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## Provisioning an Urban Center under Foreign Occupation

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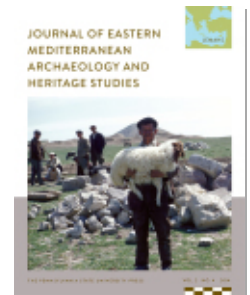
## **Provisioning an Urban Center Under Foreign Occupation: Zooarchaeological Insights into the Hittite Presence in Late Fourteenth-Century BCE Alalakh**

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# PROVISIONING AN URBAN CENTER UNDER FOREIGN OCCUPATION

## Zooarchaeological Insights into the Hittite Presence in Late Fourteenth-Century BCE Alalakh



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### ABSTRACT

The effects of foreign military interventions on production and distribution systems in occupied lands are commonly assessed through the study of textual sources and pottery typologies in Bronze Age archaeology and historiography. In this article, we explore the zooarchaeological record of the recently uncovered Late Bronze IIA deposits at Alalakh (Tell Atchana) to test whether the Hittite intrusion into Syria had any effect on the economic organization of local polities. The quantitative analysis of taxonomic compositions, mortality profiles, and body part distributions suggests that while slight modifications occurred in the distribution of provisions, the faunal economy of Alalakh did not go through drastic changes under Hittite rule.

The Hittites were incontestably the singular ruling power in Anatolia during the Late Bronze Age. Their ambitions for territorial hegemony extended well beyond their heartland in Anatolia, especially towards the northern Levant where local kingdoms vacillated between independence and vassal service to larger political entities,

such as the Mitanni Kingdom. The effects of frequent Hittite military interventions on the local political arena of Syria were heavily felt as redefined territories, toppled local dynasties, and altered tribute agreements. Finally, the definitive Hittite victory over loosely organized Mitanni centers resulted in the replacement of the ruling elites with Hittite military and administrative units in the Mitanni capital and its vassals in the mid-fourteenth century BCE (Yener 2013).

Although one of the greatest motives behind Hittite interest in Syria was to gain control over the agrarian wealth of Syria's fertile flood plains, the economic impact of the Hittite military and administrative domination over the organization of the Mitanni cities and hinterland is not well understood. While texts make it explicit that locals had to pay Hittites tribute in the form of goods, resources, and services (Beckman 1992), and Hittite objects that represented administrative control and cultic influence are omnipresent in the fourteenth-century BCE centers of northern Syria (Genz 2006), what the Hittite presence meant for local Mitanni economies has not been investigated archaeologically in great detail.

The aim of this study is to assess the influence of the Hittite presence on the economy of Alalakh (Tell Atchana), an important urban center situated in the 'Amuq Plain (Fig. 1). Located at the Anatolian-Syrian frontier, Alalakh must have become a Hittite garrison in the mid-fourteenth century BCE, during the latter half

of the Late Bronze IIA (LB IIA) (Yener and Akar 2013). To understand the economic changes the city went through under Hittite occupation, we examine one of the largest and most ubiquitous categories of archaeological materials, the animal bones, using “standard” zooarchaeological tools. Animal bones contain valuable information about the ways in which production and provisioning systems are regulated in complex societies, the scale of regulation imposed by administrative powers, and how these change along with shifting cultural and political affinities (Bigelow 2000; Crabtree 1990; Gumerman 1997; Kansa, Whitcher Kansa and Levy 2004; Zeder 1991). Although the Hittite presence in Alalakh was short-lived (ca. 50 years), the well-stratified and carefully sampled animal remains from the “Hittite” and “pre-Hittite” layers uncovered by renewed excavations at Alalakh provide us with an excellent opportunity to test, for the first time, text- and, to a smaller extent, material culture-based hypotheses about change and continuity in different aspects of economic life in Syria under the Hittites (Akar and Yener 2013; Fig. 2).

### Alalakh in the Late Fourteenth Century BCE

Alalakh was a regional capital throughout its existence during the second millennium BCE, in both the Middle and Late Bronze Age. The city had a well-connected economic and political position in the international world of the Bronze Age eastern Mediterranean thanks to its favorable situation on the Lower Orontes with easy access to the Mediterranean coast. In the Middle Bronze Age, Alalakh was vassal to the Kingdom of Yamhad (present-day Aleppo) and in the Late Bronze Age, it was first vassal to the Mitanni Kingdom and later it was incorporated into the Hittite Empire (Yener 2011).

The late fourteenth-century BCE settlement of Alalakh is generally known by its landmark military architecture, partly excavated by Sir Leonard Woolley in the first half of the twentieth century (Woolley 1955). This building replaced the palatial complex of Alalakh’s local rulers and dominated the landscape, clearly making a statement about the new and foreign political power (cf. Glatz and Plourde 2011). Renewed archaeological investigations at Alalakh<sup>1</sup> uncovered additional sectors of the Period 2 fortress (Fig. 3) including its V-shaped foundation

cutting into previous occupational phases (Area 1, Square 32/54; Akar 2013: 129–31). Similar to Woolley’s findings, intact contexts with pottery assemblages large enough to deliver quantified results about pottery typologies associated with the Period 2 fortress are largely missing from recent excavations (Yener 2013; Yener and Akar 2013).

The lack of primary contexts associated with the Period 2 fortress in the northwestern sector of the Tell Atchana are partly compensated by new horizontal exposures in the southwestern part of the tell, located in Area 4. After the removal of a badly preserved layer of sub-surface architectural remains (Area 4, Local Phase 1), excavations in this area revealed the presence of a massive mudbrick building that mimics the design of the Period 2 fortress in the northwest (Area 4, Local Phase 2; Fig. 4). Like the Period 2 fortress in the northwest, the construction of this building radically changed the previous layout and function of the area, which was a partly residential and partly industrial district (Area 4, Local Phase 3). Luckily, unlike the Period 2 fortress in the northwest, construction of Phase 2 did not cut too deep into the deposits of Phase 3 in Area 4 (Akar 2013). The building yielded radiocarbon dates that place it in a small chronological window between 1340 and 1300 BCE (Yener and Akar 2013). Phases 3 and 2 in Area 4 consist of a number of primary and secondary deposits that contain a large sample of pottery, bone, and other archaeological material, enabling a closer diachronic inspection of the area. Table 1 explains the synchronization of Woolley Levels, Yener Periods, and Local (i.e., square) Phases in Area 4.

No textual archives dating to the late fourteenth century BCE have been recovered so far at Alalakh, and the pottery typologies of the period do not display any significant Anatolian influence (pers. communication, Mara Horowitz, pers. communication; Genz 2006). Despite that, the majority of the Hittite-affiliated artifacts are remarkably of an administrative and ritual function (Yener 2011; Yener and Akar 2013). So although the Hittite presence does not lead to a total makeover of the Alalakhian material culture in the late fourteenth century BCE, newly introduced elements purposefully signify Anatolian ruling power and beliefs (Yener and Akar 2013).

