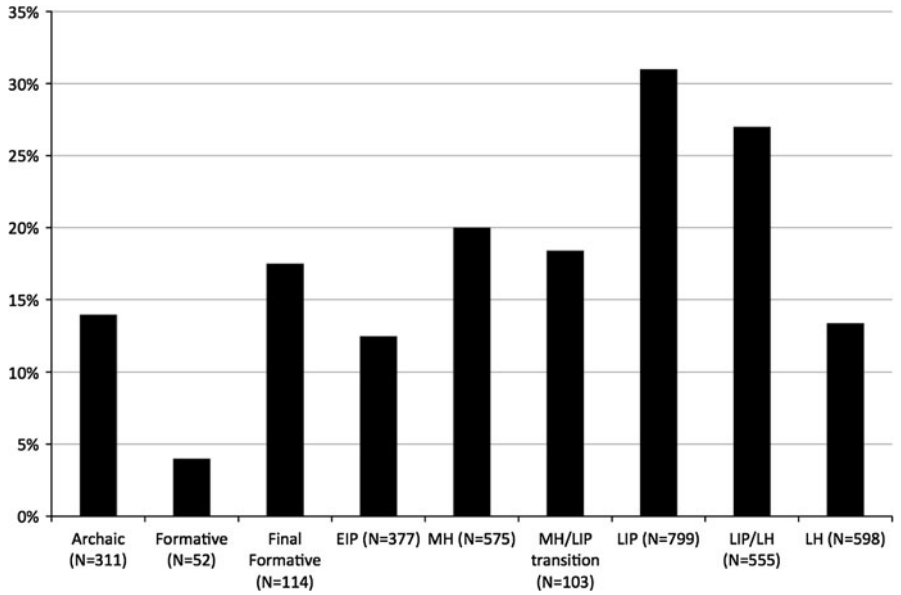


Fig. 2 Adult cranial trauma frequencies throughout the Andean sequence

Table 4 Significance comparisons of cranial trauma frequencies from one time period to the next

Time period	*P* value	*N*
Archaic vs. Formative	0.0629	366
Formative vs. Final Formative	**0.0151**	105
Final Formative vs. EIP	0.1113	491
EIP vs. Middle Horizon	**0.0071**	952
MH vs. MH/LIP transition	0.5472	678
MH/LIP transition vs. LIP	**0.0060**	902
LIP vs. LIP/LH	0.1164	1354
LIP/LH vs. LH	**0.0001**	1153
LIP only vs. LH only	**0.0001**	1374

statistical correlation within regions, probable trends are visually apparent. Cranial trauma and defensible settlement are not independent. In addition, the profound changes demarcating Andean cultural eras are often mirrored by distinct cranial trauma rates (Fig. 2). Among the eight time periods, four show a statistically significant change and one shows a nearly statistically significant change from the preceding period (Table 4).

Andean warfare ranged greatly in intensity over time. As discussed below, evidence for conflict in the Archaic and Formative periods before about 400 BC is low relative to later periods and highly localized in space. Combined Archaic cranial trauma rates are high, due to injuries among the Chinchorro of northern Chile (19 %, $N = 198$); in contrast, the non-Chinchorro Archaic trauma rate is only

4 % ($N = 113$). Conflict increased over the sequence, peaking in two phases: the Final Formative to earliest Early Intermediate period (EIP) and the Late Intermediate period (LIP). The first of these waves, c. 400 BC to AD 100, is characterized by the emergence of hillforts and hilltop settlements in several areas, especially the north coast and adjacent highlands; a handful of bioarchaeology studies also suggest more severe conflict than in earlier times. The second wave of intense conflict, c. AD 1000 to 1450, is indicated by an astounding number of hillforts and defensive sites in the highlands and upper valleys, and by adult cranial trauma rates, on large sample sizes, that are the highest in the entire Andean sequence. Although Andeanists have long known there was conflict in those phases, this review quantifies and substantiates that impression and demonstrates how geographically widespread it was. The two eras of escalated conflict across the Andean macroregion demonstrate that warfare was sometimes part of very large-scale processes.

Yet the intensity of warfare also is quite varied over space, both within these phases and in the intervening periods. It must have been greatly affected by local factors such as sociopolitical integration, population density, and resource distribution. At the broadest scale, for most periods there is stronger settlement evidence for conflict in the northern and central regions (both highlands and coast) than the south and far south that cannot merely derive from differences in the amount of research conducted. The central coast and highlands also exhibit more cranial trauma than other regions. Higher precipitation and river flow favored more reliable crop yields and denser populations in the north and central regions, and cultural developments, including the rise of social hierarchy, were more precocious; both patterns might have been related to more intense conflict.

Comparisons between the coast, midvalley, and highlands show increasing rates of trauma as one moves up in altitude. This trend is due largely to high cranial trauma among LIP communities in the highlands. Although both the coast and highlands experienced episodes of severe warfare, their histories varied. The impact of war was felt more strongly on the coast in the Final Formative and more in the highlands in the Late Intermediate period.

The origins of Andean war

Archaeologists have debated whether the first significant warfare arose in tandem with increasing sedentism and territoriality, the emergence of agriculture, or some other trigger. These events would not have been proximate causes but distal catalysts intertwined with the ecological context and local conditions. Nevertheless, their ramifications would have been transformational. In the Andes, full sedentism preceded agricultural lifeways by several thousand years, so Andean data decouple these events. Although there is spotty evidence for fighting and possibly warfare from the earliest periods, neither the advent of sedentism nor the development of agriculture were strong catalysts for warfare in the Andes. Conflict in the early periods was irregular and apparently an outgrowth of local conditions. It was not until the final part of the Formative period that evidence for warfare becomes quite

prevalent. A key finding is that the first horizon of significant warfare began some 5,000 years after full sedentism became widespread on the coast, over 2,000 years after the first florescence of multicommunity social groups anchored by monumental ceremonial centers, and about 1,000 years after irrigation agriculture became central to subsistence.

The Archaic

Andean skeletal remains from the final Pleistocene and the early Holocene are too rare to assess violence in the presedentary past (Dillehay 1997). By 10,000 BP, the end of the last ice age opened an era of initial sedentism on Peru's north coast, far southern Peru and northern Chile, and central highland Peru. Settlement sizes were quite small and there is no evidence that defense was a factor in settlement location (e.g., Chauchat 1988; Rick 1980). However, violence was not absent: traumatic injuries are found on some of the earliest human remains in South America, from the Acha-3 camp in northern Chile (Fig. 3), where a small population subsisted on shellfish around 7500–7000 cal BC (Standen and Santoro 2004). Of four naturally mummified adults, two males had injuries that are typical of violence (a sex-based pattern that parallels observations for later periods). One male exhibited healed cranial trauma and another had fractured ribs (Standen and Santoro 2004). Other very early Andean remains apparently have not been systematically examined for trauma.

By about 5000 cal BC, the coast was teeming with sedentary communities subsisting on marine resources. Coastal villages are typically found in open, nondefensible terrain, but the skeletal remains indicate fighting in some places and peace in others. The latter is indicated at Paloma, a village in the central coast from the middle Archaic, c. 5400–3800 cal BC, where 201 individuals of all ages were buried below and around pit houses. No fractures were observed on 69 adult crania (our estimated total based on Pechenkina et al. 2007) (Benfer 1999, personal communication 2010).

By contrast, violence was pervasive for people of the Chinchorro tradition of far northern Chile and far southern Peru. Although settlements are nondefensible, violent injuries are observed on the earliest Chinchorro mummies in the Camarones Valley at about 6500–5000 cal BC (Costa et al. 2000; Quevedo 1984), and cranial trauma remained consistently high into the terminal Archaic for the Arica area: about 23 % (35/154 combined; Costa et al. 2000, Standen and Arriaza 2000). Males exhibit more trauma than females, and their wounds are mostly on the frontal bone and left side of the cranium, suggesting face-to-face combat with a right-handed opponent. There are no specialized shock weapons from Chinchorro sites; blows were probably from rocks and were rarely lethal, though there are cases of lethal harpoon or projectile point wounds (Arriaza and Standen 2008, p. 104; Guillén and Carpio 1999; Standen and Arriaza 2000). For instance, in the northernmost Chinchorro range, a young male was killed by six projectile points (Guillén and Carpio 1999).

It is hard to say whether Chinchorro injuries were sustained in confrontations between groups—warfare—or in frequent within-group scuffles. But it is probably

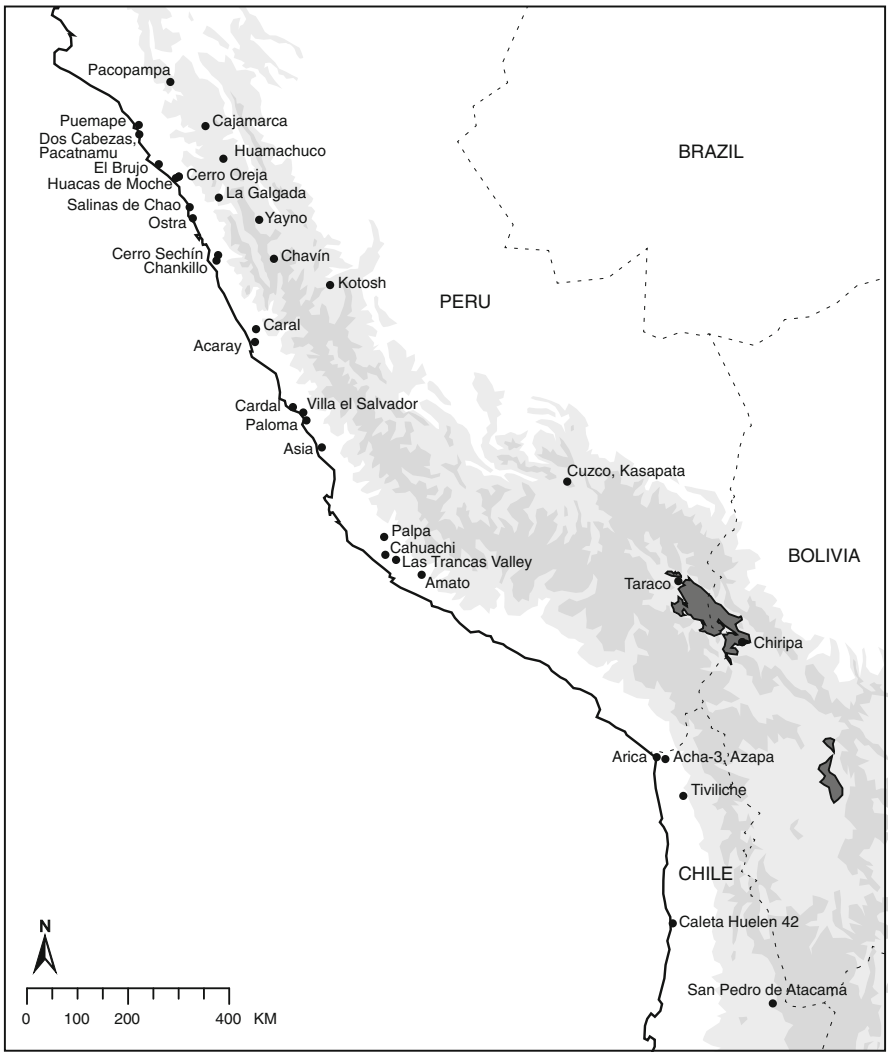


Fig. 3 Early sites referenced in the text (Archaic, Formative, and EIP)

not coincidental that Archaic trauma rates are much higher here than anywhere else. This extremely arid stretch of the coast offers only a few pockets of habitable beach with fresh water and reeds to support human life and cordage-based fishing technology, and river flow is unreliable. One can envision either territorial competition between groups over these coastal oases or intragroup friction and fighting in which moving away was impossible (Santoro, personal communication 2010). Populations south of the core Chinchorro area had a lower prevalence of conflict, although samples are smaller (Appendix A: Tiviliche, Caleta Huelen-42); these more marginal populations may have had less contact with other groups.

Only with the first evidence for defense are we able to identify concerns with warfare per se. This evidence comes from the north coast and probably from the Archaic, though the dating is not secure. At Ostra, just north of the Río Santa (Topic 1989), is a large coastal camp whose midden dates to around 4200 to 4000 cal BC. Two lines of slingstone or throwing-stone piles were placed at its northern and southern ends; the latter line runs along a defensible ridge. Slingstone piles were spaced 2–3 m apart and contain purposely selected stones of consistent size, most likely brought from the closest natural deposit some 7 km to the south. If the slingstone piles correspond to the Archaic midden, they certainly indicate conflict was present. However, it must have been sporadic. Among 36 Archaic sites in the lower Santa Valley—mostly coastal middens and windbreaks—almost none are defensibly located on hilltops or ridges (Wilson 1988, pp. 90–98). War parties would have been small and informal, so defense preparations at Ostra were light.

A stronger case comes 2,000 years later, at the very end of the Archaic, at Salinas de Chao (Alva 1986) (c. 2000–1500 cal BC) (Cárdenas M. 1998). A ceremonial complex of monumental terraced platforms, habitation sectors, and several smaller settlements occupy a bay that may already have been important for salt production. The bay is surrounded by ridges and accessible only via the Chao River Valley to the north and a pass to the south; both approaches were blocked with massive walls. The thick northern wall still extends 800 m toward the ridge to the north; its style and the lack of subsequent occupation strongly suggest it was associated with the Archaic complex (Alva 1986, p. 90). An unreported double wall protecting the southern pass 5 km to the southwest is visible in Google Earth satellite images. These are the first good candidates for defensive walls in the Andes. Probable defensive walls and slingstones also have been reported from a coastal Archaic site at the southern edge of the Santa Valley (Topic and Topic 2009). Possibly, the resource concentration of this little patch of coastline encouraged more intense intergroup competition than in other places.

