Anatolian Studies 60 (2010): 71–92

Patterns of Iron Age interaction in central Anatolia: three sites in Yozgat province

Lisa Kealhofer,[1] Peter Grave,[2] Ben Marsh,[3] Sharon Steadman,[4] Ronald L. Gorny[5] and Geoffrey D. Summers[6]

[1]Santa Clara University, [2]University of New England, [3]Bucknell University, [4]SUNY Cortland, [5]University of Chicago and [6]Middle East Technical University

Abstract

The cultural and political changes that happened in Anatolia after the collapse of the Hittite Empire have only recently been recognised as a significant, but as yet unexplained, phenomenon. Here we present the results of analyses of ceramics from three sites south and southwest of the present-day town of Sorgun – Çadır Höyük, Kerkenes Dağ and Tilkigediği Tepe – to identity how regional groups within the Hittite core area regrouped in the aftermath of the collapse. Ceramic analyses provide a means to assess both cultural continuity and the scale and nature of interaction in a region. Results suggest some evidence of cultural continuity at Çadır Höyük from the Late Bronze Age into the Middle Iron Age, and highlight the variable local responses in the aftermath of Hittite collapse.

Özet

Anadolu'da, Hitit İmparatorluğu'nun yıkılmasından sonra ortaya çıkan kültürel ve siyasal değişiklikler ancak son zamanlarda önemli sayılmaya başlanmış, fakat henüz tam olarak açıklanamamış bir olgudur. Bu makalede, imparatorluğun yıkılması sonucunda Hitit merkez alanı içindeki bir bölgenin yeniden birleşme çabalarının tespiti için, günümüz Sorgun ilçesinin güney ve güneybatısındaki üç yerleşimden; Çadır Höyük, Kerkenes Dağı ve Tilkigediği Tepe'den seramik örneklerinin analiz sonuçlarını sunmaktayız. Seramik analizleri, bize bir bölgedeki kültürel devamlılığı, onun derecesini ve aynı zamanda o bölgedeki etkileşimin kökenini belirleme olanağı sağlamaktadır. Sonuçlar, Çadır Höyük'de Geç Tunç Çağı'ndan Orta Demir Çağı'na kadar uzanan kültürel devamlılığa işaret etmekte ve Hitit İmparatorluğu'nun yıkılması sonucunda ortaya çıkan değişken yerel tepkileri vurgulamaktadır.

The region circumscribed by the large bend of the Kızılırmak river in central Anatolia has long been a focus for Bronze Age archaeologists interested in the Assyrian Colony period and the development of the Hittite Empire. The reformation of societies following the 12th-century BC collapse of the Hittites has received comparatively little attention beyond von der Osten's 1937 publication of Alişar IV and V. Consequently, our understanding of societal responses to the collapse of Hittite political control in this region and the dynamics of polity building during the first millennium BC has remained largely descriptive and limited to relatively few sites.

The present study focuses on a cluster of three Iron Age sites in Yozgat province, central Turkey, that provide an unusual opportunity to look more closely at how regional interaction was reconfigured during the first millennium BC inside the bend of the Kızılırmak. The three sites, south and southwest of Sorgun, are: Çadır Höyük, Kerkenes Dağ and Tilkigediği Tepe (fig. 1). Çadır Höyük is a mounded site with evidence of occupation from the Chalcolithic to the Byzantine period. Kerkenes Dağ is a large fortified (late) Middle Iron Age hilltop city with a relatively short occupation (<150 years?). Tilkigediği is a small, hilltop Iron Age site 3km northeast of Kerkenes.

This paper is part of a larger study of Iron Age contexts across western and central Anatolia (the Anatolian Iron Age Project). The over-arching goal of the broader project is to move beyond site-based studies to understand how exchange and interaction patterns