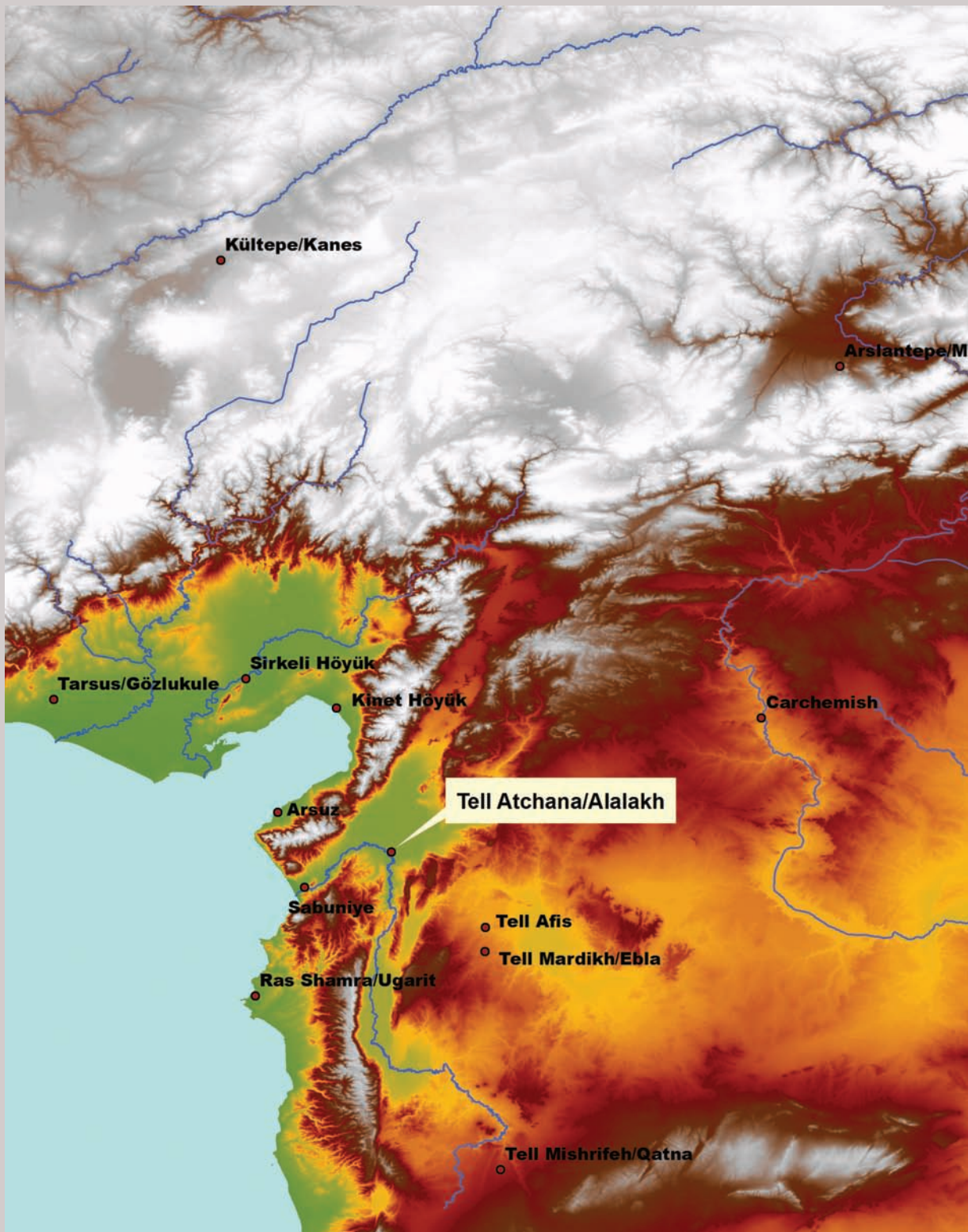


FIG. 1

The location of Alalakh (Tell Atchana) in the northern Levant. (Courtesy of Koç University Alalakh Excavations Archive.)

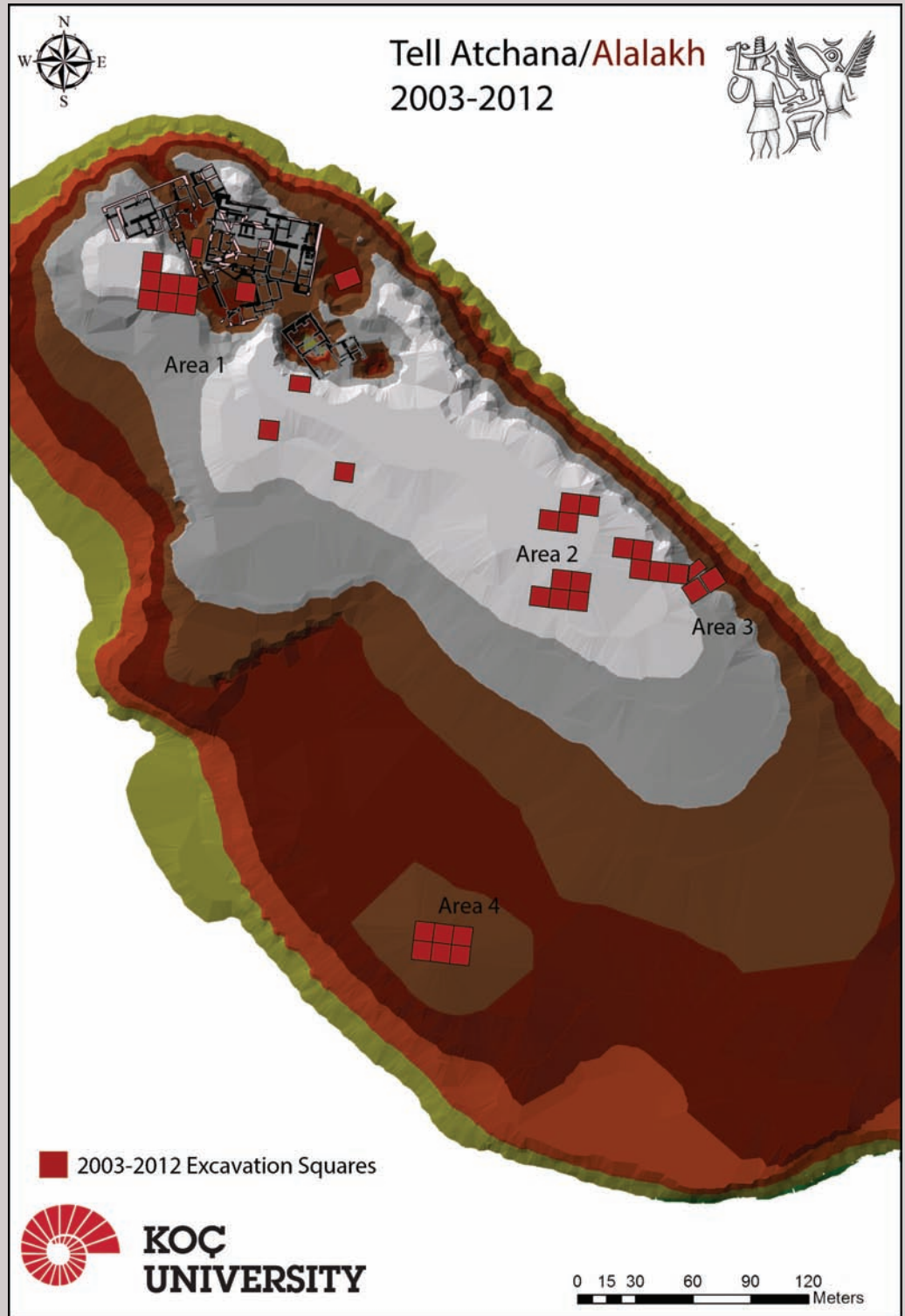


FIG. 2  
 Topographical plan  
 of Alalakh and the  
 location of excavation  
 areas. (Courtesy of Koç  
 University Alalakh  
 Excavations Archive.)



FIG. 3

Newly uncovered sectors of the Period 2 fortress in Area 1. (Photo by M. Akar. Courtesy of Koç University Alalakh Excavations Archive.)

The lack of local textual evidence and the scarcity of general changes in the movable aspects of the material culture set on a background of fundamental alterations in the architectural layout of Alalakh and the introduction of Anatolian administrative and religious symbols into the archaeological record makes the quest for understanding the nature of the Hittite presence at the site using additional aspects of archaeological deposits, including the zooarchaeological assemblages, all the more worthwhile. At the same time, differences in the depositional histories of the archaeological contexts attributed to the Hittites and their predecessors in Alalakh call for caution as to the ways in which zooarchaeological assemblages from the LB IIA phases of Areas 1 and 4 can be evaluated quantitatively and assessed together and/or in comparison with each other. First, the Period 2 fortress in Area 1 consists almost entirely of thick mud-brick walls and fills of unknown origin among them,

whereas the late fourteenth-century BCE phase in Area 4 consists mainly of floor and above-floor deposits (Akar 2013). Second, the synchronicity between architectural features and material is assured by radiocarbon dates in Area 4, while in Area 1 the chronological correlation between small finds, pottery styles, and architecture remains puzzling (Yener and Akar 2013). Third, the deep V-shaped foundation of the “Hittite Fortress” in the north obstructs the stratigraphic relationship between Period 2 and the preceding phases, whereas the transition between Local Phases 3 and 2 is clearer in Area 4. Since artifactual contemporaneity is unclear and stratigraphic integrity is low in Area 1, here we limit the diachronic reconstruction of the economies of “pre-Hittite” and “Hittite” periods at Tell Atchana to the comparison of the zooarchaeological assemblages in Area 4. For reasons of convenience, we call these layers simply Phases 3 and 2 throughout this article.





FIG. 4  
The Local Phase 2 architecture in Area 4. (Photo by M. Akar. Courtesy of Koç University Alalakh Excavations Archive.)

TABLE 1 INTEGRATED PHASING OF ALALAKH IN THE FOURTEENTH CENTURY BCE

Yener Periodization (after Yener 2013)	Woolley	Area 4 Squares 64/72–94	Article Terminology
Period 1	Level I “Fort”	Local Phase 1 (Sub-Topsoil)	Phase 1 (Below Topsoil; Heavily Disturbed)
Period 2	Level III–II “Fortress”	Local Phase 2	Phase 2 “Hittite”
Period 3	Level III–II “Fortress”	Local Phase 3	Phase 3 “Mitanni”

## Research Expectations

Changes in ancient economic systems in response to major sociopolitical events, such as migrations, invasions, and changes in the ethnic identity of the ruling class are some of the frequently visited topics in the zooarchaeology of complex societies (e.g., Capriles, Domic

and Alconini 2010; Davis 2008; Sykes 2001). Changes in the proportions of different livestock, changes in the proportions of livestock and game, introduction of new taxa, changes in mortality profiles as proxies for targeted products and consumed age cohorts, changes in the distribution of body parts that are considered to be consumption and refuse units, and changes in

the biometric properties of domestic populations are among data commonly used in such studies. In the Syro-Anatolian region, this type of zooarchaeological research has so far focused on the Late Bronze Age–Early Iron Age transition (e.g., Becker 2008; Hongo 2003; Ikram 2003), leaving previous economic transformations of early complex societies zooarchaeologically understudied.