These first Andean fortifications in the Terminal Archaic were an important development. They are the first evidence of intergroup conflict—the first indication that Andeans conceptualized themselves not as individuals with enmities but members of larger social units in violent opposition. Nevertheless, this evidence is extremely unusual in the Terminal Archaic, even though major sociopolitical developments were underway. The central and northern coasts experienced significant population growth and the rise of impressive monumental complexes, especially in the Supe, Fortaleza, and Patavilca Valleys, where populations took up simple irrigation farming early. The large-scale coordination of labor for monument construction could have been used for organized attacks on other groups, but the evidence suggests otherwise. Terminal Archaic sites are almost never fortified and are located in nondefensible, low-lying positions (e.g., Billman 1999; Haas 2007).

Published cranial trauma data from the Peruvian north coast is essentially nonexistent for this time period, but late Archaic crania from the St. Elena Peninsula in Ecuador show that about 15 % of adults had cranial trauma (Ubelaker 2003). Beyond that, scattered evidence of human sacrifice, dismemberment, decapitation, and possible cannibalism constitute the first inklings of a long-term ritual emphasis on violence. Cases include a probable sacrifice victim at Caral's Piramide Mayor

(Shady 2009, p. 117) and disarticulated, often charred human bone in middens at Aspero, Asia, Huaca Prieta, and Los Gavilanes (Lumbreras 1989, pp. 206–216; see also Rossen and Dillehay 2001; Santoro et al. 2005, pp. 339–340). Decapitation is evident at Asia Beach c. 1500 cal BC or later, where Engel (1963) excavated two headless adult skeletons and seven isolated crania (three adults and four children). One adult skull bore cut marks on the frontal bone suggesting the facial skin had been cut and peeled off, a remarkable case without parallel in early times. A hardwood club with affixed shark teeth underscores the possibility of conflict at Asia (Engel 1963, p. 57).

In the highlands, evidence from the Archaic is too scant to assess conflict. The abundance of small obsidian projectile points in the south-central highlands may have exceeded hunting needs and sometimes appear edge-modified to be more lethal (Aldenderfer 2004, p. 20). Aldenderfer (2004) argues that what conflict there was probably arose from prestige concerns and camelid theft, not territorial competition: highland pasturage is extensive rather than concentrated, and populations were low. However, Archaic settlement patterns appear nondefensive, and the very few human remains from highlands and upper valleys (e.g., at Kasapata and La Galgada) show no evidence of trauma.

Among early Andean sedentary societies, then, the strongest evidence for fighting comes from the Chinchorro area and coastal Ecuador, and for investments in defensive architecture, from Salinas de Chao. Settlement patterns are almost completely nondefensive. The uniqueness of the slingstone piles at Ostra, the shark-tooth club at Asia, and the walls at Salinas de Chao suggests that conflict was highly localized. Fighting may reflect competition in specific contexts of circumscribed resources in coastal environments. Insofar as sedentism contributed to greater territoriality, particularly in coastal zones, it would have allowed ecologically motivated violent competition to arise, but it did not cause it in any consistent way.

The Formative period

Major developments in the Formative era changed peoples' relationships to each other and the land. The period is defined by the widespread adoption of ceramics and an increasing reliance on irrigation agriculture. Populations grew and resettled to new locations. An increasing investment in monument construction powered regional religious cults. Preciosities circulated widely, as did religious knowledge and ideas about architecture and iconography. Social hierarchies developed, early in some areas and more slowly in others. Those changes might be expected to entail more frequent warfare, and indeed, the development of more complex social organization was expressed in a flourishing of iconography replete with violent themes. But warfare remained relatively rare until the last 500 years BC, when fortified sites point to intergroup conflict on a new scale.

In the Early and Middle Formative (c. 1500–800 BC), settlement expansion into inland coastal valleys to exploit irrigation agriculture was largely nondefensive. Monumental centers were typically on low-lying valley floors or their adjacent margins, and defenses are almost completely absent at them. Where small residential settlements can be found, they are dispersed and in nondefensive

locations (Billman 1999; Proulx 1985; Silva 1998). In middle and upper valleys of the north coast, there are hints of defensive settlement and fortification that may indicate violent competition or a threat from highland populations (see Appendix B), although the chronology is not secure. Further research is needed to clarify whether conflict occurred in these zones.

In the northern Peruvian highlands, defenses were occasionally necessary outside major ceremonial centers. In Huamachuco, a handful of fortified hilltop settlements were probably first occupied in the Middle Formative (Pérez 1998; Topic 2009, p. 213; Zaki 1983). Small ridgetop settlements near Chavín may have been located with a view to defense (Burger 1983). The pattern is not uniform, however, and where settlement patterns are understood, they are usually much less defensive than a few centuries later.

Bioarchaeological studies for the Formative before ca. 500 BC are very few and the samples are small, but combined they show a very low cranial trauma rate of 4 %. There is no adult cranial trauma from the Bolivian highlands (Blom and Bandy 1999) or Peru's north coast (Gillespie 1998), and trauma was very rare among 17 adults buried at Cardal in the central coast (Vradenburg 2009). Fighting continued on the north Chilean coast, where 8 % of adults exhibit cranial trauma (Fouant 1984).

Even while most inhabitants of the northern and central coast appear to have enjoyed lives unthreatened by enemies, their art and the art of the adjacent highlands glorified a spirit realm of fanged, predatory deities, trophy heads, sacrificial blades, and bound captives (Benson 2001, p. 5; Burger 1992, p. 96; Cordy-Collins 2001). This artistic emphasis on violence is likely related to the beginnings of social differentiation. It may have bestowed fierce supernatural powers on leaders/priests, who could have been performers of ritual violence. Some of the first violent iconography appeared in the Casma Valley, where monumental centers grew to enormous size early in the Formative (Pozorski and Pozorski 2005). At Cerro Sechín in Casma, by 1500 BC a large platform was faced with monolithic granite panels carved with wounded bodies and dismembered body parts, along with striding warriors carrying staffs, spear thrower darts, and disembodied heads (Bischof 2008; Burger 1992). Although Cerro Sechín's gruesome iconography has sparked much archaeological speculation, it says little about the prevalence or severity of warfare. The carvings do, however, present the first clear link between dismembered body parts and violence, and they suggest that an ideology of domination through violence was promulgated to Casma's residents. There was not much threat of outside attack, for there is no defensive settlement near the river confluence or lower down the valley; indeed, it is hard to imagine that adjacent valleys could have posed a threat at this time. Those at Cerro Sechín may have been aggressors, enacting or threatening violence upon others in the region. But Casma's warlike iconography does not coincide well with independent settlement pattern evidence for warfare—the first of many such disjunctures.

Violent themes also were depicted in the northern highlands at important ceremonial centers (Bischof 2008; Burger and Salazar 2008; Urton 1996), where predation and trophy-taking may have been occurring in practice, not just in art. Headless bodies, decapitated heads, and possibly maltreated corpses have been found at Kotosh (Izumi and Terada 1972), Pacopampa (Shady 1970), Chavín (Burger 1984,

1992; Burger and van der Merwe 1990; Reichlen 1973), and Wichqana in Ayacucho (Lumbreras 1981). One female skull from the Gallería de Ofrendas at Chavín exhibits craniofacial trauma (Reichlen 1973) and modifications typical of later trophy heads, so this may be the earliest example of an Andean trophy head (Tung 2007a). Cut, burnt, and gnawed human bone occurs in midden at Huacaloma, Layzón, and El Mirador near Pacopampa, and human bone was sometimes made into utilitarian tools (Burger 1992, p. 109; Izumi et al. 1972, Pl 27, pp. 1–2; Morimoto and Yoshida 1985; Shimada 1982). These remains may or may not reflect war-related violence against captives or enemies. But it is noteworthy that stone maceheads, the first special-purpose weapons in the Andes, appeared late in the Middle Formative in the northern highlands (Izumi and Terada 1972) and possibly in the northern coastal valleys (Strong and Evans 1952). These beautiful, highly polished objects imply a connection between combat and personal status display.

In the Late Formative (800–400 BC), Chavín-related styles and goods reached their zenith. Interregional exchange in valuables intensified, and rich burials attest to the institutionalization of an elite stratum. Several ceremonial centers in the northern highlands expanded, while monumental construction ceased at many north coastal centers (Burger 1992; Rick et al. 2011). Nevertheless, Late Formative settlement patterns on the coast, though poorly understood, appear mostly nondefensive until about 400 BC (e.g., Billman 1996). At that point, Chavín's temple had gone out of use, trade was lapsing, and conflict was on the rise.

The Final Formative

The first large-scale "horizon" of severe warfare took hold c. 400 BC–AD 100, in the Final Formative. (This era, traditionally considered the late Early Horizon and earliest Early Intermediate period, falls into Kaulicke's [1998] Final Formative and Epi-Formative periods. High rates of cranial trauma and defensive settlement continued perhaps a century later in some regions, decreasing markedly in the later EIP; our division at AD 100 is necessarily somewhat arbitrary.) Evidence for war is especially pronounced on the north coast, where it may appear earliest, but it is present in other regions as well.

The most striking evidence is hilltop forts, which became common in valleys of the north and central coast (see Brown Vega 2010). Recent carbon dates place Chankillo in Casma (Ghezzi 2006) and the walls of Acaray in Huaura (Brown Vega et al. 2013) at c. 400–200 cal BC, while a suite of dates from the Huaura Valley show a second phase of hillfort construction c. 200–1 cal BC (Brown Vega et al. 2013). Forts in the Casma, Santa, and Nepeña Valleys, assigned to the Late Formative by Pozorski and Pozorski (1987), Wilson (1988), Proulx (1968, 1973, 1985), and Daggett (1984), probably date to the Final Formative based on similarities with sites such as Chankillo (Brown Vega 2010; Daggett 1987). The largest forts are elaborate, with multiple concentric walls, parapets, bastions, and baffled gates. They were designed to defend against large-scale, organized war parties intent on storming gates or scaling walls. Their imposing walls are made of large cut-stone blocks interleaved with smaller chinking stones and mortar, often with finely dressed cornerstones and lintels. A few hillforts may have protected

ritual structures at their centers, like Chankillo (Ghezzi 2006), Acaray (Brown Vega 2008), and upvalley sites of Nepeña (Proulx 1985). Artifacts such as the richly garbed warrior figurines at Chankillo (Ghezzi 2006) and highly polished stone maces and groundstone knives (Brown Vega 2009, p. 262; Muelle 1957; Proulx 1985, p. 226) imply an emphasis on ceremonial and performative aspects of warfare and idealized warrior personae.

Warfare, however, was more than just spectacle. The great majority of defensive sites are smaller and simpler, sometimes just ridgetops defended by a ditch or wall across the access (e.g., Wilson 1995), or stone-retained hilltop platforms (Proulx 1968, 1973, 1985; Willey 1953; Wilson 1988). Many large and small hillforts were inhabited, showing that people and their dwellings were threatened by attack (Brown Vega 2008, 2010; Willey 1953, pp. 92–93, 95; Wilson 1988, pp. 104, 108). Sometimes, as in Santa, small unfortified settlements were located on defensible slopes and ridges (Wilson 1988). So warfare endangered ordinary populations, not just elites. And defeat was a real possibility; there is evidence of rapid abandonment at Acaray and of intentional sacking of temples at Acaray and Chankillo (Brown Vega 2008; Ghezzi 2006). Settlement patterns vary, with the most intense fortification in Santa, Casma, and to a lesser extent Nepeña and Virú Valleys. Forts in these valleys are often located on hill spurs at strategic bottlenecks and apparently operated as coordinated defenses for politically unified valley segments; indeed, defensive needs may have helped knit together and sustain these larger polities. In valleys farther north and south, smaller settlement clusters or independent communities were engaged in conflict, and fortifications were less elaborate.

Despite small samples, skeletal evidence supports the impression of conflict, with cranial trauma rates ranging from 6 to 33 % in the north and central coast. Violent trauma in Jequetepeque is present, though infrequent, among Final Formative (Salinar) human remains where it had previously been absent (Gillespie 1998), and decapitation is reported (Elera A. 1998, p. 144). A high rate of cranial trauma (33 %), all healed, is seen in the Moche Valley (Lambert 2011), and 15 % of adults from the Lurin Valley mouth exhibit cranial trauma (Pechenkina and Delgado 2006).

Warfare is clearly indicated on the south-central coast of Peru after about 350 BC. The late Paracas and very early Nasca pattern is of settlement nucleation, strategic hilltop sites, and walled forts (Appendix B). A quarter of adults from Palpa dating mostly to Late Paracas exhibit head trauma (Tomasto 2009), and there are anecdotal descriptions of blunt force trauma on Paracas skulls (Engel 1976, p. 154; Tello and Mejía Xesspe 1979).

The first clear examples of human trophy heads come from this late Paracas context, coinciding with the violence-related trauma (Pezzia 1968; Verano 1995). Trophy heads also were a major theme in late Paracas iconography, usually shown held by figures with supernatural attributes (Paul 2000). These early trophy heads are noteworthy because it was here that the tradition of Nazca trophy heads later reached its height. Scholars have debated whether these heads were taken from ancestors or enemies, and if the latter, whether head taking occurred in warfare or highly ritualized confrontations (Conlee 2007; DeLeonardis 2000; Kellner 2002; Knudson et al. 2009; Tomasto 2009; Tung 2007a; Verano 1995; Williams et al. 2001).