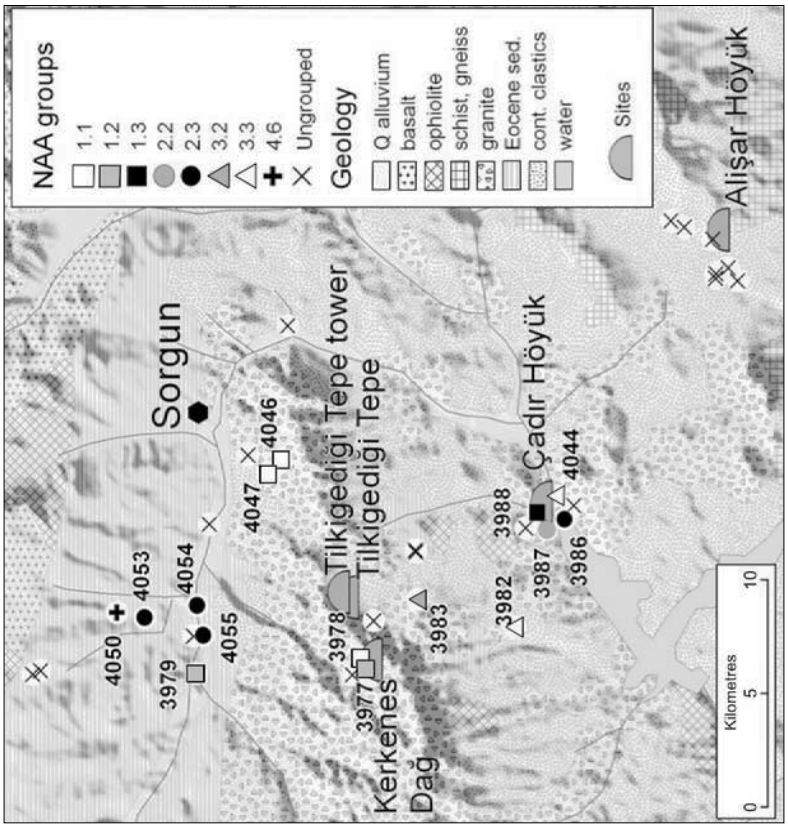

Fig. 1b. Map of the Sorgun region showing geology (based on Erentöz 2002), site and sediment sample locations, and compositional group membership of sediment samples

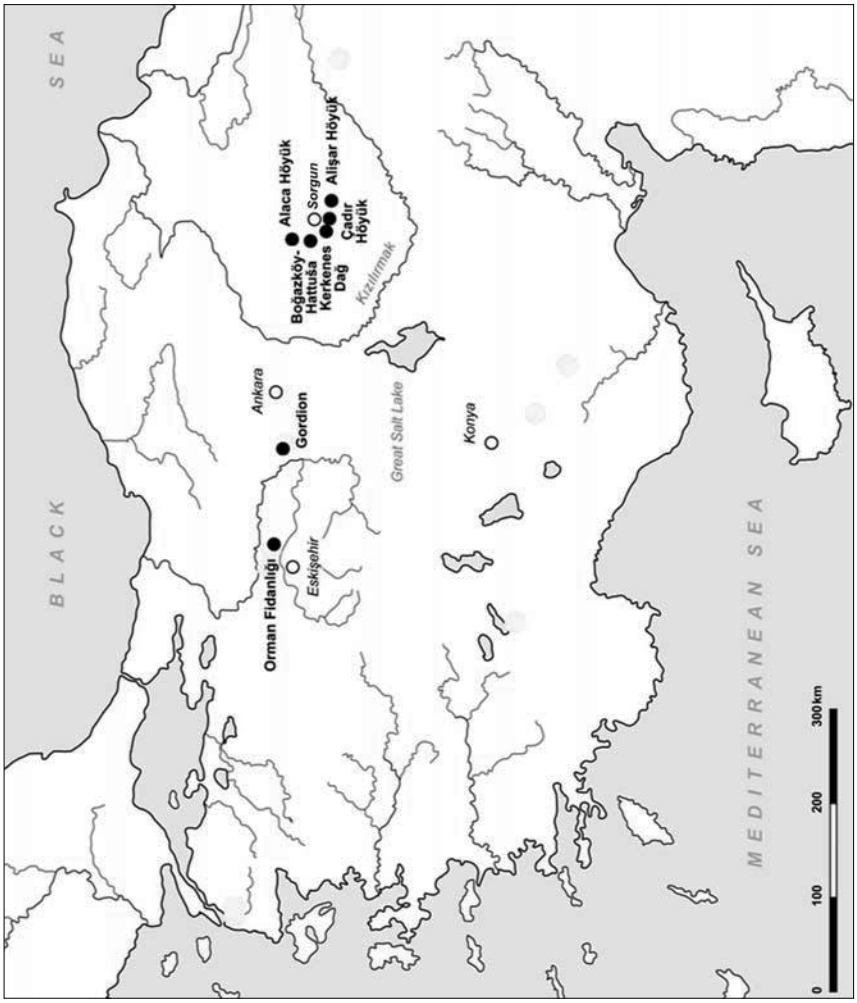

Fig. 1a. Map of Turkey showing sites and geographic features discussed in the text

changed among Anatolian polities in relation to political and economic transformations after the wide-ranging political collapses of the Late Bronze Age in the eastern Mediterranean, particularly the Hittite collapse. The few previous studies of interaction in this region have been preliminary and typically based on highly diagnostic trade goods or artefactual styles – usually ceramic (for example, Schaus 1992; Gürtekin-Demir 2002). Style, while useful for identifying emulation, is problematic for studying exchange, since it is not spatially tied to a particular location. Analytic characterisation provides an alternative which does link artefacts to their geographic source.