Although the economic consequences of Hittite intrusions into Syria have not been investigated previously with quantitative zooarchaeological methods, text- and material culture-based studies provide working hypotheses as starting points. In contrast to what common-sense might expect, these studies have a common suggestion: The Hittite presence did not disrupt the existing economic organization in Syria (Beckman 1992; Dörfler et al. 2011; Genz 2006). Beckman's conclusion, based partially on the textual archives from Emar on the Euphrates and Ugarit on the Mediterranean coast, was not tested with the zooarchaeological data, although such data are available from the more recent excavations at these sites (e.g., Gündem 2010; Gündem and Uerpmann 2003). Dörfler et al.'s argument that the Hittites intervened minimally with the economic practices of the regions they conquered is made in the context of an overview of archaeological and zooarchaeological information from Hittite Anatolia and is not supported by any data from Hittite Syria (2011). As a result of his query into Hittite material culture in Syria, Genz also suggests that unequivocally Hittite assemblages are not present (2006).

In our attempt to test these hypotheses, we adopt an approach that stresses the fact that the zooarchaeological record of centralized powers like Alalakh are shaped by what can be called the “urban filter.” In this approach, the zooarchaeological record of central settlements are not assumed to mirror the economic activities of their territories, but to reflect aspects of the hinterland economy which urban dwellers are able to extract and are interested in extracting (e.g., Crabtree 1990; deFrance 2009; Zeder 1991). For example, the “urban filter” would cause certain groups of individual animals, like age and/or sex cohorts, to be over- or under-represented in the zooarchaeological record (or even missing entirely) because carcasses of these specific cohorts are never brought to urban areas where specialized members of society live (Zeder 1991: 41–42). Similarly, body parts that yield little

or low-quality meat may never leave the loci of production because the urban elite, who are the end consumers, are not interested in these parts. All evidence shows that Alalakh was the central power in the ‘Amuq Plain in both the pre-Hittite and Hittite periods. Accordingly, regarding the animal sector of the economy of Alalakh in the fourteenth century BCE, we would expect to see features of provisioned urban economies in both Phases 3 and 2 in Area 4, unless, contrary to the hypotheses outlined above, the arrival of the Hittites toppled the economic system altogether, bringing it to the brink of collapse.

However, the organization of urban provisioning may vary greatly among different systems depending on who the actors are, how control over resources is distributed, and how much emphasis is placed on the sustainability of the system. We expect the pre-Hittite and Hittite management of provisioning Alalakh to diverge in several aspects.

First, we expect the Hittites in Alalakh, being outsiders and militaristically organized, to be placed closer to the top in the producer–consumer triangle of agrarian societies. Pastoral products would be supplied to the city more indirectly under Hittite occupation. This alteration in the system would be reflected in the frequency of the types of meat in terms of livestock taxa and age groups they come from or the “cuts” that end up at the urban site.

Second, we expect the focus on sustainability to be less pronounced during the Hittite presence in Alalakh because of the particular concern to secure large quantities of meat for the army and fast (Bryce 2007: 11). We expect such a change to be especially visible in the zooarchaeological record of Area 4 (e.g., as an increase in the culling of premature individuals and a decrease in older female individuals kept to buffer risk and increase herd size due to the radical change in the function of the area in Alalakh under Hittite rule).

Third, we expect a renewed interest in game exploitation, at the very least because representations of game species play a prominent role in conveying messages about ruling power authorized by gods in both the Syrian and Hittite realms (Collins 2002). Thus, game exploitation could serve to signal political power, but also the new administration may have sought wild resources to supplement the domesticated meat supply, reduced by disruptions in the control of economic organization.

Finally, the potentially devastating burden of providing booty in the form of cattle and sheep to be transported to the Hittite homeland should not be underestimated (Collins 2007: 110–13). Such a development would forcefully remove or reduce certain taxonomic groups and age groups from the livestock populations of the ‘Amuq, but how or whether this situation would be reflected in the urban zooarchaeological record is difficult to guess, again due to the “urban filter.”

## Methods

Excavation methods have profound effects on the results that zooarchaeological analysis can deliver (Payne 1972). The archaeological deposits in question consist of hand-collected, partially sieved (10 to 90 percent), and fully sieved “lots” (i.e., arbitrary parts of loci). Sieving decisions were taken subjectively and applied using a 4-mm mesh. Sieved and hand-collected parts of excavated lots were mixed at the site, and a careful record of how each lot was recovered was kept in the project database (e.g., 10 percent sieved, 70 percent hand-collected, etc.). The most relevant difference between dry-sieved and hand-collected samples in terms of taxonomic compositions was observed in the proportions of cattle remains. The hand-collected material contained up to 8.8 percent more cattle remains than the sieved material. In return, the sieved material contained up to 7.5 percent more medium mammal remains that could not be identified further into a biological taxonomic group, indicating that the overall overrepresentation of cattle in the hand-collected material, which is a common problem in zooarchaeology, does not mean an under-representation of smaller livestock in the identifiable part of the assemblage. When we calculated to see if randomness in the application of sieving is a potential cause for bias, we saw that the percentages of sieved and hand-collected lots in Phases 3 and 2 were disproportionate. Sixty percent of the excavated lots (100 in total) in Phase 2 were completely or greater than 50 percent dry sieved, whereas the percentage of completely or greater than 50 percent dry-sieved lots in Phase 3 is 28 percent. In order to mitigate the effects of this imbalance in excavation methods on the diachronic

comparison of the quantitative results, we converted collected zooarchaeological data into targeted data using a number of quantification techniques such as the calculations of Diagnostic Zones (see below). Moreover, we limited quantitative analysis to specimens less likely to be affected by discrepant sampling strategies, such as counting mandibles with teeth as opposed to loose teeth while quantifying culling patterns.

Calculations of taxonomic abundances are basic to understanding the general organization of livestock production and game exploitation in ancient settlements. Results of taxonomic analysis were tabulated in Number of Identified Specimens counts, which were tallied from the primary quantifiable information recorded for each specimen.<sup>2</sup> In order to correct for biases of sampling strategies, fragmentation, and differences in the number of skeletal elements that occurred in each taxon, the relative taxonomic abundances of taxa relevant to the discussion were calculated using Diagnostic Zone counts (*sensu* Watson 1979). Diagnostic Zones are easily recognizable portions of skeletal elements that are represented in equal amounts in each taxon compared. For example, in a comparison among sheep/goat, cattle, and pig, the distal humerus is taken as a Diagnostic Zone, but the second and fifth metapodial bones of a pig are not counted as Diagnostic Zones because they do not exist in the skeletons of other livestock taxa.

Culling patterns provide a means to infer the type and scale of primary and secondary production from keeping livestock (Helmer, Gourichon and Vila 2007; Payne 1973). We recorded tooth wear and eruption for the livestock taxa using the recording schemes suggested by Payne (1973) and Grant (1982) for the mandibular teeth that were inside the mandibular bone when recovered. Mortality profiles of caprines were reconstructed with uncorrected data following Payne (1973). Pig survivorship was reconstructed using age stages determined by Lemoine et al. (2014).

Over- or under-representation of meaty and non-meaty carcass parts across stratigraphic units was considered to be another way of assessing the type and character of consumer groups, and how they are provisioned (Zeder 1991: 41–42). Unaltered Number of Identified Specimens counts of body parts are masked by major differences

in the number of skeletal parts existing in the mammal body, and how they are fragmented by humans or post-depositional processes, largely as factors of age and bone density (Ioannidou 2003; Lam et al. 2003). In order to reduce such effects, we converted element and portion data of the specimens with Diagnostic Zones into another quantitative unit called Minimum Number of Elements by dividing them into the number of times they occur in the carcass in order to reveal the minimum number of times they occur in a given stratigraphic unit, then pool these into anatomical regions (Minimum Anatomical Units [MAU]) and examine them in terms of their deviation from values expected from a complete carcass (*sensu* Arbuckle 2006: 146–51). Although Arbuckle recommends using the deviation from site-wide averages to standardize for taphonomic and recovery biases (2006: 153), we looked at the %MAU results in terms of their deviation from expected complete carcass values because we are interested in the differences between two stratigraphic phases in only one area.