Two recent findings suggest that trophy heads in the Final Formative were taken from enemies in warfare, congruent with the conflictive environment indicated by settlement patterns and trauma data. In Palpa, a headless Paracas adult male was recovered with a projectile point between his ribs; cut marks on the cervical vertebrae show he was beheaded with a sharp blade (Tomasto 2009). Second is Valdez's (2009) find of the decapitated bodies of 47 men and women and 24 subadults, including several infants, at Amato in the Acarí Valley. Perimortem and partially healed rib and arm fractures suggest that the victims had been captured in a recent confrontation; all were stripped naked, and several were bound with rope on their wrists or ankles. They were buried without grave goods where they fell. This is the clearest Andean archaeological case of trophy heads taken in war. The trophy heads were not obtained in a battle (a setting with the potential for ritualized combat) but a raid on a village where both sexes and all age groups were present. The aim of war, in this case, was the extermination of an enemy group, as well as the procurement of trophy heads. In Acarí, buffer zones separated ditched and walled sites of equivalent size, spaced on natural terraces overlooking the valley's extremely limited arable land (Valdez 2009). There were no unfortified habitations, demonstrating serious (and apparently well-founded) concerns about defense.

Conflict may have been present farther south in northern Chile, although settlement patterns do not appear defensive. In the Azapa Valley, three male bodies were bludgeoned to death and buried naked without grave goods in an isolated location. Standen et al. (2010) propose that they were coastal peoples possibly ambushed by local farmers.

In the highlands there is little bioarchaeological information for this period, and settlement patterns suffer from uneven coverage and coarse chronologies. Defensive hilltop settlements and fortifications appeared in some parts of the highlands and are absent in others (Appendix B). They are most clearly marked in the northern Peruvian highlands in Cajamarca, Huamachuco, the high Chicama, Moche, Virú, and Chao watersheds, and to a lesser degree in Ancash. These patterns emerged somewhat later in the north highlands than the north coast, probably after about 200 BC. The interface between northern highlands and upper coastal valleys was especially fortified (Topic and Topic 1978). Farther south, hilltop settlement was common around Cuzco and in the Tiwanaku Valley. Stanish and Levine (2011) describe a burning episode c. AD 50 at the monumental complex of Taraco in the north Titicaca Basin that may correspond to violent sacking by a rival center.

The Final Formative was clearly a time of intensified warfare in several regions. Although our understanding of war at this time is limited, the evidence points to at least two causal factors: elite competition in a context of uncertain authority and conflict over land and goods. First, warfare was probably waged partly as elite competition to attract and incorporate people into regional systems. Over the previous millennium, populations in the northern and central highlands and coast had become integrated into regional religious communities centered at monumental complexes, and by the Late Formative marked differences in graves and houses reveal a permanent elite rank that probably derived its authority from priestly prerogatives, often (though not always) centered on Chavín-Cupisnique symbols (Burger 1992; Rick 2004). The demise of the Chavín-Cupisnique cult led to

destabilization, power struggles, and perhaps migrations, necessitating new kinds of political authority (Burger 1992). Military aggression became one way to unify and expand regional groups and confirm elite status.

This politically competitive aspect of warfare is suggested by an emphasis on war-related display: militaristic iconography, monumental and visually imposing forts, highly crafted weapons, and acts of symbolically charged destruction. Such evidence is most prevalent on the north coast where, despite conflict, similarities in architecture and artifacts testify to considerable contact and interaction (Brown Vega 2010). The coastal conflicts of this time eventually aggregated populations into valleywide polities. Military competition between emerging regional polities also took place in highland areas such as Cajamarca and the Titicaca Basin. Warfare for the first time assumed major importance in political interaction and integration.

Second, wars were fought over lands and/or goods, not just people and their allegiances. In many coastal valleys (Moche, Chicama, Santa, Lurin, Ica, Nasca, Acarí), small nonelite settlements were defensible, so attacks likely were aimed to raid for stores or captives, to eliminate enemies, or to drive them from desirable lands. The village massacre at Amato suggests that in this valley of limited agricultural land, extermination was the aim, not incorporation. Notably, 18 % of the Final Formative adult crania from the coast have trauma. The threat of attack was real, and communities planned their settlements with that threat in mind.

In a macroregional perspective, violent pressures were present more consistently on coastal than on highland societies, perhaps because of denser populations, rich and sharply circumscribed agricultural lands, and the importance of controlling critical canal intakes. By contrast, large portions of the highlands were still very sparsely occupied; land was less worth fighting over, and moving away was a more viable option. Settlement patterns in the highlands show significant levels of conflict, but less consistently than on the coast, although cranial trauma data from the Final Formative highlands are still needed. Finally, the large geographic extension of conflict is noteworthy, including places that had not adopted the Chavín-Cupisnique cult. Future research may indicate whether warfare spread outward from some affected centers or whether perhaps large-scale climate conditions played a role.

Overall, the first significant levels of Andean warfare are not associated with the transition to sedentism, or agriculture, or multicommunity socioreligious integration. Intense warfare, instead, arose in a context of emerging social stratification and elite rivalry, made fluid by the failure of the preexisting authority system.

Cultures of War: The Early Intermediate Period

From Formative times onward, many Andean societies celebrated militaristic themes and engaged in war-related spectacles. These practices tell of worldviews that placed high value on warriorhood, military victory, and the performance of violence, at least among elites and the artisans they patronized. Were these cultural attitudes consistently linked to frequent military aggression in practice?

The Andean sequence does not support this proposition. Formative iconographies of fierce deities were contemporary with nondefensive settlement patterns and low cranial trauma rates (though skeletal samples are small). By contrast, the highest rates of trauma and fortification in the Andes are from the central highlands in the Late Intermediate period (discussed below), where there was little militaristic iconography or even figurative iconography. This is not to say that there is an inverse relationship between intense warfare and warlike "culture"; cultures such as Recuay and Wari produced elaborate warlike iconography and also engaged in warfare frequently. The relationship between war and warlike display, however, is not uniform or predictable. This variation is encapsulated by the Early Intermediate period.

EIP populations lived in more complex regional polities than before. In several cases, the idea of war, war-related violence, and warriorhood became central to religion, social hierarchy, and masculinity. In Nasca and Moche areas in the coastal valleys and Pucara and Recuay cultures of the highlands, among others, the portrayal of warriors, weapons, trophies, and/or combat on ritual vessels, in ritual spaces, and in politically prominent places explicitly integrated warfare with religious and political agendas. Elites defined their roles in part as warriors and performers of violence that ritually fed and strengthened society (Swenson 2003). If this milieu helped perpetuate war—and reciprocally, if war fostered such cultural and political emphasis on violence—we should see a "horizon" of war at this time. Instead, the intensity of warfare varied greatly over space, the product of specific histories of political competition and integration.

The Nasca

Nasca polychrome ceramics from Peru's south coast often depict trophy heads, warriors, and combat themes, and numerous human trophy heads have been recovered from Nasca sites. In the Las Trancas Valley, 14 % of the 85 crania excavated by Tello were trophy heads (Kellner 2006), suggesting that a good portion of the population, men especially, were eventually decapitated. Men were clearly favored as trophies (92 % are male; $N = 98$) (Tung 2007a). Trophy heads ended up in highly ritualized contexts and are commonly interpreted as symbols of regeneration (Proulx 2001); they also may have been central to establishing elite male status.

There has been considerable debate about whether trophy heads were taken in warfare or tinku-like combat, or simply taken after a natural death (Tung 2007a; Verano 1995; for perspectives, see Browne et al. 1993; Neira and Coelho 1972; Proulx 1989, 2001; Silverman 1993; Uhle 1918). Stable isotope ratios indicate that trophy heads derived from local individuals in Nasca (Knudson et al. 2009), but this does not necessarily mean trophy heads were made from ancestors or taken in "ritual battles" between neighboring communities. Nasca was not an expansive polity, so isotope ratios should not be expected to show trophies derived far from the Nasca sphere (in contrast to the Wari, discussed later). Nasca iconography, however, shows battling warriors decapitating individuals, which may suggest battles as the source for trophy heads (Verano 1995).

Despite the trophy heads, moderate cranial trauma rates and mostly nondefensive settlement patterns show that warfare was not common enough to pose a major threat to most Nasca populations. Earlier settlement patterns in the Ica, Nasca, and Acari Valleys had been highly defensive, but hostilities lessened greatly in the EIP. Numerous small nondefensive sites occupied the valley borders in early Nasca, dominated by the monumental center of Cahuachi (Reindel 2009; Silverman and Proulx 2002). After AD 350, Middle Nasca settlement shifted to larger villages (Reindel 2009; Schreiber and Lancho 2003), with the largest and richest center at La Muña in Palpa. In late Nasca (c. AD 550–750), populations aggregated into still fewer and larger settlements in middle and upper valleys. Although not particularly defensive, large sites may have offered some degree of protection (Schreiber 1999). Over time, increased differentiation in graves accompanied a greater iconographic focus on warriors, combat, and decapitation. More trophy heads from good contexts date to middle and late Nasca, although this trend rests in part on a few unusually large caches.

Cranial trauma data indicate a moderate level of violence. Among all Nasca phases in the Las Trancas Valley, 9 % of adults ($N = 81$) exhibit at least one head wound (Kellner 2002). Twenty-four percent of head wounds from all time periods (EIP to MH) are on the frontal bone (Kellner 2002), suggesting that victims were sometimes facing their attacker, as in battlefield contexts or interpersonal fights. Head injuries slightly increased from middle to late Nasca (Kellner 2002), mirroring the increased numbers of trophy heads and more depictions of them. Adding other skeletal samples from the Nasca drainage (Tomasto 2009; Tung and Schreiber 2010), the overall adult cranial trauma frequency (excluding trophy heads) averages about 8 % (9/119), not particularly high for Andean samples. Women suffered head trauma at a rate similar to that of men, perhaps in village raids or intrahousehold violence, since it is unlikely that females were on battlefields. Nasca trophy heads reported by Kellner (2002, 2006), Forgey and Williams (2005) and Verano (1995) have a comparable fracture rate of 10 % ($N = 79$), though some injuries may go undetected because the posterior portion of some trophy skulls was removed.

Raids and/or battles of some sort were carried out in Nasca society, because trophy heads must have resulted from them, and it is possible that other forms of violence occurred too. In later Nasca times, there is more militaristic iconography, an increase in head taking, a slight uptick in violent trauma, and a shift in settlement patterns that might suggest increasing conflict. Nevertheless, conflict was probably never as severe as it had been in the late Paracas period when defensive settlements were common and about a quarter of the adult population exhibited skull trauma. Nor was it as severe as it was 1000 years later in the LIP, when settlements in the region were defensible and sometimes walled, even though head hunting was no longer practiced.

The Gallinazo and the Moche

The Moche are famous for a cultural and religious emphasis on militarism. Moche elite styles and polities arose around AD 300 out of a number of earlier Gallinazo societies on the north coast. The largest and most integrated Moche polity was the

southern Moche state based at Huacas de Moche and including the Chicama, Virú, Santa, and Nepeña Valleys. To the north, it is uncertain how many independent Moche polities there were and what the relationships were between them (Quilter and Castillo 2010). Warfare has been a dominant theme in Moche studies; portrayals of warriors, prisoners, weapon bundles, and sacrificial elements constitute over 60 % of known Moche art (Donnan 2010, p. 60). Combat imagery typically depicts elite warriors in single combat battling and taking prisoners, or lone human warriors battling a deity. This has led some to propose that conflict was highly ritualized, tethered to ceremonial cycles and limited to elites (Bourget 2001; Donnan 2003; Hocquenghem 1978) whose goals were to take captives for sacrifice, not expand territory or control resources (Benson 1972). Others argue that Moche warfare would have involved commoners as well as elites and would have been employed in part as a strategy of expansion (Billman 1997; Lumbreras 1980).

Moche sacrificial victims recovered archaeologically are proof of the importance of combat, captive taking, and sacrifice to Moche ritual. They also demonstrate that violence targeted young men. At Huaca de la Luna in the Moche Valley, about 107 young adult males were tortured, sacrificed, dismembered, and deposited in several episodes over at least two centuries (Backo 2011; Bourget 2006; Verano 2001a). Partially healed wounds indicate that they were taken in battle or abused after capture, and healed wounds on about 21 % of the frontal and parietals suggest they were previously involved in combat (Philips 2009). Other indications of sacrifice include decapitated skulls from Dos Cabezas in Jequetepeque (Cordy-Collins 2001) and burials of bound or decapitated males in Santa (Gagné 2009) and Nepeña (Chicoine 2011). Although the injured captives show that combat occurred, it is unclear how representative those victims are. What percentage of men were taken captive? What was the impact of warfare on whole Moche populations?

Those questions require trauma data from Moche cemeteries. At Cerro Oreja in the Moche Valley, cranial trauma (antemortem and perimortem combined) gradually increased through the three Gallinazo phases, from 18 to 23 to 39 % (Lambert 2011; Appendix A). The aggregate Gallinazo sample exhibits a skull trauma frequency of 19.2 %, showing that violent injury affected commoners in the Moche Valley before and during the initial rise of the Moche polity. Among approximately 30 adults buried at the massive pyramid complex of El Brujo, 11 (37 %) have ante- or perimortem skull trauma, or both; the fractures are most commonly on the nasal bones (24 %), parietals (12 %), then frontal bones (8 %); none were on the occipital (Philips 2009). This suggests face-to-face fighting was common, some of it lethal. At the Moche commoner cemetery at Pacatnamu, four of about 30 (13 %) adults have healed cranial trauma, and nasal fractures are again the most common (13 %) (Philips 2009). Combat injuries affected the general Moche population, suggesting a phenomenon distinct from the elite combat featured on Moche pots.