Of the range of techniques available we adopt geochemical profiling using Neutron Activation Analysis (NAA), a technique that has proven robust and reliable in distinguishing local from non-local materials, particularly ceramics and obsidian. A further advantage of this technique is that large NAA datasets already exist for the Mediterranean littoral that are readily comparable to our datasets and thus have the potential to extend greatly our understanding of large-scale interaction over time (for example, Knapp, Cherry 1994; Mommsen et al. 2002; Glascock, Neff 2003). From the patterns defined here, more detailed follow-up studies investigating sources and individual decision-making processes using more labour-intensive techniques, such as petrography, may provide another dimension in understanding the local economic and social contexts of ceramic production, but this more detailed objective is outside the scope of the present study.

Definitions of time and space

Chronology and periodisation for the Iron Age remain problematic and contentious in central Anatolia (DeVries et al. 2003; Genz 2003; 2007; Summers 2008). Individual site sequences are often idiosyncratic and difficult to correlate with other sites, particularly given the low resolution of absolute dates during the radiocarbon plateau of the mid to late first millennium BC. For the present study, we use a combination of historical events/convention and radiocarbon dating to define the three Iron Age phases used here: Early Iron Age 1150–900 BC; Middle Iron Age 900–550 BC; and Late Iron Age 550–330 BC. The end of the Early Iron Age is defined by radiocarbon dates from Boğazköy and Gordion (the best dated sites in the larger region). The end of the Middle Iron Age is historically defined by a combination of the Lydian assault on sites across the region from the west in the first half of the sixth century BC and the chronologically overlapping Achaemenid incursions from the east (ca. 540s BC at Gordion). This is most apparent at Gordion, where the Persian attack is documented in the destruction of the Küçük Höyük fortress (Voigt, Young 1999). At the time of the Persian attack, there is substantial evidence that Lydian influence was strong at Gordion (in the form of a significant Lydian ceramic assemblage and Lydian style architectural terracottas). Given the limited ability to define these more rigorously, phase boundaries are somewhat arbitrary. For the end of the Middle Iron Age we have chosen a date of 550 BC (while earlier dates for the end of the Middle Iron Age have been proposed, tied to Alişar IV ceramic distributions, these distributions remain poorly dated). The end of the Late Iron Age in this region is conventionally defined by Alexander's invasion of Anatolia in 330 BC.

A fundamental aspect of our study is the ability to separate 'local' from 'non-local' production. To do this we adopt a provenance approach using geochemical signatures. In this approach 'local' and 'non-local' are understood in relation to the specific geological context of the site, or sites, under consideration. The scale of a 'local' region is related to the complexity of the regional geology. For a site with a homogeneous limestone catchment of, for example, 25km radius, 'local' resolution is likely to equate with that catchment. In contrast, regions with more diverse and localised geology allow the possibility of greater 'local' resolution.

The Çadır/Kerkenes region is geologically complex (fig. 1b), with volcanic (basalt), plutonic (granite), metamorphic (schists, gneiss and marble) and sedimentary lithologies (Erentöz 2002). In addition, these geologies are highly 'patchy', with multiple outcrops of each type and corresponding alluvial lithologies. In this context, 'local' is defined through ceramic matching of sediment sources within the survey area, recognising that there may well be very similar lithologies in regions further afield. Note that we adopt a highly conservative approach to differentiating local from non-local and are more likely to identify as local some ceramics that may come from non-local sources than to suggest that exotic sources are local.

Background

Sites

While both Çadır and Kerkenes have been surveyed and/or excavated for more than a decade, the focus of work at Kerkenes has been on remote sensing and mapping with excavations mainly in the monumental Cappadocia Gate and adjacent Palace areas beginning in 2000. Tilkigediği has not been excavated, and the sample analysed here represents a surface survey collection.

Çadır Höyük

Çadır is located on a limestone ridge overlooking the Eğri Öz Su valley, now near the edge of the Gelingüllü reservoir (Steadman et al. 2008). A systematic surface survey of the site in 1993 provided evidence of occupation from at least the Chalcolithic through to the Byzantine period. The site has been excavated over the course of the last ten years, focusing primarily on Byzantine, Hittite and Chalcolithic levels, with a step trench providing some measure of the site's overall chronology. Publications cover the Middle Chalcolithic (ca. 5300 BC) into the Early Bronze Age (up to 2000 BC), as well as preliminary excavation overviews (Gorny et al. 2002; Gorny 2006; Steadman et al. 2008).