### The Zooarchaeological Record

Analyzed zooarchaeological material from Phases 3 and 2 in Area 4 consist of a broad range of vertebrate taxa representing the well-watered, species-rich, yet anthropogenic landscape of the Orontes Valley (Table 2). The Late Holocene fauna of the Orontes Valley have been outlined previously by zooarchaeological studies at Tell Afis (e.g. Wilkens 2000), Qatna (Vila and Gourichon 2007), and Tell Atchana itself (Çakırlar and Rossel 2010). Altogether 34 biological taxa were identified in Area 4; twenty-six of these are represented in Phase 2 and twenty-seven in Phase 3. The absence of certain taxa from one phase or another does not seem to conform to any strong pattern that would indicate a significant change in environmental exploitation or the economic system. If differential sieving decisions played a significant role on patterns of representation, we would expect small-bodied taxa, such as birds, to be represented more frequently in Phase 3, but this is not the case.

Like all Bronze Age assemblages of the eastern Mediterranean, domestic animals make up the largest

component of the zooarchaeological assemblage representing the LB IIA in Area 4. The remains of caprines (i.e., sheep and goats) are more numerous than other livestock taxa, but they do not dominate the livestock assemblage overwhelmingly (Fig. 5). The abundance of geological water and relatively high annual rainfall in the ‘Amuq<sup>3</sup> must have greatly assisted in keeping cattle and pigs as a viable part of the pastoral economy. Alternatively, beef and pork may have been reserved for the inhabitants of Alalakh; a suggestion we will not be able to test without excavating rural settlements in the ‘Amuq Plain.

The proportion of domestic food animals in the zooarchaeological record shows a significant change from the Mitanni to the Hittite phase (both according to Number of Identified Specimens and Diagnostic Zones counts; Chi-square 10.49;  $P = 0.03$ ). While cattle remains decreased, the proportion of pig remains increased by more than 35 percent in the Hittite phase.<sup>4</sup> Without an independent variable, such as the density of taxa per volume of excavated unit (cf. Zeder 1991: 243–44), it was not possible to assess whether beef production decreased in Phase 2 or beef production remained the same and pork production increased. As explained above, cattle might be generally over-represented in these hand-collected and partially sieved assemblages, but the relatively low representation of cattle in Phase 2, where deposits were less frequently recovered through sieving, does not suggest the recovery bias sieving would be expected to create.

Although the absolute numbers of wild animals were low in the assemblages, the relative proportion of terrestrial game (deer, gazelle, and wild boar) versus domestic mammals showed a significant increase in the Hittite phase (according to Number of Identified Specimens counts; Chi-square 7.15;  $P = 0.007$ ; Fig. 6). Deer species, especially fallow deer<sup>5</sup> and red deer are the most frequently exploited game animals. Today, fallow deer are known as park species; they live in open and gallery forests and adapt well to captivity. Red deer tend to inhabit denser forests in higher elevations. Deer populations were probably large and dense in the region during the Bronze Age. Wild boar are still numerous on the heavily cultivated ‘Amuq Plain and the surrounding hilly landscape. Today, the range of gazelles (*Gazella gazella*)

TABLE 2 SUMMARY OF VERTEBRATE TAXA FROM PHASES 3 AND 2 IN AREA 4

Taxa	Common Names	Phase 2	Phase 3
<i>Bos taurus</i>	Cattle	103	173
<i>Ovis aries</i>	Sheep	43	57
<i>Capra hircus</i>	Goat	23	33
<i>Ovis aries/Capra hircus</i>	Sheep or goat	257	377
<i>Sus domesticus</i>	Pig	145	174
Equidae	Equids	5	26
<i>Canis familiaris</i>	Dog	12	26
<i>Ovis orientalis</i>	Wild sheep	2	2
<i>Capra aegagrus</i>	Wild goat	1	2
<i>Gazella</i> spp.	Gazelles	18	11
<i>Dama dama</i>	Fallow deer	19	20
<i>Cervus elaphus</i>	Red deer	4	5
Cervidae (medium/large deer)	Fallow or red deer	13	10
<i>Capreolus capreolus</i>	Roe deer	3	4
<i>Sus scrofa</i>	Wild boar	6	3
<i>Ursus arctos</i>	Brown bear	3	3
<i>Vulpes vulpes</i>	Red fox	2	1
<i>Martes foina</i>	Beech martin	1	0
<i>Lepus capensis</i>	Cape hare	1	3
<i>Spalax leucodon</i>	Lesser blind mole rat	1	0
<i>Trionyx triunguis</i>	Nile softshell turtle	0	5
Testudinidae indet.	Unidentified tortoise	15	25
<i>Clarias gariepinus</i>	North African catfish	2	7
Cyprinidae	Carp	0	1
<i>Sparus aurata</i>	Gilt-head sea bream	1	0
Pisces indet.	Unidentified fish	0	5
<i>Anser</i> spp.	Large geese	0	1
<i>Anser erythropus</i>	Lesser white-fronted goose	0	1
<i>Anas platyrhynchos/acuta</i>	Mallard or pintail	1	0
<i>Anas acuta</i>	Pintail	0	2
<i>Anas penelope/clypeata</i>	Eurasian wigeon or northern shoveller	0	1
<i>Haliaeetus albicilla</i>	White-tailed eagle	0	1
<i>Alectoris chukar</i>	Chukar partridge	1	0
<i>Francolinus francolinus</i>	Black francolin	2	0
<i>Fulica atra</i>	Eurasian coot	1	0
<i>Otis tarda</i>	Great bustard	0	1
Aves indet.	Unidentified bird	4	20
Mammalia indet.	Unidentified mammals	593	1654
<b>TOTAL</b>		<b>1282</b>	<b>2654</b>

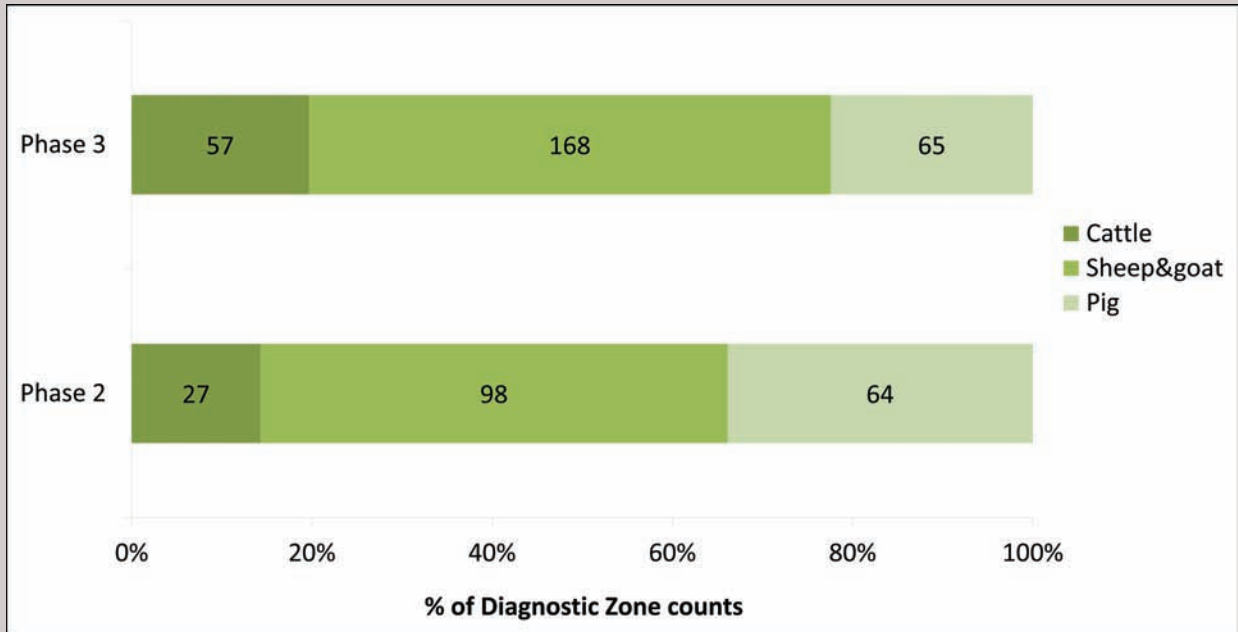


FIG. 5  
 Changes in the relative abundance of livestock in Phases 3 and 2 in Area 4. Data labels = absolute Diagnostic Zones counts. (Graph by C. Çakırlar.)