Settlement evidence from Gallinazo and early Moche populations leads to similar conclusions. In the Moche Valley (Billman 1999), many Gallinazo habitation sites are in defensible settings and a few are fortified, forming a concentrated middle-valley cluster protecting itself from the highlands and/or from Virú to the south. As the Moche state coalesced in Moche and Chicama Valleys, defensive site locations decreased, while strategic defensive sites guarded the interface with the highlands

(Billman 1999; Gálvez and Briceño 2001; Topic and Topic 1978). Late in the Moche sequence, a political schism probably arose between the old capital and a new fortified center at Galindo (Lockard 2009).

Scholars have long been interested in whether the valleys south of Moche, where Moche styles appeared at about the same time as the emergence of the southern Moche state, were annexed in military conquests. The process of incorporation apparently depended on the valley. The lower Virú Valley was already unified under a native regional polity, with nondefensive settlement in the lower valley and fortified hilltop temples strategically placed at the valley neck (Willey 1953). In the later EIP, the continued existence of local Virú elites suggests that Moche control was hegemonic or indirect (Millaire 2010), while a threat from the highlands is indicated by defensive walls in the Huacapongo branch (Willey 1953). In the Santa Valley, strongly defensive Gallinazo settlement eventually gave way to exclusive Moche domination of the lower valley, typified by nondefensive settlement (Chapdelaine et al. 2009; Wilson 1988). The displacement of local valley residents suggests Moche expansion was coercive in nature (Chapdelaine et al. 2009). In Nepeña, intrusive, largely nondefensive Moche sites likewise seem to have displaced the earlier settlement pattern in the lower and middle valley (Proulx 1985). The continued use of many defensive sites in the middle and upper Santa and Nepeña Valleys suggests that native valley residents may have been physically threatened by the Moche occupation of the lower valleys. Territorial expansion and population displacement in Santa and perhaps Nepeña contrast with later Andean imperialism aimed at the conquest and incorporation of new subjects as well as the annexation of lands.

The Moche presence farther north in the Jequetepeque and Zaña Valleys appears less stable and politically integrated. Early Moche settlement patterns are not well understood; by middle and late Moche (the time of the Pacatnamu burials discussed above), multiple forts were present, with high walls, parapets, and slingstone piles (Castillo 2010; Dillehay 2001). By late Moche, nearly every settlement was associated with a hilltop refuge or fortified settlement, suggesting that conflict between subvalley polities severely threatened communities.

On the north coast, then, settlement patterns support the existence of warfare that threatened populations and had political consequences. There was persistent conflict between coastal people (Gallinazo/Moche) and neighboring highlanders. There was a decrease in defensive settlements from early to late EIP as lower valleys came under more centralized control. Arguably, there is evidence for Moche military expansion into the Santa and Nepeña Valleys. Settlement patterns also indicate a greater threat of attack on local Moche communities in the north than in the southern Moche sphere, where the greatest ritual focus on militarism is apparent. Whereas settlement evidence indicates conflict with non-Moche populations, Moche pots almost exclusively portray battles between Moche elites. This simply demonstrates that Moche iconography of combats and sacrifices served not to document the whole range of Moche warfare but to establish and maintain a particular social order (Bawden 1996; Verano 2001b). Of course, it is possible that Moche elites also engaged each other in highly ritualized battles. Indeed, the complex regional Moche histories that are emerging could have involved multiple kinds of conflict, including between elite Moche factions.

The Recuay

East of the Moche, the Ancash region was occupied by a number of large, independent chiefdoms with a common material culture: Recuay. Militaristic Recuay iconography aligned with high levels of warfare. Defensive settlement patterns in this area are among the clearest in the EIP, despite the lack of systematic survey. There was a proliferation of defensible ridgetop sites, often fortified with ridgeline ditches and high parapeted walls, to the near exclusion of other site types (Alcalde 2003; Herrera 2003; Ibarra 2003; Lau 2004, 2010). Defensive architecture is exemplified at Yayno, the largest and best-studied Recuay regional center (Lau 2010). Yayno was a densely occupied hilltop fortified town encircled by elaborate defensive trenches and some parapeted/walled ledges. Weapons from the site include slingstones and club/axe heads. The circular residential compounds are also defensive, with massive walls at least 12 m high and very few external doorways at the ground level; the entrances that exist are baffled or indirect (Lau 2010). Smaller fortified villages on rocky hilltops also are common in Ancash, suggesting that Recuay people at all levels of society were under frequent threat (Lau 2004), potentially from other Recuay chiefdoms, non-Recuay highlanders, and Moche incursions.

As in other EIP societies, an iconographic emphasis on militarism linked elite status and warrior identity (Lau 2010; Tello 1929, pp. 75–80). Ceramics and stone sculpture feature weapons and finely garbed warriors, often with trophy heads (Tello 1929), and large modeled pots portray walled towns defended by armed fighters (Lau 2010). For the Recuay, warfare and militaristic iconography can be interpreted as facets of chiefly competition and status aggrandizement; warfare also may have involved conflicts over lands, herds, and resources.

Thus, while many EIP cultures stressed militaristic iconography and ritual, the actual severity of warfare was far from uniform among them. We do not argue that war in concept and ritual was unrelated to war in practice, or that wars in the EIP were unconnected with elite statements about violent domination. Warriors and leaders enacted and experienced violence within a framework of cultural understandings and values. The severity of Andean warfare, however, was not a simple product of those understandings. It also was affected by local environments, histories, and agents. Consequently, politico-religious spectacle and imagery that refers to warfare is not by itself good evidence for intense warfare.

States of coercion

The latter part of the Andean sequence after about AD 600 is characterized by the rise and fall of powerful state polities (Fig. 4). With them, coercive forms of political authority became much more important, and war's primary role became the territorial conquest and incorporation of new subjects and tribute payers. Wari and Inka expansion closely correlates with state emergence, and conquest warfare may have been one component of state formation.

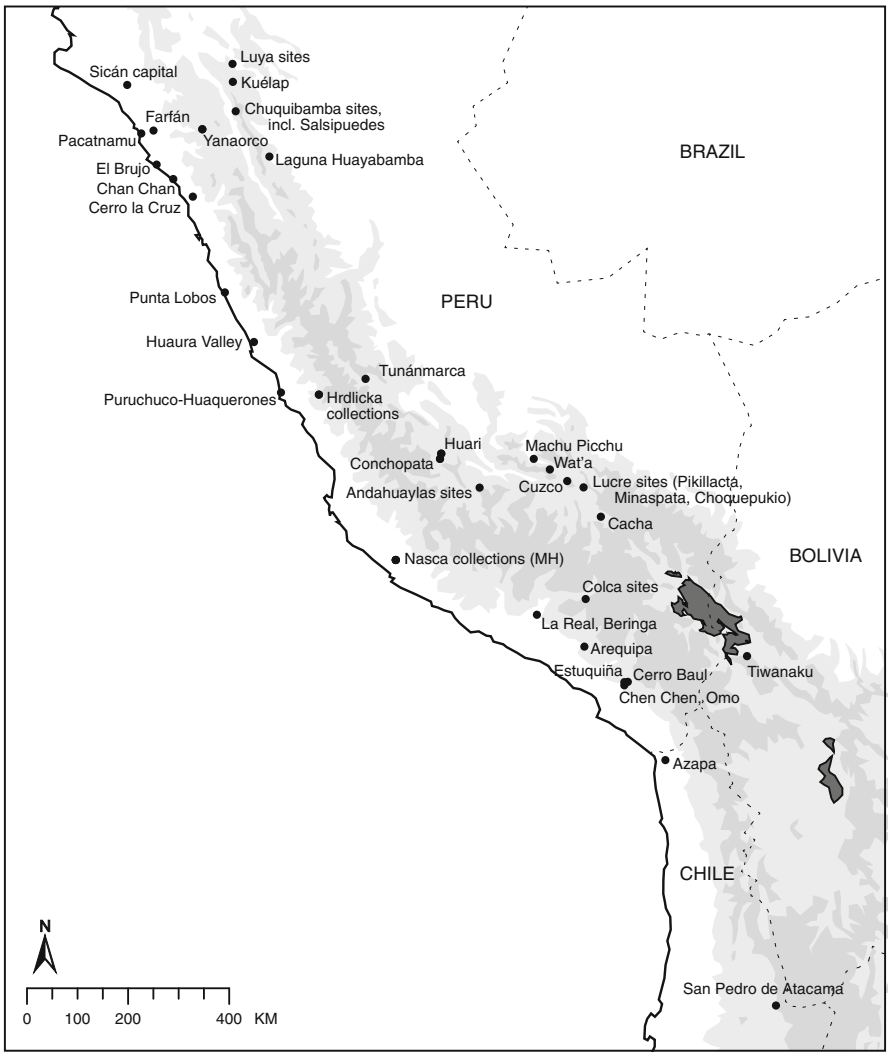


Fig. 4 Late sites referenced in the text (MH, LIP, and LH)

As Andean states consolidated power, they created spheres of protection in their interior and pushed warfare to frontiers where conflict continued with external enemies. Internal violence and fortification decreased most clearly with the emergence of the southern Moche state and with the spread of the Chimu and Inka empires, indicating little threat of attack on communities under state control. However, that does not mean state subjects were freed from the experience of war: surprisingly high cranial trauma rates for some Wari and Inka populations may reflect conscription in military campaigns. State populations also were exposed to ritual violence. Because state settlement patterns are typically nondefensive except

at frontiers or provincial colonies, trauma is especially important for revealing participation in violent encounters.

As Andean imperialism developed, the signatures of warfare changed. The fortification of settlements was supplanted by strategic outposts protecting large areas and controlling transport corridors. Conquest, revolt, and the suppression of rebellions sometimes entailed the destruction of important places. Wari and Inka logistical investment in military campaigns helped fuel the expansion of roads, provincial storage, and intensified agricultural production. However, in comparison to Wari, Chimu, and Inka, there is less evidence for Tiwanaku and Sicán military expansion. Hence, the (bio)archaeology of Andean war illustrates different ways of becoming and being a state.

Wari and Tiwanaku

The Middle Horizon was marked by the emergence of the Wari empire (AD 600–1000/1100) in the central highlands and the Tiwanaku state (AD 550 – 1000/1100) in the Lake Titicaca basin. Both states established colonies and contacts far from their heartlands.

Wari provides the first clear case of Andean imperialism (Schreiber 2001). The enormous urban capital of Huari coalesced at about the same time as the initial appearance of far-flung Wari colonies, suggesting that military expansion was an inherent part of state formation (Schreiber 2001, p. 81). High cranial trauma rates in some regions and the presence of trophy heads support militarism, but low rates in other areas suggest that Wari also used other means for expansion.

In the Majes Valley of Arequipa, cranial trauma affected about a third of the population, and trophy heads are not uncommon (Tung 2007b). Similarly, about a quarter of the Wari-affiliated (Nasca-Chakipampa) burials in Nasca have cranial trauma (Kellner 2002). Wari-affiliated populations exhibit lower cranial trauma rates in the highland areas of Cuzco (8 % of adults and 19 % of males, Andrushko and Torres 2011) and Andahuaylas (9 %, Kurin 2012). In the Wari heartland, individuals at larger, higher-status sites appear to show more violent injuries than those at smaller sites (Tung 2012). At the capital of Huari, 42 % of adults from the elite Cheqo Wasi sector exhibited healed cranial trauma. At the intermediate elite site, Conchopata, antemortem cranial trauma affected nearly a quarter of adults. But at the smaller sites of Trigo Pampa and Nawinpukio, cranial trauma was absent among the small sample of adults, though trophy heads were present. Elites may have been preferentially involved in warfare and other violent activities (Tung 2013). Warfare and militaristic iconography may have mutually reinforced each other in Wari society (Tung 2012): ceramic iconography from Huari and Conchopata is replete with warriors carrying weapons, prisoners, and trophy heads. Human trophy heads also provide evidence for war raids. At Conchopata, 42 % of 31 trophy heads exhibited trauma (Tung 2008a). There is persuasive evidence that the trophy heads were from nonlocal enemies: strontium isotope ratios show that 14 of the 18 sampled derived from a geological locale outside of the Ayacucho Basin (Tung and Knudson 2011).

Settlement evidence supports Wari imperialism, though it does not always indicate violent conflict. Wari colonial outposts are often located on pre-Columbian roads, some with storage facilities that may have supplied military garrisons (Schreiber 2001). Most are not particularly defensive, though they are usually defined by high walls that limit access. Pikillacta in the Lucre Basin has massive walls and hilltop sites that control valley access (McEwan 1991); a large cache of warrior figurines repeats the characteristic Wari emphasis on militarism (Tuni and Tesar 2011). But in many regions with Wari presence, such as Andahuaylas and Huamachuco, local settlement was not defensive.