While the focus of this paper is on understanding Iron Age dynamics after the Bronze Age political collapse, interaction must be contextualised in both chronological and geographic terms. As one means to contextualise the patterns of interaction we see in the Iron Age, we make use of an additional, Chalcolithic period dataset from Çadır to provide a comparative sample. The Chalcolithic assemblage potentially provides a preliminary measure of regional dynamics for a non-state society and allows us to compare dynamics from Iron Age contexts, where the scale of polity is unknown. While many factors are clearly different between these two phases, the scale of interaction and the scale at which production was organised can be usefully compared. Several different types of data point to long-distance exchange in the Chalcolithic, particularly the use of obsidian. The Chalcolithic sequence includes a monumental stone gate, substantial enclosure wall and a clearly prosperous settlement with a mixed pastoral and agricultural economy (Steadman et al. 2008).

Areas on the mound with stratified evidence from the Iron Age include the Lower South Trench and the Upper South Slope. Two stratigraphically contemporary samples from an oven and a pit provided radiocarbon ranges in the Early Iron Age and Middle Iron Age (2σ: 1270–910 BC cal [BETA 146703] and 1190–840 BC cal [BETA 146704]). Units in the Upper South Slope yielded Late Iron Age pottery above a Middle Iron Age town wall and part of a gate. Below these deposits, ceramics appeared 'transitional' Late Bronze Age/Early Iron Age, and thus were attributed to the Early Iron Age (Gorny 2006). At this same level, an unusual set of three round plaster floors was also uncovered, which the excavators suggest might be related to wool processing (finds include loom weights, spindle whorls and an iron hook). Hittite remains occurred immediately below this feature with no evidence (for example, ash layers, sterile fill) to suggest any break in continuity between the Late Bronze Age and Early Iron Age occupations. Excavations on the North Slope encountered a wall and gate about half way up the mound, dating to the Late Bronze Age but with evidence for continued use and modifications in the Early Iron Age. During the Late Iron Age the gate was filled in to form part of a wall.

In sum, these contexts indicate a substantial fortified settlement occupied throughout the Iron Age, though absolute dating for these Iron Age sub-phases is limited and involves wide error margins.

Kerkenes Dağ

Kerkenes, one of the largest (2.5km^2) fortified town sites in Anatolia, lies 50km southeast of Boğazköy, 25km northwest of Alişar and 10km northwest of Çadır Höyük. It has been identified as the strongest candidate for the site of Pteria of Herodotus (1.76; Summers 2008). Occupation ended when the city, including the timber-laced stone defences and the seven city gates, was sacked and burned in the mid sixth century BC (end of the Middle Iron Age). Since 1993 a programme of remote sensing data collection has detailed the urban layout at the time of the destruction and abandonment (Summers et al. 1996; Branting, Summers 2002; Summers 2006). Finds include an Old Phrygian inscription and graffiti (Brixhe, Summers 2006), semi-iconic idols (one on a stepped monument), various architectural embellishments, megara, metalwork and ceramics, all in styles similar to those found in the Phrygian Highlands to the west.

The evidence from remote sensing, excavations and ceramics is consistent with an occupation of less than 150 years (for example, 700/650–550 BC). The site includes one main building level and no evidence of any earlier Alişar IV style ceramics. Based on this evidence, a foundation date for this new city is suggested to be no earlier than the (late?) seventh century BC, hence no useful radiocarbon dates are available for the site (occupation occurs within the extended 400 year radiocarbon plateau of the mid first millennium BC).

The founding of the city at Kerkenes undoubtedly had a major impact on nearby settlements, including Çadır. Based on a wide range of both élite and non-élite material culture (for example, graffiti on pots) and the integrated nature of the urban layout which has strong parallels with Phrygian architectural styles, Summers argues that Kerkenes represents a large migration of people from the west who made up the entire population of the city, or almost so.

Additional information can be found on the Kerkenes website (www.kerkenes.metu.edu.tr) as well as in several recent publications (Summers, Summers 1998; 2008; 2010; Stronach, Summers 2003; Summers et al. 2004; Branting 2005; Brixhe, Summers 2006; Summers 2006; Draycott et al. 2008).