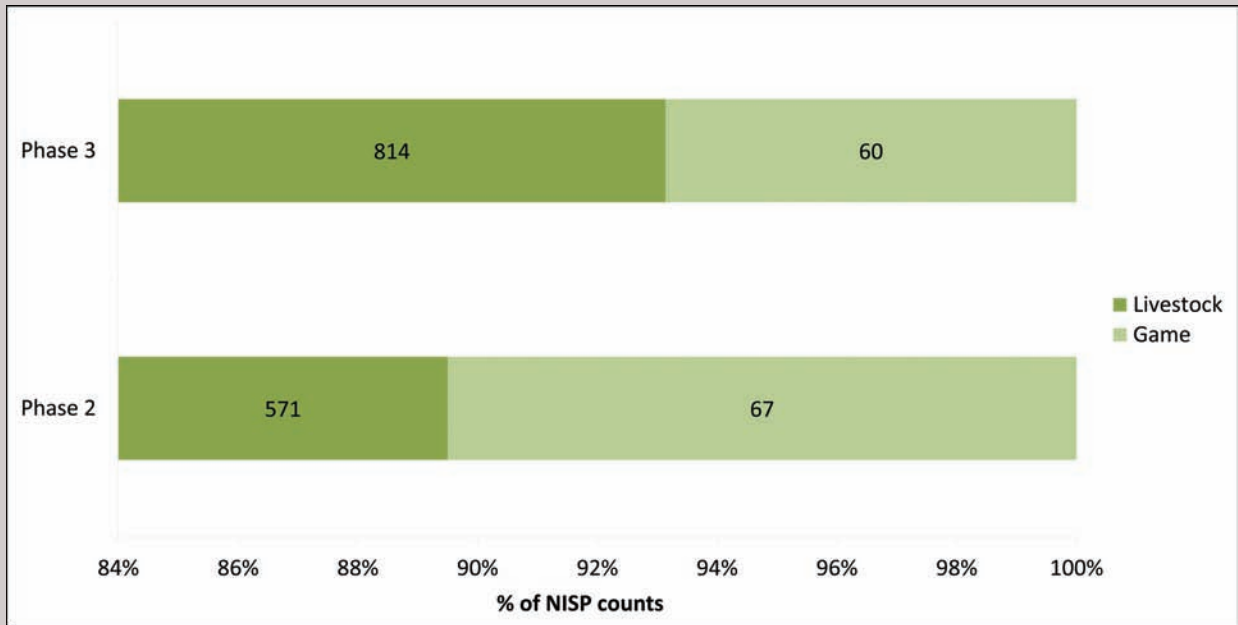


FIG. 6  
 Changes in the relative abundance of terrestrial game and livestock taxa in Phases 3 and 2 in Area 4. Data labels = absolute Number of Identified Specimens counts. (Graph by C. Çakırlar.)

is limited to a few square kilometers on the sloped no-man's land near the Turkish–Syrian border, where they share grazing opportunities with domestic sheep and goat herds. In the Late Bronze Age, all of these wild artiodactyls could be taken (captured, hunted, or otherwise poached) without the need of large expeditions far away from Tell Atchana.

Large carnivorous animals were only represented by brown bear. Numbers were low but their mere presence is noteworthy because it might signify hunting efforts in densely forested areas towards or in the mountains and for purposes other than food. No clear butchery marks were observed on the brown bear remains, but carcasses seem to have been brought to the site as complete carcasses; skull, hand, and foot bones, as well as leg bones are represented in the deposits of Phases 3 and 2 in Area 4.

The absolute number and frequency of bird remains were too small to reveal any statistically significant results about the exploitation of avian fauna in Area 4. Despite the small amount of bird bones recovered from the LB IIA deposits in Area 4, the identification of at least eleven taxa shows the relatively high diversity of wild fowl exploited at Alalakh. Bird hunting or trapping for meat (and feathers) was likely carried out along the Orontes and/or in marsh areas, such as the then-extant 'Amuq Lake, which were the natural habitats for most of the identified species, like the waterfowl (geese, ducks, and coots), the black francolin, and the white-tailed sea eagle. Commonly mentioned in archaeological sites (Tyrberg 1998), the chukar partridge can be found everywhere in rocky and open landscapes of the eastern Mediterranean. The great bustard was identified by a single humerus, but some large-size unidentified bird bones could also belong to this large bird which, until recently, used to winter in large numbers in open grasslands of northern Mesopotamia (Baumgart 1995). Chop and cut marks observed on some Anatidae bones clearly indicate that birds were processed and dismembered before cooking and consumption, just like mammals.

Fish and turtle remains made up the smallest group in the vertebrate remains. Freshwater fish, such as catfish and carps, represented catches from the

Orontes or the 'Amuq Lake, whereas a single bone of a gilt-head sea bream represents marine fish brought from the Mediterranean Sea. Likewise, Nile softshell turtles, carapace fragments of which were identified in the various loci of Phase 3, were an import from the Mediterranean coast or the mouth of the Orontes. Nile softshell turtles populate the coastal zones of the eastern Mediterranean and the lowest courses of large rivers that flow into it.

Due to sample size restrictions, only caprine remains allowed for a meaningful quantitative analysis of the diachronic distribution of body parts. The body part distributions of caprine remains in Phases 3 and 2 of Area 4 are presented as %MAU in relation to the expected frequency of body parts in a complete carcass (Fig. 7). Extremities (i.e., hands and feet) contain almost no meat, and they are usually discarded during skinning. Bones of the skull (here represented by lower and upper jaw bones with teeth) and axial body (here represented by atlas, axis, and pelvis) also yielded smaller amounts of meat, and depending on the culture, they were either regarded as delicacies or discarded as useless parts when the carcass was dismantled into consumption units. Extremities were particularly underrepresented in Area 4, suggesting that slaughtering and skinning took place outside Area 4 in both phases of occupation. In most cases, slaughtering and skinning took place outside of the city, and more meat-bearing parts were brought in for consumers. Portions of the head and the axial body were represented close to expected proportions in a complete carcass in both phases, but they were somewhat less frequent in Phase 2. This divergence might indicate a more limited interest in the urban processing of these low-meat parts in Phase 2 than in the previous phase.

The clear difference between the body part distributions of caprines is in the occurrence of meat-bearing portions of fore and hind limbs. Portions of the forelimbs were over-represented in both phases, whereas hind limbs were over-represented in Phase 2 and under-represented in Phase 3. Hind limbs contain more and higher quality meat than other meat portions of ruminants. It seems that Area 4 was supplied with “good” meat in Phase 3 and high-quality choice cuts in Phase 2.

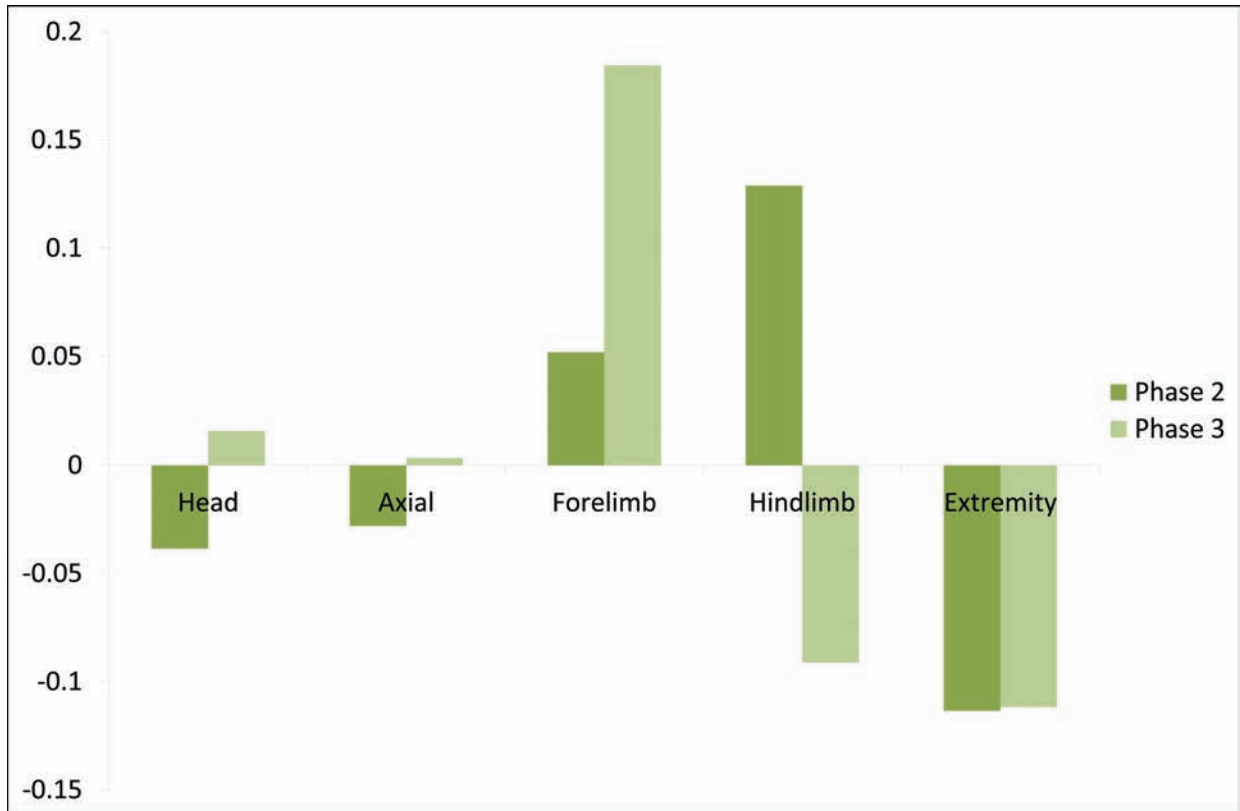


FIG. 7

The representation of body portions of sheep and goats from Phases 3 and 2 as deviations from expected in a complete carcass. (Graph by C. Çakırlar.)