Some of the most intensive research on Wari and Tiwanaku is in the Moquegua Valley of southern Peru, where both states established colonies. Wari colonists arrived in the early 7th century AD, but avoided the middle valley where local farmers and Tiwanaku Omo colonists resided; instead, they settled in the uninhabited upper valley (Williams and Nash 2002). Those Wari settlements appear defensive (Moseley et al. 1991; Williams 2001), especially Cerro Baúl, located on a highly defensible mesa (though its location may have been partly based on views of religiously important mountain peaks; Williams and Nash 2006). Cerro Mejía, adjacent to Cerro Baúl, is surrounded by multiple walls (Moseley et al. 1991). Cerro Trapiche, a Wari/Huaracane site in the middle valley near Tiwanaku settlements, includes a walled hill peak with slingstone caches (Green and Goldstein 2010). This, along with spatial segregation of Tiwanaku and Wari settlements (Owen and Goldstein 2001) in the first half of the MH, suggests that Wari people initially experienced or perceived hostilities—perhaps because they were outnumbered by Tiwanaku colonists and indigenous residents (Green and Goldstein 2010). In turn, the new Wari upper-valley irrigation systems were a form of "conquest by hydraulic superiority, accomplished through economic rather than military means" (Williams 2002, p. 366).

By contrast, current interpretations of Tiwanaku emphasize ceremonial activities and social projects of more peaceful affiliation (e.g., Goldstein 2005). Tiwanaku sites present little evidence for defense. Most in Moquegua are nondefensive, although Cerro Echenique is on a fortified hilltop, and Omo occupies potentially defensible bluff tops (Goldstein 2005). Violent trauma among Tiwanaku-related Chen Chen populations in Moquegua also appears quite low (Blom et al. 2003a). Elsewhere, Tiwanaku-related sites are rarely defensive, with the exception of Arequipa, where they occupy hilltops and are sometimes fortified (Cardona 2002, pp. 78–87). Moderate levels of trauma affected populations in Azapa and San Pedro de Atacama, which had dealings with Tiwanaku (Fouant 1984; Torres-Rouff and Costa 2006), but nothing like the high trauma levels for some Wari-affiliated populations (Koontz 2011; Tung 2007b, 2012). Although the settlement and trauma evidence indicates that violence was not absent from Tiwanaku populations, the contrast with Wari supports visions of the Tiwanaku state as more incorporative than coercive. Nevertheless, violent spectacle formed part of state ceremony. Human bodies (with no antemortem trauma) were violently dismembered (Blom et al. 2003b) and deposited with camelid sacrifices on the steps of the monumental Akapana at Tiwanaku's capital, perhaps as public spectacle.

The north coast: Sicán and Chimu

As Wari and Tiwanaku collapsed around 1000/1100 AD, giving way to the Late Intermediate period, several complex societies emerged in the central and northern coastal valleys. The most important were the Lambayeque (Sicán) polity and the Chimu empire; the Chimu eventually conquered Sicán and other coastal peoples. (Evidence from the highlands in the LIP is presented in a later section.)

The Sicán polity emerged around AD 900–1100 (middle Sicán), with its capital in the La Leche Valley and several large centers from Lambayeque to Jequetepeque. Sicán rulers were apparently more interested in amassing wealth through trade than in annexing new territories. There is little evidence of warfare in Lambayeque and La Leche, where middle Sicán settlements were almost never defensive (Shimada 1990, p. 339). Craniofacial trauma was rare, around 5 %, at Sicán and El Brujo (Farnum 2002, 2006). In contrast to Moche ritual killings of captured warriors, Sicán sacrifices included young females and children (Farnum 2006; Klaus et al. 2010; Toyne 2008), signaling a shift toward the dedicatory sacrifice of local people (Toyne 2008). Conditions were less peaceful in Jequetepeque, where dispersed, walled hamlets were on defensible hillsides and the center of Pacatnamu was strongly fortified (Dillehay et al. 2009, p. 42; Donnan 1986).

About AD 1100, the major temples of the Sicán center were burned and abandoned (Shimada 1990). This massive destruction has been interpreted as a revolt, spurred by extreme social stratification and an extended drought (Shimada 2000). However, most settlement continued to be nondefensive.

The Chimu state offers a contrasting model of military expansion. Chimu consolidated the Moche, Chicama, and Virú Valleys, and late in the LIP Chimu rapidly expanded to conquer the rival Sicán and Casma peoples (Mackey 2009; Mackey and Klymshyn 1990; Moore and Mackey 2008). This expansion was militaristic, evidenced by fortifications and garrisons along the expanding Chimu frontier, built by both Chimu and its foes. For example, Vogel (2012) interprets Cerro la Cruz in the Chao Valley—a large hilltop settlement with triple walls, parapets, and slingstone piles—as a northern frontier outpost of the Casma polity. This site (AD 890–1290) fell to the Chimu; widespread burning at its abandonment may have been a closing ritual or deliberate sacking (Vogel 2012). In the middle Nepeña Valley, the "great wall" on the northern side and its associated watch stations are interpreted by Proulx (1973, pp. 94–96) as a defense against Chimu invasion. The Final Formative fort of Acaray in Huaura was rebuilt and expanded in the LIP, probably as a defense by Chancay people against Chimu expansion (Brown Vega 2009, p. 264).

The Chimu violently annexed the Jequetepeque Valley around AD 1300 (Mackey 2009), as suggested by the razing of Farfán, with Chimu rebuilding above two sacrificed individuals with local head modification. The Lambayeque and La Leche Valleys were enveloped by Chimu within the next century (Mackey 2009, 2010; Shimada 1990, p. 313). Chimu hillforts, with massive parapeted walls enclosing habitation, ceremonial, and administrative architecture, were established in these areas (Dillehay et al. 2009, pp. 250–254, 279–283; Figueroa and Hayashida 2004;

Tschauner 2001). The locals lived under the gaze of these Chimu strongholds in valley-floor habitations (Tschauner 2001).

The violence of Chimu expansion is also indicated by two mass killings. To the south, in Huarmey on Punta Lobos beach, an execution at cal AD 1250–1300 of almost 200 men and boys is plausibly interpreted as a Chimu reprisal killing (Verano 2007; Verano and Walde 2004). To the north, at the fortified center of Pacatnamu in Jequetepeque, 14 young men, with lethal blunt force trauma and stab wounds, were bound, mutilated, and killed, then tossed into a defensive trench (Verano 1986). They had previous combat injuries (Verano 1986): 12 % of nasal bones and 3 % of frontal bones had healed fractures (Philips 2009). Verano (1986) suggests that the local population captured and sacrificed these enemy warriors, perhaps Chimu invaders, although their identity is unclear. Chimu wooden *maquetas* include images of prisoners who may be captured warriors (Jackson 2004; Uceda 1997).

Once Chimu control was established, there was peace. In the Chimu heartland, the lower Moche and Virú Valleys, defensive settlement was rare in the LIP. Settlement patterns in Casma, Santa, and Nepeña became nondefensive under Chimu control (Proulx 1968, pp. 34–35; Wilson 1988, 1995). Chimu never extended control eastward beyond the lower valleys; fortifications and defensive settlements in middle valleys may have protected inhabitants from highland raids (Topic 1990).

The Inka empire (Late Horizon)

The Inkas are the premier example of Andean militaristic imperialism. Ample colonial documents offer a detailed picture of Inka arms, military conscription, logistics, and campaigns of conquest (see treatments by Bram 1941; D'Altroy 1992, 2002; Quiroga I. 1962; Rostworowski de Diez Canseco 1988; Rowe 1946; Urteaga 1919). We restrict ourselves to the archaeology. Settlement patterns, skeletal trauma, and destruction episodes provide a picture of warfare at the frontiers and coercive Inka control in the provinces based partly on military might but with less severe violence than in the preceding LIP.

Conquest was just one of several strategies by which Inka control over the Cuzco heartland was consolidated (Bauer and Covey 2002; Covey 2003). The Inkas then began an ambitious program of imperial expansion that, according to the documents, was predicated on military power. Archaeologically, the preexisting LIP defensive settlement patterns make it difficult to identify defenses built against the Inka advance. (In Cajamarca, rapid expansion of the Yanaorco hillfort may be in defense against the Inka invasion (Toohey 2009).) But destruction episodes provide some evidence of violent conquests, especially where natives resisted or rebelled. In the Lucre Basin, burning events at Minaspata (Dwyer 1971, p. 74) and Choquepukio (Hiltunen and McEwan 2004, p. 245) may correspond to Inka aggression. Tunánmarca in the upper Mantaro Valley was abandoned and in part destroyed, perhaps as retribution for fierce resistance (Hastorf 2001, p. 324). Burning and abandonment of some Chan Chan ciudadelas may have been an Inka reprisal for an uprising (Moseley 1990, p. 15). More commonly, the Inkas razed native elite

residences or ceremonial structures and rebuilt over them. Many such destructions may lie beneath Inka architecture in provincial settlements (e.g., Hyslop 1990, p. 262; Kosiba 2010; Nielsen 2008). The intentional burning and dismantling of several Inka buildings at Tomebamba in Ecuador probably occurred in the Inka civil war (Hyslop 1990, p. 265). These acts of destruction symbolized military dominance and superior might.

After conquest, imperial control is considered to have produced a *pax Inka* (Murra 1986). Shifts to less defensive locations are clear in parts of the central and southern Andes where prior settlement patterns were strongly defensive. For instance, walled hilltop sites were abandoned for nondefensive settlements in the Lake Junín region (Parsons et al. 2000, p. 138), the upper Mantaro Valley (D'Altroy 1992, pp. 189–193), Ayacucho (Schreiber 1993; Valdez and Vivanco 1994), the upper Moquegua Valley (Stanish 1992), and the Titicaca Basin (Arkush 2011; Stanish 2003; Stanish et al. 1997). Some chroniclers ascribed resettlements to Inka fiat (Cieza de León 1985; Sarmiento de Gamboa 2007). However, lower-elevation sites near farmland also may have been attractive to populations relieved from the threat of attack.

Elsewhere, settlement patterns were generally conserved, especially where settlements were already nondefensive (e.g., north and central coast and the Cuzco heartland), or moderately defensive (e.g., Arequipa), often with the addition of an Inka administrative center in a new spot or at an existing native settlement (Stanish 2001). Most new Inka centers were in nondefensive locations, indicating that Inkas and their delegates did not feel threatened by local resistance; their command of bridges and roads instead evoked a concern to control passage through the empire, underlining the Inka reliance on a large, mobile army (D'Altroy 1992, 2002). Although overall settlement patterns show a lessening of conflict in the LH relative to preceding centuries, there is some evidence of patches and phases of conflict. Early Inka forts near Cuzco imply that initial Inka control of the heartland was not untroubled: New Inka structures and probably new fortifications were built at earlier ridgetop settlements at Raqchi and War'qana (Covey 2006, pp. 127–129), and massive encircling walls were erected at new Inka precincts at Wat'a and Pumamarka shortly after the Inka takeover (Kosiba 2010). The Inka center at Cacha is likewise surrounded by a massive perimeter wall (Sillar and Dean 2002). Such walls barred local populations from entering important centers. Similar considerations, or threat from the adjacent lowlands, may have prompted walls and control points at Ollantaytambo and Machu Picchu. The fortification of Sacsahuaman above Cuzco was a magnificent architectural statement that also ensured a refuge against uprising or invasion.

Rebellions and resistance in the provinces are described in documents but are hard to detect archaeologically. An Inka hilltop garrison of colonists controlled the potentially troublesome Lurín Valley (Makowski 2002). Inka architecture atop hillforts in the Titicaca Basin, identified in documents as rebel forts, testifies to their recapture (Arkush 2008, 2011). But forts were largely a late development in Inka military strategy, present mostly at strategic points and passes near the frontiers rather than in the provinces conquered in earlier years (for useful overviews, see

D'Altroy 2002, pp. 209–213; Hyslop 1990, pp. 146–190; Raffino 1988, 1993). Fortifications in northern Chile may correspond to an earlier frontier or to an area where special vigilance was necessary (D'Altroy et al. 2007; Niemeyer and Schiappacasse 1988). Frontier fortifications are particularly dense in Ecuador, in Bolivia where the highlands descend, in the southeastern frontier in Argentina, and near the southern frontier in Chile (see D'Altroy 2002, p. 211; D'Altroy et al. 2007, p. 97). The Inkas sometimes reutilized earlier native strongholds, especially in the southern empire (Gallardo et al. 1995; Planella et al. 1992; Stehberg 1976). In other cases, new fortifications were built (e.g., Ecuador; Connell et al. 2003). The uneven distribution of Inka forts suggests that they were never built as a uniform policy but as a specific response to difficult expansions or the threat of invasion by unconquered people. For instance, cordons of intervisible Inka forts north and south of modern Quito are evidence of hostile engagements late in the empire's history, described in documents (Plaza 1976). In sum, settlement evidence suggests that conflict declined with Inka rule, and LH warfare took place largely, though not wholly, in the fringes where conquest campaigns clashed with local groups.