Tilkigediği Tepe

Tilkigediği Tepe is a small mound on the northern end of a ridge extending 3km northeast from Kerkenes Dağ. A description of the site and surface finds has been published by Summers et al. (1995). The site commands views in all directions and has springs at its base (currently intermittent). The mound is ca. 30m in diameter with steep sides and has a roughly-made stone glacis. Based on pitting on the site, the site seems to have been occupied mainly during the later Iron Age (there is no evidence of previous or later periods except one Early Bronze Age sherd and lithic and a few unpublished sherds of so-called 'Galatian' ware). The size and location of the site, with its walls and glacis, have led to the suggestion that it may have functioned as a watch-tower (Summers 2001).

Geological context

The geology of the Sorgun region is characterised by large expanses of relatively homogenous lithologies which are interspersed with patches of significantly different rock types. The granitic basement rock is partially covered by two sedimentary layers – an Eocene section of coal, limestone, siltstone and conglomerate, and a later, overlying, Tertiary-age layer of locally-derived continental clastics.

The sites of Kerkenes and Tilkigediği are located on the granite upland (fig. 1b). Çadır, in contrast, has a diverse range of sediments nearby. It is located on the later clastics, at the edge of a low granitic landscape, but also on the major stream draining the Eocene clastics. Today, ceramic tile production is widespread in the Sorgun valley and abandoned clay pits are present in the Eocene clastics. Small ophiolite bodies are also common, especially near Çadır.

Ceramic repertoires from each site

Çadır Höyük ceramics

For the Chalcolithic, two types of clay fabric are visually identifiable, one with a high mica content and one with almost none (Steadman et al. 2008). Most of the ceramics, however, are not micaceous. The Chalcolithic pottery is handmade; smaller vessels were made using a pinching technique, while larger cooking and storage vessels were more often made using slab construction. Forms include a limited repertoire of bowls and open jars. By the Late Chalcolithic and transitional periods, a wider range of forms occur, including larger, more closed vessels as well as pedestal bowls ('fruitstands'). Most of the Chalcolithic ceramics are black, occasionally buff or red, and burnished (Steadman et al. 2008). A few forms have lugs on the rim or shoulder. Bowls and jars are most common, with bowls becoming more abundant in the Late Chalcolithic. Some incised decoration and red paint also occur in the Late Chalcolithic. By the end of the Chalcolithic, buff to orange fabrics are more common, but burnishing remains the main decorative treatment.

The Chalcolithic ceramics find parallels both at Alişar (19–18M; von der Osten 1937) and, slightly later, at Orman Fidanlığı in the Porsuk valley (particularly the small, fine, hemispherical bowls; Efe 2001). The general similarity in style and form across the north-central plateau suggests a larger interaction zone than in either the Late Bronze Age or Iron Age (or a recent shared tradition?), with less evidence of interaction to the west (Steadman et al. 2008). Some specific traits (for example, pedestal bowls) are common to south-eastern Anatolia. The amount and extent of interaction in the Chalcolithic period is one of the questions pursued here.

Genz (2001) completed a preliminary analysis of unstratified samples of Çadır's Iron Age ceramics. Dates were suggested based on stylistic parallels with the nearby sites of Büyükkaya (Boğazköy) and Alişar. The samples included a range of decorative styles and forms comparable to Early Iron Age types at Büyükkaya. One particular style of red decoration (dot-filled red triangles), Genz has suggested, is found only in a limited area during the Early Iron Age (Alaca, Boğazköy and Çadır). Some of the assemblage was similar to the Middle Iron Age (ninth century BC) material variously known as Alişar IV or Silhouette Ware (with animal silhouettes, concentric circles, pendants, wavy lines, hatched triangles, etc.), with a dark matte painted decoration that also has parallels at Boğazköy. The Late Iron Age material is less well-defined, but includes elaborated 'panel' decoration (polychrome: red and brown animals or geometrics on a white panel) and grey wares. Late Iron Age ceramics show relatively strong continuity with those of the Middle Iron Age, with the addition of banded decoration (red or brown). The assemblage includes a range of bowls (hemispherical bowls and some with flanged rims), jugs and juglets (including trefoil forms), jars and cooking pots.

Kerkenes Dağ ceramics

The ceramic assemblage from Kerkenes that was available for sampling is relatively small, as no corpus of material from good domestic contexts has as yet been excavated. The majority of the pottery is plain; tableware fabrics are mainly red-buff and kitchen ware is mainly grey. Some pitchers and broad-rimmed bowls have coarse white slip panels and polychrome painted geometric designs, while some closed vessels have painted bands. A few small, fine, black polished bowls

with flat or disc bases are present, along with even fewer incised or impressed grey ware sherds. The range of forms is relatively limited, including, jars, bowls and jugs of varying sizes. There are no Alişar IV style sherds. The overall character of the assemblage appears to be Middle to Late Iron Age.