The most reliable quantifiable results to plot the ages of the individuals extracted from available livestock were provided by caprine mandibles (Fig. 8). The majority of sheep and goat provisioned to Area 4 were adult individuals when they were culled. These were individuals between (estimated) four and six years old. They were kept primarily for their lifetime (i.e., secondary) products, especially wool. Newborn individuals, infants, and juveniles that yielded tender meat of higher market value were rarely consumed in Area 4. No statistical difference was found between the culling patterns of sheep and goats in Phases 3 and 2. Missing age cohorts in Phase 2 can be explained by the small sample size of mandibles from this phase (Number of Identified Specimens = 5).

Cattle teeth and mandibles that survived in the archaeological record were not plentiful, so we do not

attempt a quantitative reconstruction of cattle culling patterns. Relatively more numerous were the mandibles with teeth from pigs (Number of Identified Specimens = 16), which indicate that pigs were domestic and kept for their meat (Fig. 9). Notable is the contrast between an apparent focus on infant cullings (Age Class B according to the “Simplified A System” described in Lemoine et al. 2014) in Phase 2 and the more evenly distributed culling events in Phase 3. However, this difference was not statistically significant (Chi-square 3.35;  $P = 0.34$ ). The occurrence of so many mandibles with teeth in the rather limited pig sample indicates that whole carcasses were processed in Area 4, meat-bearing and non-meaty parts alike. Together with the high density of infants in Area 4, body part representation of pigs suggests that pig rearing took place at the settlement or in its immediate vicinity.



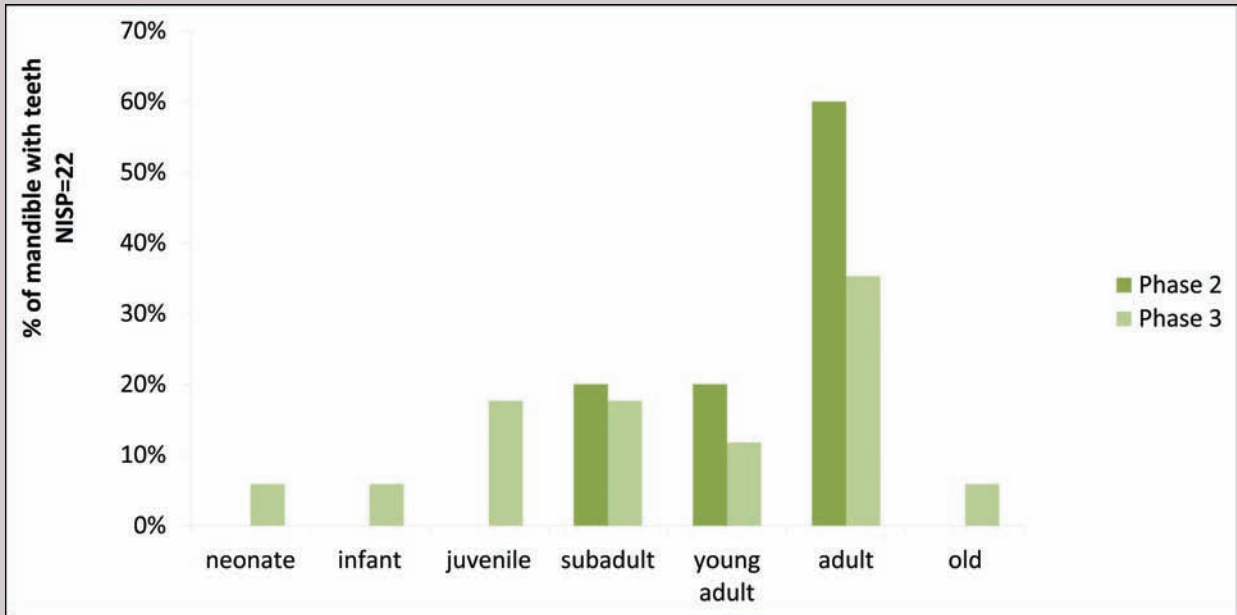


FIG. 8

The survivorship of sheep and goats by phase based on tooth wear and eruption data. The age stages correspond to Payne's classes: Neonate = A; Infant = B; Juvenile = C; Subadult = D; Young Adult = E&F; Adult = G; and Old = H (1973). (Graph by C. Çakırlar.)

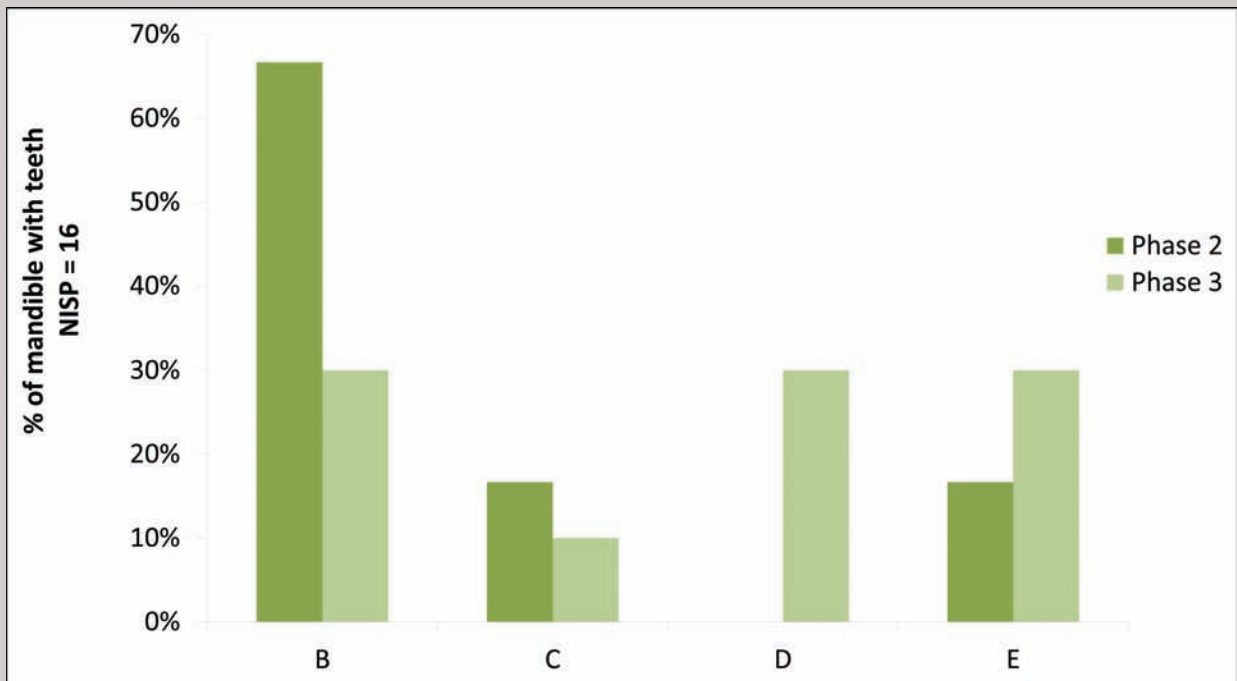


FIG. 9

The survivorship of pigs by phase based on tooth wear and eruption data (following Lemoine et al. 2014: Table 3, "Simplified A System"). (Graph by C. Çakırlar.)

## Discussion

In contrast to common sense expectations, as far as we can tell from the urban contexts of Alalakh, no major disruptions occurred in the animal sector of the economic system of the 'Amuq Plain with the penetration of Hittite administration into the area. This result is largely in agreement with textual and material cultural studies of Syria under the Hittites. Livestock was already the main source of meat as it was in the Middle Bronze II and LB I phases of occupation at Tell Atchana and the zooarchaeological results from Phases 3 and 2 in Area 4 indicate that the animal-based economy of Alalakh supplied by herding did not go through an extensive change during the late fourteenth century BCE (Çakırlar and Rossel 2010; van den Hurk 2013).

The zooarchaeological results further show that Alalakh was provisioned by a pastoral economy that put emphasis primarily on wool production and then on supplying the administrative center with tender meat (lamb and mutton) in both periods. Wool has been a major source of economic return and an item of long-distance exchange in the Syro-Anatolian region since at least the Middle Bronze Age (Atıç 2014). The urban dwellers of Alalakh were probably involved in wool production and trade themselves while they were vassals to the Mitanni Kingdom and thereafter. Wool production and processing featured prominently in the Hittite economy, and wool was also part of rituals (Beckman 1988). Neither the Hittite administration nor their predecessors in Alalakh seem to have attempted or were able to acquire tender meat from caprines other than on rare occasions, indicating that the social distance between the ruling urban economy and the pastoral subjects was not clear. When the layout of Area 4 changed radically in Phase 2, although the amount of caprine consumption remained the same, a certain change in the redistribution of caprine meat occurred that caused larger proportions of meaty cuts to end up in the archaeological deposits. The occurrence of high-quality consumption units can be attributed to the newly attained administrative and military character of the area.