Inka-period violent trauma rates bear little spatial correlation with settlement patterns, perhaps reflecting participation in distant military campaigns. For some, fighting did not decrease with Inka rule but became more lethal. There are similar rates of cranial trauma near Cuzco in the LIP (24 %) and LH (23 %), and fighting became more deadly, with "major cranial injuries" significantly increasing (Andrushko and Torres 2011). Andrushko and Torres (2011) hence suggest that warfare was less significant early in Inka state development than when the Inkas expanded outside the core in the LH. Elsewhere, adult trauma shows varied levels of exposure to violence. The rate was about 4–5 % at the royal estate of Machu Picchu (Verano 2003) and in San Pedro de Atacama in Chile (Torres-Rouff and Costa 2006). In contrast, at the Chachapoyas-Inka site of Salsipuedes, about 22 % had head trauma (Jakobsen et al. 1986, pp. 156, 164, 178), similar to the rate in the LIP, suggesting that conflict continued until quite late (Schjellerup 1997, pp. 242–243). At the Inka and early colonial site of Puruchuco-Huaquerones outside Lima, cranial trauma affected around 15 % of adults (Murphy 2004, p. 136; Murphy et al. 2010). Lethal (perimortem) trauma was unusually common at Puruchuco, about 9 % (Murphy et al. 2010). As in the Cuzco area (Andrushko and Torres 2011), adults died from serious blows to the skull, likely resulting from hand-to-hand combat. Even while trauma rates declined overall during the LH (Fig. 1) and the threat of attack lessened in many places, some people within the empire experienced significant violence, perhaps from service in expansionist campaigns.

It is clear, then, that Wari, Chimu, and Inka states pioneered new ways of making war: mustering larger-scale war parties and engaging in long-distance expansionary campaigns supported by a logistical investment in garrison forts and/or stockpiled supplies. Military conquest in the Andes could be very violent; its impact on outside populations is exemplified by Wari trophy heads, Chimu massacre victims at Punta Lobos, and the Inka destruction of native architecture. However, once incorporated, most subject populations found their houses and families under less danger of attack than in many nonstate contexts in the Andes, such as the LIP in the highlands.

Hard Times: The Late Intermediate Period (AD 1000–1400)

The LIP, the interregnum between the Middle Horizon states of Wari and Tiwanaku and the Inka empire, is the second clear "horizon" with widespread, intensive conflict. The highest trauma rates in the Andean sequence, and some of the most defensive settlement patterns, appeared at that time (Fig. 2, Table 4). In the highlands and upper valleys there is a clear settlement shift to ridges and hilltops, with larger sites often defended by fortifications and slingstone caches. These defensive patterns pervade the central Andes and reach to Ecuador, northern Chile, and northwestern Argentina (Appendix B; see also Arkush 2006; Covey 2008), raising the question of what caused warfare on such a geographic scale. This time, it is probable that a major factor was a prolonged environmental crisis during a time of social instability following state decline.

LIP warfare was most intense in the highlands and upper valleys. In lower valleys and the coast, settlement patterns show regional pockets of peace and conflict (Appendix B). Political integration of lower valleys under the hegemony of centralized regimes (Casma, Sicán, Chimu) suppressed internecine conflict and lessened external threat, except by enemy states' campaigns of conquest. But in the highlands, polities were smaller, and warfare involved brief, fierce assaults, not organized armies bent on conquest. Documents from the central Andes describe remembered conflict in pre-Inka times (LIP): communities led by petty warlords fought over lands, flocks, crop stores, and women, and defeated communities could be slaughtered or forced to flee (Julien 2003).

The period benefits from well-studied settlement patterns and a comparatively large number of bioarchaeological studies (Appendices A and B). Here we focus on a few regions where both lines of evidence converge. Warfare is particularly evident in Chachapoyas. Settlement patterns in this large region are poorly understood, but they include hilltop villages encircled by walls with parapets (Schjellerup 1992, 1997). Adult cranial trauma rates are generally high—about 20 %— in several studies from different Chachapoyas sites (Darcy et al. 2010; Jakobsen et al. 1986; Koschmeider and Gaither 2010; Nystrom 2004; Nystrom and Toyne 2013; Schjellerup 1997, p. 222). There was disproportionately more trauma on men (Darcy et al. 2010; Koschmeider and Gaither 2010) and high rates of lethality from crushing blows: about a third of all fractures in one study were perimortem (Jakobsen et al. 1986; Schjellerup 1997, p. 222). The best-known Chachapoya site is Kuélap, a large ridgetop settlement with monumentally high retaining walls and a cache of 2,500 slingstones and numerous broken stone axeheads (Narváez 1987). Though lethal injuries were rare at Kuélap (Nystrom and Toyne 2013), Narváez and Toyne uncovered evidence of a mass killing in the site's southern sector. More than 100 men and children were killed with multiple blows to the head and left unburied with houses toppled down around them (Toyne and Narváez 2013). Over half were children, including a few infants, suggesting an attempt to exterminate the resident population (and perhaps abduct females). The mass killing is not well dated and most likely occurred after the LIP, but it fits with a generally conflictive environment among the Chachapoya.

The central highlands show especially pronounced defensive settlement patterns and extraordinarily high trauma rates. Around Junín, Jauja, and Ayacucho, LIP settlements moved to higher, more defensible locations that also allowed greater exploitation of pasturage. Although sites varied greatly in scale, fortifications were almost universal, even at small settlements, compelling evidence of pervasive threat to whole populations (Appendix B). South of Ayacucho and into Andahuaylas, populations also moved to defensible sites that were often fortified. The highest trauma rates in the Andean sequence come from the central highlands at this time. At the former Wari capital, 84 % (26/31) of adults had at least one cranial fracture, with similar rates for women and men (Tung 2008b). The burial sample is not representative of a once-living community (juveniles are underrepresented), so it is not included in Appendix A or the summary graphs. It may represent victims of a massacre or several separate killing sprees; more than 40 % of the adults and 30 % of the children suffered fatal blows to the skull, and many have multiple perimortem wounds (Tung 2008b). The high rate of healed trauma (71 %) suggests that violence was common for this population. That also was the case for populations in nearby Andahuaylas, where over half of 222 adult crania exhibited head fractures, many of which were lethal blows (Kurin 2012). Finally, the Hrdlicka collection of LIP/LH crania from the western sierra near the upper Chillón drainage presents a trauma rate of 43 %, with a higher injury rate on men, though the collection may not be representative (Verano 2002). Combined, the evidence for intense warfare in the central highlands is very strong.

Warfare was less severe in the Cuzco region. The Cuzco and Paruro basins had unprotected valley-bottom settlements (Bauer 1992, 2004), evidence of early social integration into the Inka state. In surrounding valleys, small ridgetop settlements were rarely fortified (Appendix B). Yet nearly a quarter of adults in and near Cuzco had cranial trauma, including almost 40 % of men (Andrushko and Torres 2011). Because only 5 of the 47 injured exhibited "major cranial injuries," Andrushko and Torres (2011) suggest that hand-to-hand combat was not common in the LIP during early Inka state development; instead, wounds were sustained in "small-scale raids, skirmishes, and ritual conflicts."

Settlement patterns and cranial trauma converge in the far southern highlands. Defensive settlement in the southern Andes is patchily distributed and most pronounced in the large nucleated hillforts of the northern Titicaca Basin (Arkush 2011) and to the west in the upper Colca (Wernke 2006), while dispersed settlements are nondefensive in the southern Titicaca Basin and the Bolivian altiplano (Appendix B). But the pattern of walled nucleated villages reappeared on a smaller scale in southern Bolivia, northwestern Argentina, and northern Chile. In San Pedro de Atacama, both lines of evidence indicate warfare peaked in the LIP. Settlement patterns were more defensive than at other times (although less defensive than in many other Andean regions): Small, nondefensible settlements coexisted with centers like Pukara de Quitor (AD 1300), located on a hillside and fortified with a high wall on one side (Muñoz 1984). Cranial trauma in Atacama reached a height at the MH-to-LIP transition and in the LIP when approximately a third of the skulls had healed wounds, including several with multiple injuries. Cranial trauma

then decreased in the terminal LIP and Late Horizon (Torres-Rouff and Costa 2006).

Defensive settlement in the coastal valleys was much patchier. Where cranial trauma rates are known, they are considerably lower than in the highlands. For instance, walled ridgetop sites are typical in the middle and upper Moquegua Valley (Moseley 1989; Owen 1995; Stanish 1992). Yet Williams (1990, pp. 185, 191) found relatively low levels of healed crania at Estuquiña, around 10 %. In Huaura, two large forts in the lower valley attest to a threat of attack (Brown Vega 2008), yet cranial injury rates from looted cemeteries were less than 8 % (Jahnke 2009).

We can state with confidence that unprecedentedly severe warfare gripped the Andean region at this time, especially the highlands. What conditions led to this second large-scale horizon of war? One explanation is that the Wari and Tiwanaku collapse, and the attendant decline in political infrastructure and stable social networks, sowed the seeds of warfare (e.g., Hyslop 1976). Indeed, strongly defensive settlement patterns are associated with the aftermath of earlier collapses: the end of the Chavín-Cupisnique complex in the Final Formative and the disintegration of Moche polities. The collapse of the Middle Horizon regimes was itself a violent process accompanied by episodes of destruction. Omo, Chen Chen, and several other Tiwanaku-affiliated sites in Moquegua were destroyed (Moseley et al. 1991). A rich palace complex at the Tiwanaku capital was abandoned and deliberately burned (Couture and Sampeck 2003). A massive burning episode just after the abandonment of the Wari colony of Pikillacta may indicate that the site was sacked by hostile groups (McEwan 1996), and sudden abandonment and burning at Qoripata leads Glowacki (2002, p. 275) to suggest that attackers tried to expel the Wari from Cuzco.

In parts of the central, southern, and far south highlands, however, settlement evidence of warfare increased over the LIP, with strongly defensive, nucleated settlements in the 13th and 14th centuries (see Arkush 2008; but see Bauer et al. 2010). Whereas the decline of the MH states allowed internecine war to flourish, other factors may have encouraged it to escalate over time, such as prolonged resource scarcity and gradually increasing political integration. It is likely that scarce resources exacerbated a baseline condition of social and political tensions, since three paleoclimate records demonstrate sharply reduced precipitation in the early LIP in the central and southern Andes (Abbott et al. 1997; Bird et al. 2011; Thompson et al. 1985; see Arkush 2008). Perhaps not coincidentally, warfare in the Andean LIP correlates with episodes of severe conflict in North America (Lambert 2002) and in the Pacific (Field and Lape 2010), pointing to hemispheric climate disruption. In the Andean highlands, diminished political infrastructure may have limited LIP communities' abilities to manage drought and draw on trade networks to ameliorate scarcity, making them more prone to the conflicts over lands, herds, and stores that are described in the documents (Julien 2003). Although these texts also describe ambitious war leaders who capitalized on conflict, archaeologically warfare appears less political than in other phases: It is rarely accompanied by artistic celebration, ritualized spectacles, or the destruction of ceremonially important places. Warfare probably had more to do with the control of resources

by the community than the control of people by leaders, though the two are not mutually exclusive.

Conclusions

Intense episodes of war can be identified that affected Andean lives in much more far-reaching ways than tinku battles. Synthetic treatments of warfare in North America (e.g., Lambert 2002) likewise reveal pan-continental trends, showing that periods of especially frequent war may alternate with more peaceful periods in "long waves" (Haas 2001). In the Andes, these macroregional episodes that went beyond specific cultural contexts can be plausibly linked with violent competition over resources or political allegiances during "crisis times": periods of environmental stress and/or major sociopolitical transformation, especially after the breakdown of earlier forms of political integration.

In the Andes, pervasive and severe war is not correlated with big transitions in lifeways, such as the adoption of domesticates. The intensity of war also is not consistently related to warlike cultural representations and performances. In practice, the experience of warfare and warriorhood must have been informed by trophy head taking, iconographies of violence, and public sacrifices, and sometimes those phenomena went hand in hand with frequent warfare, as in Recuay and Wari, but not always. Warlike representations formed enduring traditions of symbolism that could be more persistent than specific patterns of actual warfare, as in the long-term iconographic resonance of trophy heads and the abiding, gradually evolving north coast tradition of ritual human sacrifice.

On the other hand, warfare was clearly affected by sociopolitical complexity. The highest trauma rates were not in regions with the largest fortifications but where there was very little political centralization, such as Andahuaylas and San Pedro de Atacama in the LIP. Such groups apparently lacked much political centralization and were characterized by tensions between small factions or ethnic groups. This is coherent with Keeley's (1996) comparisons of casualty rates between "tribal" and "chiefdom/state" warfare in ethnographic and historic sources, in which decentralized societies experienced much higher frequencies of injury and death over time, even though the casualties in any single engagement were few. At the other end, expanding states engage in conquest war, but the process of expansion and integration creates areas of nondefensive settlement (Macleod 1998). Andean state margins were sometimes associated with fortifications and high trauma rates, but not always. The experience of people living in and near Andean states could be quite peaceful or quite violent; state militarism was dependent on evolving state strategies, local sociopolitical conditions, and environmental contexts.

Finally, the counterpoint of these two lines of evidence is revealing. Bioarchaeological evidence and settlement evidence often converge and clarify the other dataset and associated interpretation. For instance, there are almost no cases in which an apparently defensive settlement pattern is contravened by a reliable study showing little or no trauma. That suggests that both lines of evidence

are indeed related to the scale and severity of warfare and thus they are suitable to use in conjunction. Yet there are some ways in which bioarchaeological evidence offers a critical perspective that is hidden from settlement archaeology. First, the Chinchorro demonstrate that violence among and/or within egalitarian forager communities is not captured by settlement patterns. Such communities rarely invested in hilltop settlements or fortifications, so we must be careful about interpreting nondefensive settlement patterns in these situations. Second, the high cranial trauma rates among some Wari and Inka populations show that violence experienced by those living in states or closely affected by states is not fully reflected in settlement patterns. Settlement patterns and cranial trauma align best in contexts of violent competition between nonstate polities, when recurrent conflict contributes to a change in settlement patterns and the buildup of defensive structures. Yet even in these contexts, as in the LIP, trauma rates indicate quite a significant variation in the experience of violence that is not always perfectly captured by settlement evidence, partly because social scale affects fortification so strongly. Trauma patterns such as lethality, female versus male injury rates, and wound location also reveal considerable variability that might be related to social scale (armies vs. small raiding parties) or cultural traditions of fighting (e.g., high rates of nasal fractures and female injury through time in San Pedro de Atacama). The lethality of injuries (ante- vs. perimortem) is especially telling and can help differentiate between low-casualty encounters of projectile fire and high-casualty hand-to-hand combat.