Tilkigediği Tepe ceramics

All the pottery in our sample is wheelmade, with finishes ranging from slips and washes to burnishing (polish in some cases). Forms are limited: shallow open bowls, narrow-necked jars and kraters. Decoration includes some polychrome banded wares as well as pattern burnishing. The forms and decoration of the Tilkigediği assemblage are quite distinct from those at Kerkenes (Summers et al. 1995).

Methods

The larger eastern Mediterranean region has a long history of ceramic compositional analysis applied at a variety of scales (for example, Knapp, Cherry 1994; Slane et al. 1994; Yellin 1995). Here we take a landscape approach, situating entire assemblages of ceramics relative to their find locations. This approach not only provides a robust means of establishing provenance but also addresses our broader goal of defining the large-scale patterning of inter-site interaction.

Excavated ceramics were sampled at each site. Sampling criteria included good stratigraphic contexts and/or highly diagnostic styles or forms. Samples were photographed, described and tabulated in the field, and then shipped to the University of New England laboratory for preliminary processing. Processed samples (ca. 1g) were sent for Neutron Activation Analysis at Becquerel Laboratories, Canada.

In order to identify local production we need to tie ceramic compositional profiles to the surrounding landscape. The inherent and often insurmountable difficulties involved in defining ancient clay sources, particularly in the context of a substantially eroded landscape with alluviated valleys, demand an alternative landscape sampling strategy. Our approach for defining 'local' ceramics is based on characterising the geochemistry of the regional geology surrounding the sites sampled. This involves the collection of sediment samples from both residual geological contexts and from exposed clay deposits across the catchments associated with each site studied. If we sample the full range of geochemical variability in the geology of the region, the local ceramic compositional range should be encompassed, allowing us to differentiate non-local from local ceramics. Previous work has demonstrated the general effectiveness of this strategy (Grave et al. 2008; 2009; Kealhofer et al. 2009). The three sites' proximity in this study provides an unusual opportunity to extend this strategy to a more fully integrated regional approach.

NAA results of both ceramics and sediments were interpreted based on a variety of statistical techniques, including Principle Components Analysis (PCA) and Canonical Variates Analysis (CVA), to establish discrete groups. These most commonly represent geological provenance, but can also reflect clay processing techniques (removal and/or addition of minerals; see Grave et al. 2008). Statistical results were graphed and manipulated in three-dimensional space to evaluate group distribution (shape and density) in relation to local sediment samples (see Grave et al. 2008; 2009; Kealhofer et al. 2009 for a more detailed discussion of methods).

Decorative identifications are generally based on the Gordion corpus, the best described central Anatolian Iron Age ceramic assemblage (for example, Schaus 1992; Henrickson 1994; 2005; Sams 1994; DeVries 1997). Genz's work at Iron Age Boğazköy provides the other main corpus of well-described Iron Age ceramics (Genz 2004; 2006).

The sample

Ceramics from Çadır (n=243) were sampled with a primary focus on Iron Age contexts but included a smaller sample (n=43) from the Chalcolithic. Of these, 210 are included in this discussion; 33 samples were not included, mainly due to size (sherds too small for standard analysis). Of the samples from Kerkenes (n=69) 57 samples are discussed here. The remainder were excluded as compositional singletons. Their significance may be better ascertained later with the progressively wider perspective of the Anatolian Iron Age Project. The Tilkigediği survey collection of diagnostic sherds provided another 30 samples, all of which are included here. Of a total ceramic assemblage of 342 samples from the three sites, the results for 297 are discussed here. Twenty eight soil samples were collected from around Kerkenes and Çadır (fig. 1b).

Results

Sediments

Descriptions of the 28 regional sediment samples are provided in table 1 (see fig. 1b for sample locations). A total of 15 sediment samples matched four ceramic groups, the remaining 13 sediment samples did not match ceramic groups and are not included here. Group 5 does not have any sediment matches for the ceramic samples, and is therefore considered as a likely non-local profile (fig. 2). Groups 1 (and sub-groups), 2 and 3 included ceramic samples and local sediments (fig. 3). Group 4,