The Hittites may have tried to compensate for the requirement to supply meat to the altered urban

population of Alalakh, which may have had a larger administrative and military component, by giving more importance to pork production. Various properties of pigs, such as their ability to reproduce fast and feed on garbage, make them a good alternative when it is necessary to secure a meat source that is less dependent on the pastoral system (Zeder 1998). Whether, whence, and where pork was avoided as a form of "taboo" is a huge debate (Vila 2006; Sapir-Hen et al. 2013). In our case, pork cannot be used to distinguish between Hittite and Mitanni traditions; neither the Hittites nor the populations in northern Syria seem to have avoided pork during the Late Bronze Age (Dörfler et al. 2011; Vila 2006).

Meat supplements obtained through game exploitation may also have increased in the late fourteenth century BCE in Alalakh. If this development included changes in patterns of bird hunting and fishing, it is not visible in the zooarchaeological record. Whether game exploitation in Late Bronze Age Alalakh signifies an "elite sport," as both Hittite and Syrian iconographic and textual sources suggest (Collins 2002), or was it an activity the urban population (military, administrative, and other specialists) had to turn to at times of necessity when the demand for meat could not be met by livestock production is difficult to tell. The two possibilities need not be mutually exclusive.

## Conclusion

In this article, we investigated the zooarchaeological record of a limited area in fourteenth-century BCE Alalakh in order to identify the economic changes that took place in northern Syria under the Hittites. Our starting point was, on one hand, the fundamental changes and introductions in the material culture of Alalakh in the late fourteenth century BC at the time when the Hittites claim a definite victory over the Mitanni, and on the other, the lack of archaeobiological studies that probed the consented assumption that the Hittites did not attempt any change in the economic systems of the lands they invaded.

The zooarchaeological data we present here support the idea that the general structure of Syrian

economies remained largely unaltered under the Hittite administration in Alalakh. One of the most important commodities was wool and regardless of who was controlling pastoral production and how, herding strategies prioritized its production. Game and pork may have become more favored alternatives to lamb and beef during this period, because they provided a relief from reliance on herding and a means to display power. In Alalakh, Area 4 became an area where better meat cuts were consumed in the late fourteenth century BCE, probably because the area attained a military and administrative function after the Hittites arrived in the region.

Our results can only speak for a small slice of time at one frontier city in northern Syria. The approach used here should be re-applied and results should be tested when more material is available from future excavations into the fourteenth-century BCE phases of Alalakh. These investigations should be designed to clarify the character of Area 4 and other insulae that emerged in Hittite Alalakh, thereby allowing observations on a larger variety of contexts. The 50 years that the Hittites reigned in Alalakh might simply not be a sufficiently large portion of the archaeological palimpsest to observe changes and continuities in the economic system. To test this possibility, the questions raised in our article should be addressed to other and larger zooarchaeological assemblages dating to the Hittite presence in northern Syria, including Alalakh itself.

## Notes

1. Archaeological investigations at Alalakh were renewed under the directorship of K. Aslihan Yener in 2003, under the auspices of the Turkish Ministry of Culture, and are ongoing. Faunal analysis at Tell Atchana was generously sponsored by the Amuq Regional Survey and Excavation Project, now of the Koç University, and the American Research Institute in Turkey (ARIT) intermittently between 2007 and 2011.
2. Recording and identification were done by C. Çakırlar, S. Pilaar Birch, and R. Berthon at the site using a small reference collection and osteological manuals between 2007 and 2012. Parts of the material were exported and studied at the Institut für Naturwissenschaftliche Archäologie at Tübingen University, Germany; Koninklijk Belgisch Instituut voor Natuurwetenschappen in Brussels, Belgium; and the Institute of Archaeology of the Groningen University, the Netherlands, by C. Çakırlar. The final identifications for the bird bones were done by L. Gourichon at Muséum national d'Histoire naturelle in Paris, France.
3. Modern annual rainfall patterns can exceed 1,100 mm in the 'Amuq.
4. The morphological and demographic traits of the *Sus* populations in Bronze Age Atchana allow the great majority to be considered domestic, while a few stand out with their large dimensions as wild boar (Çakırlar forthcoming).
5. The fallow deer on the 'Amuq were most probably *Dama dama mesopotamica*, the "Persian" or "Mesopotamian" subspecies of fallow deer that are endemic to Anatolia.

## References

- Akar M. 2013. The Late Bronze Age Fortresses at Tell Atchana/Alalakh: Architecture and Identity in Mediterranean Exchange Systems. In *Across the Border: Late Bronze–Iron Age Relations between Syria and Anatolia; Proceedings of a*

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- Symposium Held at the Research Center of Anatolian Studies, Koç University, Istanbul, May 31–June 1, 2010*, ed. K. A. Yener, 37–60. Ancient Near Eastern Studies Supplement 42. Leuven: Peeters.
- Akar, M., and K. A. Yener. 2013. Alalah: 10 Yılın Ardından. *Türk Eskiçağ Bilimleri Enstitüsü Haberler* 35:4–10.
- Arbuckle, B. S. 2006. *The Evolution of Sheep and Goat Pastoralism and Social Complexity in Central Anatolia*. PhD diss., Harvard University.
- Atıcı, L. 2014. The Secondary Products Revolution in the Light of Textual Evidence from Kültepe/Kanesh, Central Turkey. In *Animal Secondary Products: Domestic Animal Exploitation in Prehistoric Europe, the Near East and the Far East*, ed. H. J. Greenfield, 233–52. Oxford: Oxbow.
- Baumgart, W. 1995. *Die Vögel Syriens: Eine Übersicht*. Heidelberg: Max Kasperek.
- Becker, C. 2008. Die Tierknochenfunde aus Tell Schech Hamad/Dur-Katlimmu: Eine haustierkundlich-zoogeographische Studie. In *Umwelt und Subsistenz der assyrischen Stadt Dur-Katlimmu am Unteren Habur*, ed. H. Kühne, 61–125. Berichte der Ausgrabung Tell Seh Hamad/Dur-Katlimmu (BATSH) 8. Wiesbaden: Harrassowitz.
- Beckman, G. 1988. Herding and Herdsmen in Hittite Culture. In *Documentum Asiae Minoris Antiquae: Festschrift für Heinrich Otten zum 75. Geburtstag*, ed. E. Neu and C. Rüster, 33–44. Wiesbaden: Harrassowitz.
- . 1992. Hittite Administration in Syria in the Light of the Texts from Hattuša, Ugarit, and Emar. In *New Horizons in the Study of Ancient Syria*, ed. M. W. Chavalas and J. L. Hayes, 41–49. Bibliotheca Mesopotamica 25. Malibu, CA: Undena.
- Bigelow, L. 2000. Zooarchaeological Investigations of Economic Organization and Ethnicity at Late Chalcolithic Hacinebi: A Preliminary Report. *Paléorient* 25:83–89.
- Bryce, T. 2007. *Hittite Warrior*. Warrior 120. Oxford: Osprey.
- Çakırlar, C. Forthcoming. The Faunal Remains from LBII Alalakh. In *Alalakh Excavations 2006–2010: The LB II Levels*, ed. K. A. Yener, M. Akar, and M. T. Horowitz. Istanbul: Koç University Press.
- Çakırlar, C., and S. Rossel. 2010. Faunal Remains from 2003–2004 Excavations at Tell Atchana. In *The 2003–4 Excavation Seasons*. Vol. 1 of *Tell Atchana, Ancient Alalakh*, ed. K. A. Yener, 141–43. İstanbul: Koç University Press.
- Capriles, J. M., A. I. Domic, and S. Alconini. 2010. Continuity and Change in Faunal Consumption Patterns at the Pre-Inka and Inka Site of Yoroma, Bolivia. In *Anthropological Approaches to Zooarchaeology: Complexity, Colonialism, and Animal Transformations*, ed. D. Campana, P. Crabtree, S. D. deFrance, J. Lev-Tov, and A. M. Choyke, 105–112. Oxford: Oxbow/Oakville, CT: David Brown.
- Collins, B. J. 2007. *The Hittites and Their World*. Archaeology and Biblical Studies 7. Atlanta: Society of Biblical Literature.
- . ed. 2002. *A History of the Animal World in the Ancient Near East*. Handbook of Oriental Studies 1, Near and Middle East 64. Leiden: Brill.
- Crabtree, P. J. 1990. Zooarchaeology of Complex Societies: Some Uses of Faunal Analysis for the Study of Trade, Social Status and Ethnicity. In *Archaeological Method and Theory*, Vol. 2, ed. M. B. Schiffer, 155–205. Tucson: University of Arizona Press.
- Davis, S. J. M. 2008. Zooarchaeological Evidence for Moslem and Christian Improvements of Sheep and Cattle in Portugal. *Journal of Archaeological Science* 35:991–1010.
- deFrance, S. 2009. Zooarchaeology in Complex Societies: Political Economy, Status, and Ideology. *Journal of Archaeological Research* 17:105–68.
- Dörfler, W., C. Herking, R. Neef, R. Pasternak, and A. von den Driesch. 2011. Environment and Economy in Hittite Anatolia. In *Insights into Hittite History and Archaeology*, ed. H. Genz and D. P. Mielke, 99–124. Colloquia Antiqua 2. Leuven: Peeters.
- Genz, H. 2006. Hethitische Präsenz im spätbronzezeitlichen Syrien: Die archäologische Evidenz. *Baghdader Mitteilungen* 37:499–509.
- Glatz, C., and A. M. Plourde. 2011. Landscape Monuments and Political Competition in Late Bronze Age Anatolia: An Investigation of Costly Signaling Theory. *Bulletin of the American Schools of Oriental Research* 361:33–66.
- Grant, A. 1982. The Use of Tooth Wear as a Guide to the Age of Domestic Ungulates. In *Ageing and Sexing Animal Bones from Archaeological Sites*, ed. B. Wilson, C. Grigson, and S. Payne, 91–107. BAR British Series 109. Oxford: B.A.R.
- Gumerman, G., IV. 1997. Food and Complex Societies. *Journal of Archaeological Method and Theory* 4:105–39.
- Gündem, C. Y. 2010. Animal Based Subsistence Economy of Emar during the Bronze Age. In *Roman and Medieval Cemeteries and Environmental Studies*. Vol. 1 of *Emar after the Closure of the Tabqa Dam: The Syrian-German Excavations 1996–2002*, ed. U. Finkbeiner and F. Sakal, 125–76. Subartu 25. Turnhout: Brepols.
- Gündem, C.Y., and H.-P. Uerpmann. 2003. Erste Beobachtungen an den Tierknochenfunden aus Emar (Syrien)—Grabungen bis 2002. *Baghdader Mitteilungen* 34:119–28.
- Helmer, D., L. Gourichon, and E. Vila. 2007. The Development of the Exploitation of Products from *Capra* and *Ovis* (Meat, Milk and Fleece) from the PPNB to the Early Bronze in the Northern Near East (8700 to 2000 BC cal.) *Anthropozoologica* 42:41–69.
- Hongo, H. 2003. Continuity or Changes: Faunal Remains from Stratum IId at Kaman-Kalehöyük. In *Identifying Changes: The Transition from Bronze to Iron Ages in Anatolia and Its Neighbouring Regions; Proceedings of the International Workshop, Istanbul, November 8–9, 2002*, ed. B. Fischer, H. Genz, É. Jean, and K. Köroğlu, 257–69. Istanbul: Türk Eskiçağ Bilimleri Enstitüsü Yayınları.
- Ikram, S. 2003. A Preliminary Study of Zoological Changes between the Bronze and Iron Ages at Kinet Höyük, Hatay. In *Identifying Changes: The Transition from the Bronze to the Iron Ages in Anatolia and Its Neighbouring Regions; Proceedings of the International Workshop, Istanbul, November 8–9, 2002*,