Finally, there is much more work to be done. Bioarchaeology studies have missed large areas, and they are especially needed for early periods. The reanalysis of old and inadequately studied collections could yield new insights. More systematic survey will augment known settlement patterns, but so would better reporting and publishing of survey results (including for time periods that are not the investigator's major focus) and more refined chronologies. This kind of new work could significantly increase knowledge about Andean warfare and peace.

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Appendix A

Frequencies of adult cranial trauma among Andean skeletal populations (ante- and perimortem trauma were collapsed if both were reported)

Period	Date	Region	Site(s)	Culture	Affected	Observed	%	Reference
ARC	7500–7200 BC	N Chile coast	Acha-3		1	4	25.0	Standen and Santoro (2004)
ARC	8340–6220 BC	Paracas, S Peru coast	Santo Domingo Pampa		0	2	0.0	Beynon and Siegel (1981)
ARC	5400–5000 BC	Chilca, central Peru coast	Paloma		0	69	0.0	Benfer (1990, 1999, personal communication 2009)
ARC	5000–4540 BC	Far NE Chile	Patapatane		0	1	0.0	Santoro et al. (2005)
ARC	4400–3100 BC	Cuzco, central Peru	Kasapata		0	3	0.0	Sutter and Cortez (2007)
ARC	3800–1500 BC	Rio Grande Valley, Nasca, S Peru coast	Pernil Alto		1	2	50.0	Tomasto (2009)
ARC	3400–1500 BC	St Elena Peninsula, Ecuador	Real Alto		4	27	14.8	Ubelaker (2003)
ARC	3800–2000 BC	N Chile coast	Caleta Huelen 42	Chinchorro-related?	1	27	3.7	Cocilovo et al. (2005)
ARC	3200–1250 BC	N Chile coast	Morro de Arica de Uhle	Chinchorro	19	88	21.6	Costa et al. (2000)
ARC	2600–1800 BC	N Chile coast	Morro 1, Morro 1/6, Maderas Enco, Playa Miller 8	Chinchorro	16	66	24.2	Standen and Arriaza (2000)
ARC	2400–1900 BC	N Chile coast	Tiviliche-2	Chinchorro-related?	0	13	0.0	Standen and Nuñez (1984)
ARC	2500–1700 BC	Santa drainage, Huanuco, N Peru	La Galgada	Kotosh	0	12	0.0	Malina (1988a, b)
Archaic total					**42**	**311**	**13.5**	
F	1000–800 BC	Azapa, N Chile	Azapa	Azapa	2	25	8.0	Fouant (1984)
F	1500 BC–AD 100	Titicaca basin, Bolivia	Chiripa	Chiripa	0	10	0.0	Blom and Bandy (1999)
F	1200–500 BC	Jequetepeque, N Peru coast	Puemape	Early Cupisnique	0	17	0.0	Gillespie (1998)

Period	Date	Region	Site(s)	Culture	Affected	Observed	%	Reference
Formative total					**2**	**52**	**3.8**	
FF	400 BC–AD 100	Rio Grande, S Peru coast	Juaranga (and other sites)	Paracas	5	20	25.0	Tomasto (2009, personal communication, 2010)
FF	400 BC–AD 100	Moche Valley, N Peru coast	Cerro Oreja	Salinar	5	15	33.3	Lambert (2011)
FF	400 BC–AD 100	Jequetepeque, N Peru coast	Puemape	Salinar	1	18	5.6	Gillespie (1998)
FF/EIP	100 BC–100 AD	Lower Lurin, central Peru coast	Villa El Salvador XII		9	61	14.8	Pechenkina and Delgado (2006)
Final Formative total					**20**	**114**	**17.5**	
EIP	AD 1–200	Moche Valley, N Peru coast	Cerro Oreja	Gallinazo, Early Moche	14	73	19.2	Lambert (2011)
EIP	~AD 290	Chiclayo, N Peru coast	Sipan Tomb 1 (Lord of Sipan)	Moche	0	9	0.0	Verano (1997)
EIP	AD 1–600	Chicama Valley, N Peru coast	El Brujo	Moche	11	30	36.6	Philips (2009)
EIP	AD 300–450	Santa Valley, N coast Peru	El Castillo	Moche	3	6	50	Philips (2009)
EIP	~AD 500	Jequetepeque, N coast Peru	Pacatnamu	Moche	4	30	13.3	Philips (2009)
EIP	AD 1–750	Las Trancas Valley, S Peru coast	El Pampon, La Marcha, Los Medanos	Nasca	7	81	8.6	Kellner (2002)
EIP	AD 100–750	Palpa, S Peru coast	Nasca-Palpa sites	Nasca	1	19	5.3	Tomasto (2009, personal communication, 2010)
EIP	AD 1–700	Nasca & Taruga Valley, S Peru coast	Nasca & Taruga Valley sites	Nasca	1	19	5.3	Tung and Schreiber (2010)
EIP	AD 100–500	Ayacucho, central Peru	Conchopata	Huarpa	1	11	9.1	Tung (2007b)
EIP	200 BC–AD 600	Atacama, Chile	Toconao Oriente	Tiwanaku-affiliated?	5	99	5.1	Torres-Rouff and Costa (2006)

Period	Date	Region	Site(s)	Culture	Affected	Observed	%	Reference
Early Intermediate period total					**47**	**377**	**12.5**	
MH	AD 650–800	Majes Valley, S Peru	Beringa	Wari-affiliated	13	39	33.3	Tung (2007b)
MH	AD 650–1000	Majes Valley, S Peru	La Real	Wari-affiliated	32	104	30.8	Tung (2007b)
MH	AD 750–900	Las Trancas Valley, S Peru coast	El Pampon, La Marcha, Los Medanos	Nasca-Loro (Burials w/ local ceramics)	5	81	6.2	Kellner (2002)
MH	AD 750–900	Las Trancas Valley, S Peru coast	El Pampon, La Marcha, Los Medanos	Nasca-Chakipampa (Burials w/ Wari goods)	4	17	23.5	Kellner (2002)
MH	AD 750–1000	Palpa, S Peru coast	Nasca-Palpa sites	Nasca MH	0	7	0.0	Tomasto (2009)
MH	AD 600–1000	Ayacucho, central Peru	Huari-Cheqo Wasi	Wari	10	24	41.7	Tung (2013)
MH	AD 600–1000	Ayacucho, central Peru	Conchopata	Wari	10	49	20.4	Tung (2012)
MH	AD 600–1000	Ayacucho, central Peru	Nawinpukio	Wari	0	3	0.0	Tung (2013)
MH	AD 600–1000	Ayacucho, central Peru	Trigo Pampa	Wari	0	2	0.0	Tung (2013)
MH	AD 600–1000	Cuzco, central Peru	Qotakalli, Ak'awillay, Choquepukio, Cotocotuyoc	Wari and Cuzco	3	36	8.3	Andrushko and Torres (2011)
MH	AD 650–900	Cuzco, central Peru	Pikkillacta	Wari	1	2	50.0	Verano (2005)
MH	AD 600–950	Atacama, Chile	Solcor 3	Tiwanaku-affiliated?	10	92	10.9	Torres-Rouff and Costa (2006)
MH	AD 600–1000	Andahuaylas, central Peru	Turpo	Qasawirka and Wari-affiliated	2	22	9.1	Kurin (2012)
MH	AD 400–1000	Titicaca basin, Bolivia	Chiripa	Tiwanaku	0	5	0.0	Blom and Bandy (1999)
MH	AD 692–962	Uyuni salt flats, Bolivia	Juch'uypampa Cave	Tiwanaku-affiliated	1	3	33.3	Tung (personal communication, 2011)
MH	AD 500–1000	Azapa	Maitas, Cabuza	Tiwanaku-affiliated?	16	89	18.0	Fouant (1984)

Period	Date	Region	Site(s)	Culture	Affected	Observed	%	Reference
Middle Horizon total					**107**	**575**	**20**	
MH/LIP	AD 900–1100	La Leche, N Peru coast	Sicán capital	Sicán (Lambayeque)	1	32	3.1	Farnum (2002, 2006, personal communication 2010)
MH/LIP	AD 900–1100	Chicama, N Peru coast	El Brujo	Sicán (Lambayeque)	2	27	7.4	Farnum (2002, 2006, personal communication 2010)
MH/LIP	AD 850–1200	Atacama, Chile	Coyo 3	Tiwanaku-affiliated?	16	44	36.4	Torres-Rouff and Costa (2006)
Middle Horizon/Late Intermediate period transition					**19**	**103**	**18.4**	
LIP	AD 1000–1400	Cuzco, central Peru	Various LIP sites in/near Cuzco	pre-Inka	47	199	23.6	Andrushko and Torres (2011)
LIP	AD 950–1400	Atacama, Chile	Yaye, Quitor 6	Atacama	46	151	30.5	Torres-Rouff and Costa (2006)
LIP	AD 1300–1400	Atacama, Chile	Catarpe 4-5	Atacama	3	36	8.3	Torres-Rouff and Costa (2006)
LIP	AD 1350–1470	Chachapoya, N Peru	Kuélap, Revash temporal group of Reichlen collection	Chachapoya	13	78	16.7	Nystrom and Verano (2003)
LIP	AD 1000–1150	Chachapoya, Dept. of San Martin, Peru	Laguna Huayabamba (Vira Vira)	Chachapoya	2	25	8.0	Nystrom (2004)
LIP	AD 1100–1470	Andahuaylas, central Peru	Cachi, Ranracancha, Pucullu, Qasiachi	Chanka	117	222	52.7	Kurin (2012)
LIP	AD 1200–1500	Chachapoya, N Peru	Luya sites, Dept. of Amazona, Peru	Chachapoya	13	27	48.1	Darcy et al. (2010)
LIP	AD 1100–1470	N Chile coast	Azapa (RDP)	Regional	3	13	23.1	Fouant (1984)
LIP	AD 1100–1450	Titicaca Basin, S Peru	Molino-Chilacachi	Lupaqa	7	48	14.6	de la Vega et al. (2005)
Late Intermediate period total					**251**	**799**	**31.4**	
LIP/LH	AD 1100–1532	Upper Chillon watershed, central Peru	San Damian (Hrdlicka collection)		50	121	41.3	Verano (2002)

Period	Date	Region	Site(s)	Culture	Affected	Observed	%	Reference
LIP/ LH	AD 1100–1532	Upper Chillon watershed, central Peru	Cinco Cerros (Hrdlicka collection)		16	34	47.1	Verano (2002)
LIP/ LH	AD 1100–1532	Upper Chillon watershed, central Peru	Matucana (Hrdlicka collection)		9	20	45.0	Verano (2002)
LIP/ LH	AD 900–1532	Chuquibamba, N Peru	Combined Chuquibamba sites	Chachapoya	31	137	22.6	Jakobsen et al. (1986)
LIP/ LH	AD 1000–1532	Cuzco, central Peru	Urubamba sites	Pre-Inka, Inka	37	225	16.4	MacCurdy (1923)
LIP/ LH	AD 1000–1532	Colca Valley, southern Peru	Malata	Collagua/ Inka	9	18	50.0	Tung et al. (2008)
Late Intermediate Period/Late Horizon Total					**152**	**555**	**27.4**	
LH	AD 1400–1532	Lima, central Peru coast	2 sites at Puruchuco-Huaquerones: Puruchuco, 57AS03	Local Lima / Inka	22	148	14.9	Murphy et al. (2010)
LH	AD 1400–1532	Atacama, Chile	Catarpe 1-2	Atacama	8	208	3.8	Torres-Rouff and Costa (2006)
LH	AD 1400–1485	Chachapoyas, N Peru	Chachapoya sites	Chachapoya	5	23	21.7	Jakobsen et al. (1986, pp. 156, 164, 178)
LH	AD 1400–1532	Cuzco, Peru	Various Inka sites	Inka	50	219	22.8	Andrushko and Torres (2011)
Late Horizon total					**80**	**598**	**13.4**	
Total of all samples					**706**	**3448**	**20.48**	