Group	AIA no.	UTM E	UTM N	Description
1.1	3977	677188	4402494	Kerkenes site, minor drainage, southeast sector
1.1	4047	685310	4406692	Mixed shale, coal dump at Sorgun, granite, quartz bedrock adjacent
1.1	4046	685919	4406091	Quartzite hillside above Sorgun coal mine area
1.2	3979	676519	4402235	West Kerkenes site, south minor drainage; shallow section
1.2	3978	676737	4402280	West Kerkenes site, minor middle drainage
1.3	3987	683665	4394108	Çadır area, clayey lens overbank, west of mound
2.2	3986	683557	4394133	Çadır area, minor west drainage; silt/clay from field ponding
2.3	4055	678197	4409605	Çadır area, floodplain of lateral stream in shale area
2.3	4053	678992	4412248	Yozgat Road, soil on shaley bedrock used for brickworks
2.3	4054	679521	4409872	Yozgat Road, medium-sized drainage from Eocene uplands
2.3	4044	683300	4393321	Lake bed below Çadır, draining large Sorgun area
3.2	3983	679773	4399942	Kerkenes area, weathered ophiolites; much weathered clay on rock
3.3	3982	678563	4395612	Çadır area, soil/transported sediment from ophiolite caliché-rich soil
3.3	3988	683873	4394070	Çadır mound, bricky wash, east face
4.6	4050	679210	4413492	High in Eocene section, deep iron-rich material with ash layer
Ungrouped	3980	676455	4402882	Kerkenes site, silt bank of stream at Water Gate
Ungrouped	3984	678156	4410050	Raw clay material from Yozgat Road tileworks
Ungrouped	3985	678156	4410050	Modern waste tile from Yozgat Road tileworks
Ungrouped	3981	678833	4401936	Kerkenes site, unoccupied east slope; current mud-brick source
Ungrouped	3989	684004	4393596	Çadır site, major stream overbank sediment at lake
Ungrouped	4051	676466	4417283	Çadır area drainage, conglomerate rich in green schist
Ungrouped	4052	676632	4416925	Çadır area, clayey road fill from unknown ophiolite source
Ungrouped	4056	681869	4400017	Çadır area, clayey portion of ophiolite bank
Ungrouped	4057	681948	4400041	Çadır area, tan section of ophiolite bank
Ungrouped	4045	682901	4394810	Heavily weathered granite above Çadır road
Ungrouped	4049	683096	4409318	Yozgat Road, probable lowland brick clay source
Ungrouped	4048	686126	4407586	Sorgun, acidic clayey pale layer above coal beds
Ungrouped	4065	691825	4405787	Samsun Road tileworks, wasters

Table 1. Sediment samples used in this study giving compositional group, project number (AIA = Anatolian Iron Age Project), UTM coordinates and description

an extensive and diverse group containing non-local ceramics, also included one sediment sample, however the ultimate provenance of this ophiolitic sediment sample is unclear as it derived from road fill. It is likely the material comes from somewhere in the larger region.

Group 1 ceramics, and adjacent sub-groups 1.1–1.6, are linked to sediment samples with high granitic content and contain the most elemental diversity (figs 2 and 3). Group 1.1 is a sandier fraction and 1.3 has more clay, representing natural sorting by stream and slope processes over increasing distance from the outcrops. In general, this group derives from sediments in the area of Kerkenes and Tilkigediği. The two samples in 'group' 1.25, with a distinctive uranium and thorium signature, however, are comparable to the non-local group 5 profile.

Group 2 is also high in iron, but it is relatively impoverished in other elements, and may represent a mixed lithology (table 1; fig. 1b). Group 2.3 comes from drainages that connect to the Eocene section to the north. This sediment is most closely related to recent tile

production, coming from the area of abandoned tile clay quarries (although the modern tiles and tile clay did not fall into a group). Group 2.2 is intermediate in origin between 1.3 and 2.3.

The sediment samples from group 3, and adjacent groups 3.2–3.6, are high in calcium. Groups 3.2 and 3.3 are weathered and transported soil from ophiolite rocks, with 3.2 having a higher clay fraction. These soils are abundant near Çadır. Mud-brick from Çadır falls into this group.

Group 4, mostly associated with samples from Kerkenes and elsewhere, has a high iron content. Given the lack of a matching local geology, group 4 is treated as non-local here. Because of the internal diversity of group 4 it is broken down into sub-groups and outliers. Group 4.6 includes an anomalous sample of Eocene sediments (otherwise like 2.3) with a strong component of volcanic ash.

Group 5, as noted, has no matches to local chemistry or sediments and therefore is presumed to be exotic to the region sampled here. In terms of its elemental signature, group 5 is unusually high in uranium and thorium suggesting a granitic source. This group of ceramics unambiguously matches a compositional group we have identified from Alişar with classic Alişar IV decorative treatment. While the decorative elements of the group 5 sample are not distinctively Alişar IV in style, the compositional match suggests they are diagnostically equivalent (they belong to the same production locale and period).