- ed. B. Fischer, H. Genz, É. Jean, and K. Köroğlu, 283–94. Istanbul: Türk Eskiçağ Bilimleri Enstitüsü Yayınları.
- Ioannidou, E. 2003. Taphonomy of Animal Bones: Species, Sex, Age and Breed Variability of Sheep, Cattle and Pig Bone Density. *Journal of Archaeological Science* 30:355–65.
- Kansa, E. C., S. Whitcher Kansa, and T. E. Levy. 2004. Eat Like An Egyptian? A Contextual Approach to an Early Bronze I “Egyptian Colony” in the Southern Levant. In *Integrating Zooarchaeology*, ed. M. Maltby, 76–91. Oxford: Oxbow/Okaville, CT: David Brown.
- Lam, Y. M., O. M. Pearson, C. W. Marean, and X. Chen. 2003. Bone Density Studies in Zooarchaeology. *Journal of Archaeological Science* 30:1701–8.
- Lemoine, X., M. A. Zeder, K. J. Bishop, and S. J. Rufolo. 2014. A New System for Computing Dentition-Based Age Profiles in *Sus scrofa*. *Journal of Archaeological Science* 47:179–93.
- Payne, S. 1972. Partial Recovery and Sample Bias: The Results of Some Sieving Experiments. In *Papers in Economic Prehistory*, Vol. 1, ed. E. S. Higgs, 49–64. Cambridge: Cambridge University Press.
- . 1973. Kill-Off Patterns in Sheep and Goats: The Mandibles from Aşvan Kale. *Anatolian Studies* 23:281–303.
- Sapir-Hen, L., G. Bar-Oz, Y. Gadot, and I. Finkelstein. 2013. Pig Husbandry in Iron Age Israel and Judah: New Insights Regarding the Origin of the “Taboo.” *Zeitschrift des Deutschen Palästina-Vereins* 129:1–20.
- Sykes, N. J. 2001. *Norman Conquest: A Zooarchaeological Perspective*. PhD diss., University of Southampton.
- Tyrberg, T. 1998. *Pleistocene Birds of the Palearctic: A Catalogue*. Publications of the Nuttall Ornithological Club 27. Cambridge: Nuttall Ornithological Club.
- van den Hurk, Y. 2013. *Interpreting the Zooarchaeological Remains from an Intact Kitchen Context from Middle Bronze Age Alalakh: Palace, Redistribution and Feasts*. BA thesis, Groningen University.
- Vila, E. 2006. Les restes de suidés, un marqueur archéologique au Levant? In *De la domestication au tabou: le cas des suidés dans le Proche-Orient ancien*, ed. B. Lion and C. Michel, 215–26. Travaux de la Maison René-Ginouvès 1. Paris: Boccard.
- , and L. Gourichon. 2007. Apport de l’étude de la faune mammalienne et de l’avifaune à la réflexion sur l’environnement de Qatna à l’Age du Bronze et à l’Age du Fer. In *Urban and Natural Landscapes of an Ancient Syrian Capital: Settlement and Environment at Tell Mishrifeh/Qatna and in Central-Western Syria; Proceedings of the International Conference Held in Udine, 9–11 December, 2004*, ed. D. Morandi Bonacossi, 161–68. Studi archeologici su Qatna 1; Documents d’archéologie syrienne 12. Udine: Forum.
- Watson, J. P. N. 1979. The Estimation of the Relative Frequencies of Mammalian Species: Khirokitia 1972. *Journal of Archaeological Science* 6:127–37.
- Wilkens, B. 2000. Archaeozoology Westward: The Fauna of Tell Afis (Syria). *Topoi Supplement* 2:5–14.
- Woolley, L. 1955. *Alalakh: An Account of the Excavations at Tell Atchana in the Hatay, 1937–1949*. Reports of the Research Committee of the Society of Antiquaries of London 18. London: Society of Antiquaries.
- Yener, K. A. 2011. Hittite Metals at the Frontier: A Three Spiked Battle Ax from Alalakh. In *Metallurgy: Understanding How, Learning Why; Studies in Honor of James D. Muhly*, ed. P. P. Betancourt and S. C. Ferrence, 265–73. Prehistory Monographs 29. Philadelphia: INSTAP Academic.
- . 2013. New Excavations at Alalakh: The 14th–12th Centuries BC. In *Across the Border: Late Bronze–Iron Age Relations between Syria and Anatolia; Proceedings of a Symposium Held at the Research Center of Anatolian Studies, Koç University, Istanbul, May 31–June 1, 2010*, ed. K. A. Yener, 11–36. Ancient Near Eastern Studies Supplement 42. Leuven: Peeters.
- , and M. Akar. 2013. Alalakh–Tell Atchana. In *Hittites: An Anatolian Empire*, ed. M. Alparslan-Doğan and M. Alparslan, 264–71. Anadolu uygarlıkları serisi 3. Istanbul: Yapı Kredi Yayınları.
- Zeder, M. A. 1991. *Feeding Cities: Specialized Animal Economy in the Ancient Near East*. Smithsonian Series in Archaeological Inquiry. Washington, DC: Smithsonian Institution Press.
- . 1998. Pigs and Emergent Complexity in the Ancient Near East. In *Ancestors for the Pigs: Pigs in Prehistory*, ed. S. M. Nelson, 109–22. MASCA Research Papers in Science and Archaeology 15. Philadelphia: Museum Applied Science Center for Archaeology, University of Pennsylvania Museum of Archaeology and Anthropology.