Appendix B

Defensive and nondefensive settlement patterns over time

Archaic	
North coast	Nondefensive, aside from Salinas de Chao (Alva 1986) and possibly Ostra (Topic 1989)
Central coast	Nondefensive
South coast	Nondefensive where known
Far south coast	Nondefensive
Central highlands	Nondefensive where known
South highlands	Nondefensive where known
Formative up to 500 BC	
North coast	Nondefensive (e.g., Billman 1999; Proulx 1985). Possible small fortifications in Jequetepeque (Dillehay 2008) upper Casma and Sechin Valleys (Wilson 1995), and Culebras (Giersz and Przadka 2009). One site in Chao protected by stone walls linking incised gullies (Cárdenas 1998, site 157–158). Potentially defensible settlement on hill spurs in middle Fortaleza Valley (Vega-Centeno et al. 1998)
Central coast	Some hilltop settlement (Silva 1998) and possibly some early hillforts (Brown Vega et al. 2013)
South coast	Nondefensive
Far south coast	Nondefensive
North highlands	Generally nondefensive. A few hilltop settlements with walls and/or ditches, e.g., Cerro Huachac (Topic 2009) and Cerro Pelón (Pérez 1998; Zaki 1983). Some small ridgetop sites in the Mosna drainage (Burger 1983)
Central highlands	Nondefensive where known
South highlands	Nondefensive
Final Formative	
North coast	Many large hillforts in Santa, Casma, Nepeña, and Virú Valleys (Brown Vega 2010; Daggett 1984; Proulx 1985; Przadka and Giersz 2003; Willey 1953; Wilson 1988, 1995). Settlements in Moche and Chicama are defensible and sometimes fortified (Attarian 2009; Billman 1996; Russell 1992). Some large hillforts to the south, especially in Huaura (Brown Vega 2010)
Central coast	In the Lurin Valley, small dispersed ridgetop settlements, sometimes fortified (Earle 1972). Nucleated, potentially defensible settlements in middle Chincha (Canziani 1992, 2009)
South coast	Nucleated hilltop sites and hillforts in the lower Ica Valley and the Palpa area (DeLeonardis 1991; Paul 2000, p.75, n 17; Reindel 2009; Reindel and Isla 2006, pp. 246–247). Small hilltop settlements, sometimes with slingstones, in the southern Nazca drainage (Schreiber and Lancho 2003, p.14; van Gijseghem and Vaughn 2008). Nucleated fortified settlements and buffer zones in the Acari Valley (Valdez 2009)
North highlands	Hilltop settlement, sometimes fortified, in Cajamarca after c. 250 BC (Julien 1988; Seki 1998). Significant fortification and defensible settlement in uppermost Chicama, Moche, and Virú Valleys and adjacent highlands (Pérez 1998; Topic and Topic 1978). Hilltop settlement in Huamachuco, sometimes with walls (Topic 2009; Topic and Topic 1978). Some large hilltop sites in Ancash, at least one fortified (Ponte 2000; Topic and Topic 1982). Nondefensive settlement east toward the Marañon (Herrera 2003; Ibarra 2003)
Central highlands	Around Cuzco, many hilltop/ridgetop settlements (Bauer 2004; Zapata 1998)
South highlands	Nondefensive except for some large hilltop settlements in the Titicaca Basin (Arkush 2008) and Chiripa settlements in the Tiwanaku Valley on defensible hills between incised gullies (Albarracin-Jordan and Matthews 1992, pp. 71–72). Nondefensive in the Bolivian altiplano and Cochabamba Valley (Lecoq and Céspedes 1997; McAndrews 2005)

Early Intermediate period	
North coast	Hilltop settlement in early EIP (Gallinazo) in the Moche Valley; less defensive in later EIP, with some strategic forts in the middle/upper Chicama and Moche Valleys (Billman 1999; Topic and Topic 1978). Nondefensive settlement in Virú protected by strategic hillforts (Willey 1953). In Santa, Nepeña, and Casma, nondefensive Moche sites in lower valleys and strongly defensive Recuay-affiliated sites in middle and upper valleys (Chapdelaine et al. 2009; Proulx 1985; Wilson 1988, 1995)
Central coast	Largely nondefensive (Canziani 1992; Paredes 2000; Silva 1996), with some hilltop settlement in the later EIP (Earle 1972)
South coast	Nondefensive in Nasca and Palpa, with increasing nucleation over time (Reindel 2009; Schreiber and Lancho 2003; Silverman and Proulx 2002). In Acarí, transition about AD 350 from defensive sites to smaller unwalled settlements (Valdez 2009). Nondefensive in Moquegua (Goldstein 2005, p. 123)
North highlands	In Cajamarca, early EIP defensible hilltop settlement shifting to valley floors in late EIP (Julien 1988). In Huamachuco, competing early EIP centers with walls and ditches shift to less defensive settlement dominated by Marcahuamachuco (Topic 2009). In Ancash, many hilltop and fortified sites
Central highlands	Near Junín, several late EIP/MH walled sites (Parsons et al. 2000). Clustered but unfortified Huarpa sites in the Ayacucho Valley (Isbell 1985, p. 90). Nondefensive in Andahuaylas and Cuzco (Bauer 2004; Bauer et al. 2010)
South highlands	Some possible defensive settlement in the early EIP in the northern Titicaca Basin; nondefensive in the southern Titicaca Basin (Janusek and Kolata 2003; Matthews 2003)
Far south highlands	Nondefensive (Lecoq 1997, 2001; Nielsen 2001b); layout of nucleated villages at San Pedro de Atacama is somewhat defensible (Llagostera and Costa 1999)
Middle Horizon (where known)	
North coast	Defensive settlement patterns in the middle and upper Moche, Jequetepeque, and Zaña Valleys; after about AD 800, dispersal into small hillside fortified hamlets (Dillehay 2001; Dillehay et al. 2009; Topic 1991; Topic and Topic 1987). Less defensive to south, except for defensible and sometimes fortified settlements in Nepeña (Proulx 1985)
Central coast	Largely nondefensive (e.g., Silva 1996), but some hillforts in Huaura (Brown Vega et al. 2013)
South coast	Partial abandonment (Conlee 2006; Reindel 2009; Schreiber 2001)
Far south coast	Mostly nondefensive in Moquegua with some fortified outposts (see text)
North highlands	Hilltop settlement continues in Huamachuco (Topic 2009; Topic and Topic 1978, 1987); nondefensive in Cajamarca (Julien 1988)
Central highlands	Some hilltop location and possible fortification at Wari satellites in Ayacucho (Pérez 1999); nondefensive Cuzco area settlement except for Pikillacta (Bauer 2004)
South highlands	Mostly nondefensive, with a few fortified sites in Arequipa (Cardona 2002; Doutriaux 2004; Jennings 2002; Stanish et al. 1997; Wernke 2003)
Far south highlands	Mostly nondefensive (Higueras 1996; Lecoq and Céspedes 1997)
Late Intermediate period	
North coast	Mostly nondefensive, with some defenses in middle valleys (Proulx 1973; Willey 1953; Wilson 1988). Denser fortifications in the Culebras and Casma Valleys (Brown Vega 2010; Przadka and Giersz 2003; Wilson 1995)
Central coast	Relatively nondefensive settlement in lower valleys under powerful regional polities (Canziani 1992, 2009; Feltham 1984). In Chillón, most sites have defensive locations and walls (Silva 1996)
South coast	Late LIP Nasca area settlements use defensive hilltops and occasionally fortifications (e.g., Conlee 2006; Reindel 2009)
Far south coast	Highly defensive walled sites in middle and upper Moquegua especially after AD 1200 (Moseley 1989; Owen 1995; Stanish 1992)

North highlands	Hilltop settlement common in Cajamarca (Julien 1988; Toohey 2009), Chachapoyas (Schjellerup 1992, 1997), and Huamachuco (Pineda 1989; Topic 2009), sometimes with fortifications. Defensive wall systems and strategic forts in the upper Jequetepeque, Chicama, and Moche watersheds (e.g., Krzanowski 1977; Topic and Topic 1979a, b, 1987). Fortified hilltop sites in the Callejón de Huaylas and the upper Marañon (Herrera 2003; Mantha 2009; Ponte 2000)
Central highlands	In the Upper Mantaro, early LIP ridgetop settlements shift to nucleated, fortified hilltop centers after AD 1300 (Earle et al. 1980; Hastorf et al. 1989). Nearly all settlement on ridgetops and fortified in Tarma near Junín, in Asto territory to the south, and in the upper Chillón drainage (Farfán 1995; Lavallee and Julien 1973; Parsons et al. 2000, p. 160). In southern Ayacucho and Andahuaylas, nucleated ridgetop sites, sometimes fortified (Kellett 2010; Meddens 1984, 1999; Pérez 1999; Schreiber 1993, p. 82; Valdez and Vivanco 1994; Valdez et al. 1990). Less defensive closer to Cuzco, with small, unfortified ridgetop sites (Covey 2003; Dean 2005; Heffernan 1996; Kosiba 2010; Lee 2000; Sillar and Dean 2002), and nondefensive settlements in the Cuzco, Paruro, and Lucre Valleys (Bauer 1992, 2004)
South highlands	In the Titicaca Basin, nucleated walled hilltop centers with smaller unfortified sites nearby (Arkush 2011; Frye and de la Vega 2005; Hyslop 1976; Neira 1967; Stanish 2003; Stanish et al. 1997). Dense, fortified, hilltop refuges in the upper Colca Valley (Wernke 2006). In the southeastern Titicaca Basin and the Bolivian altiplano, nondefensive dispersed settlement with few small refuge hillforts (Albarracin-Jordan 1990; Bandy 2001; Janusek and Kolata 2003; McAndrews 2005; Pärssinen 2005)
Far south highlands	Near Potosí and on the eastern slopes, defensive hilltop settlements, sometimes walled (Alconini 2004; Higueras 1996; Lecoq and Céspedes 1997). In far southern Bolivia, north Chile, and northwest Argentina, small, low-lying settlements with a few larger, fortified villages (Chacama 2005; DeMarrais 2001; Llagostera and Costa 1999; Nielsen 2001a, 2002; Nuñez and Dillehay 1978, pp. 111–112; Ruiz and Albeck 1997; Santoro et al. 2004; Schiappacasse et al. 1989)
Late Horizon	
North coast	Continuation of nondefensive patterns established by the late LIP in Virú, Santa, Nepeña, and Casma (Proulx 1973; Willey 1953; Wilson 1988, 1995)
Central coast	Shift to nondefensive settlements in the Chillón and upper Lurin Valleys (Feltham 1984; Silva 1996)
Far south coast	Hillforts in Moquegua abandoned for nondefensive valley-floor sites (Stanish 1992)
North highlands	Inka centers founded in nondefensive locations on the Inka road, e.g., Cajamarca, Huamachuco, Huanuco Pampa. Local settlement patterns unclear but may continue from LIP; abandonment of some defensive sites in Chachapoyas (Schjellerup 1997, p. 241) and of the Yanaorco hillfort in Cajamarca (Toohey 2009)
Central highlands	Shift to unfortified sites and less defensive locations in the Junín region, Upper Mantaro Valley, Ayacucho, and Andahuaylas (Bauer et al. 2010; D'Altroy 1992, pp. 189–193; Parsons et al. 2000; Schreiber 1993; Valdez and Vivanco 1994). Cuzco settlement patterns change little from LIP
South highlands	Arequipa patterns change little aside from new Inka centers (Doutriaux 2004; Jennings 2002; Sciscento 1990; Wernke 2006). In Titicaca Basin, major resettlement from hillforts to nondefensive sites (Stanish et al. 1997)
Far south highlands	In Potosi, shift to less defensive locations (Lecoq and Céspedes 1997). In northern Chile and northwest Argentina, most fortified settlements abandoned for lower villages; some Inka fortresses (intrusive or reused native forts; D'Altroy et al. 2007)

Appendix C

Codes for settlement patterns by region and period

	Archaic			Form			F Form			EIP			MH			LIP			LH		
Highlands	D	F	S	D	F	S	D	F	S	D	F	S	D	F	S	D	F	S	D	F	S
Cajamarca							2	1	0	1	0	0	0	0	0	1	1	1	1	0	0
Chachapoyas																2	2	0			
Huamachuco - Alto Chicama				1	1	0	2	1	2	1	1	1	1	1	1	1	2	1	0	0	0
Ancash - Huanuco				1	0	0	1	1		2	2	1				2	1	0	0?	0?	0
Junin - Upper Mantaro										1	0	1				2	2	0	1	0	0
Ayacucho - Andahuaylas				0	0	0				1	0	0	1	0	0	2	1	0	1	0	0
Cuzco area	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	1	1	1	1	0	0
Arequipa	0	0	0							1	0	0	1	1	0	1	0	1	1	0	1
Titicaca basin - N Bolivia	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	2	1	0	0	0
S Bolivian highlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
NW Argentina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	1
Chilean sierra	0	0	0	0	0	0				0	0	0	0	0	0	1	1	0	0	0	1
Coast																					
Lambayeque																0	0	1			
Jequetepeque	0	0	0	0	0	1?	0	0?	1?	1	1	0	2	2	0	2	1	0			
Moche - Chicama	0	0	0	0	0	0	2	1	0	1	1	2	2	1	0	1	1	1			
Virü - Chao	0	0	0	0	1?	0	1	0	2	0	0	2	1	0	1	0	0	1	0	0	1
Santa	0	1	1	0	0	0	2	1	2	1	1	0	0	0	1?	1	1	0	1	1	0
Nepena	0	0	0	0	0	0	1	1	2	1	1	0	2	1	1?	1	1	0	1	1	0
Casma - Culebras	0	0	0	1?	1	0	1	0	2	1	1	0	1	1	1	1	0	2	0?	0?	0?
Norte Chico	0	0	0	1	0	0	1	1	2							0	0	2			
Chillon to Chincha				1	0	0	2	1	0	1	0	0	0	1	0	1	1	1	0	0	0
Ica, Nasca, Acari	0	0	0	0	0	0	2	1	0	0	1	0	1	0	0	2	1	0			
Moquegua	0	0	0							0	0	0	0	0	2	2	1	0	0	0	0
N Chilean coast	0	0	0							0	0	0	0	0	0	1	0	0			

D = settlement locations are defensive; F = settlements are fortified; S = strategic fortifications; 0 = absent, 1 = present, 2 = common

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