Çadır (n=210)

Table 2 presents the samples and the summary NAA data (the raw data are available from the senior authors). The distribution of ceramics by period and form, period and NAA group, and form and NAA group are listed in tables 3–5. The period distribution is not representative of the site *per se*, but the extant Iron Age excavated material available for sampling. By sampling across assemblages recovered over several excavation seasons we have attempted to take as representative a sample as possible. This has allowed us to include a larger and wider range of contexts and time. It should be noted that the chronological attribution of the ceramics is based on the stratigraphic associations determined by the site excavators. The stylistic and formal data discussed below indicate a slightly different phasing for the Middle Iron Age and Late Iron Age ceramics; this is treated more fully in the Discussion section.

Forms

Given the fragmentary nature of the samples, most body forms were either designated bowl (open form) or jar/jug (closed form), unless specific rim or handle attributes provided additional information (table 3). The chronological distribution of the samples is variable across periods, with the Middle Iron Age best represented (table 4). The Chalcolithic sample contains a relatively equal number of bowls and jars, and one period-specific vessel, the 'fruitstand' (pedestal bowl). The Iron Age sample varies over time, with a shift from a nearly equal number of bowls and jars to a progressively larger proportion of jars (up to ca. 3:1 in the Late Iron Age). Jugs are common throughout the Iron Age, and cooking pots are present in all Iron Age periods as well. All identified bases are flat for jars and bowls. In general, more forms are present in the Iron Age than in the Chalcolithic, including both tablewares and other forms (jugs and juglets, cooking pots, basin, cups, etc.).

Both bowls and jars are distributed across a large number of NAA groups, with more groups found for jars (14) than for bowls (11; table 5). This may represent a sample size effect, with jars being approximately twice as common as bowls in the two most common local groups (2 and 3). All of the Chalcolithic fruitstands are group 1.1, suggesting some degree of specialisation or localisation in their production. However, group 1.1 also includes a range of bowls and jars. The cooking pots (n=6) are all Iron Age in date, but are distributed across four different NAA groups, suggesting a range of local production sites. The jugs date to all phases represented here, and cover a range of NAA groups, including one non-local sample, 'group' 1.25, linked to Alişar sediments (the only 1.25 sample).

The greater diversity of NAA groups for jars and jugs suggests that these moved around the region more often than bowls. This might indicate not just the movement of ceramics, but also of the goods that they contained. While the cooking pot sample is small (n=6), it is distributed across four groups. This relatively high diversity might relate to family/gendered links between sites in the region.

Decoration/surface treatment

Decoration provides additional information: including possible chronological placement as well as evidence of interaction (emulation or exchange). Given the limited chronological data available for the assemblage discussed here, we turn to stylistic treatments that have been identified with particular periods or locations. The range of decorative types is detailed in table 6, which includes only non-Chalcolithic samples (see also fig. 4 for examples).

Decoration during the Chalcolithic primarily involved surface burnishing and the creation of red, black or brown surfaces – variably on the inside or outside of the vessel – and in two cases streaky red and black. Different interior and exterior colours are common on bowls (red/black or black/red). Incising or impressing (cord) is also present (for example, fig. 4.3h).

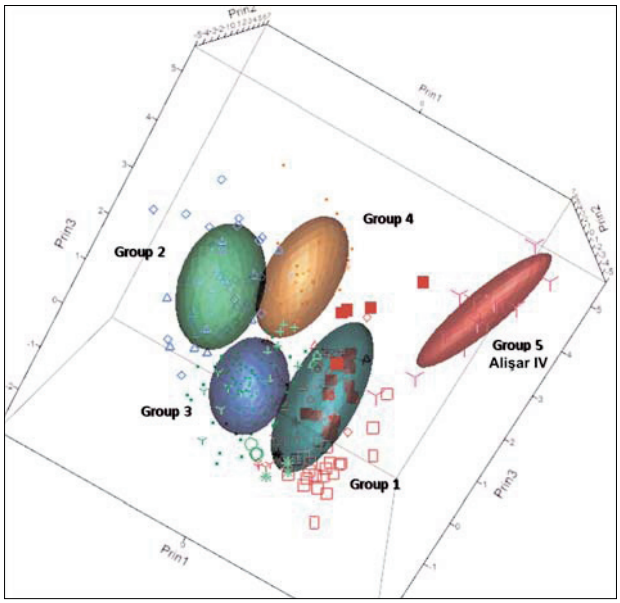

Fig. 2. Principal Components Analysis (PCA) of combined NAA compositional data for the Çadır, Kerkenes and Tilkigediği samples: three component projection with distribution of major groups marked by confidence ellipses

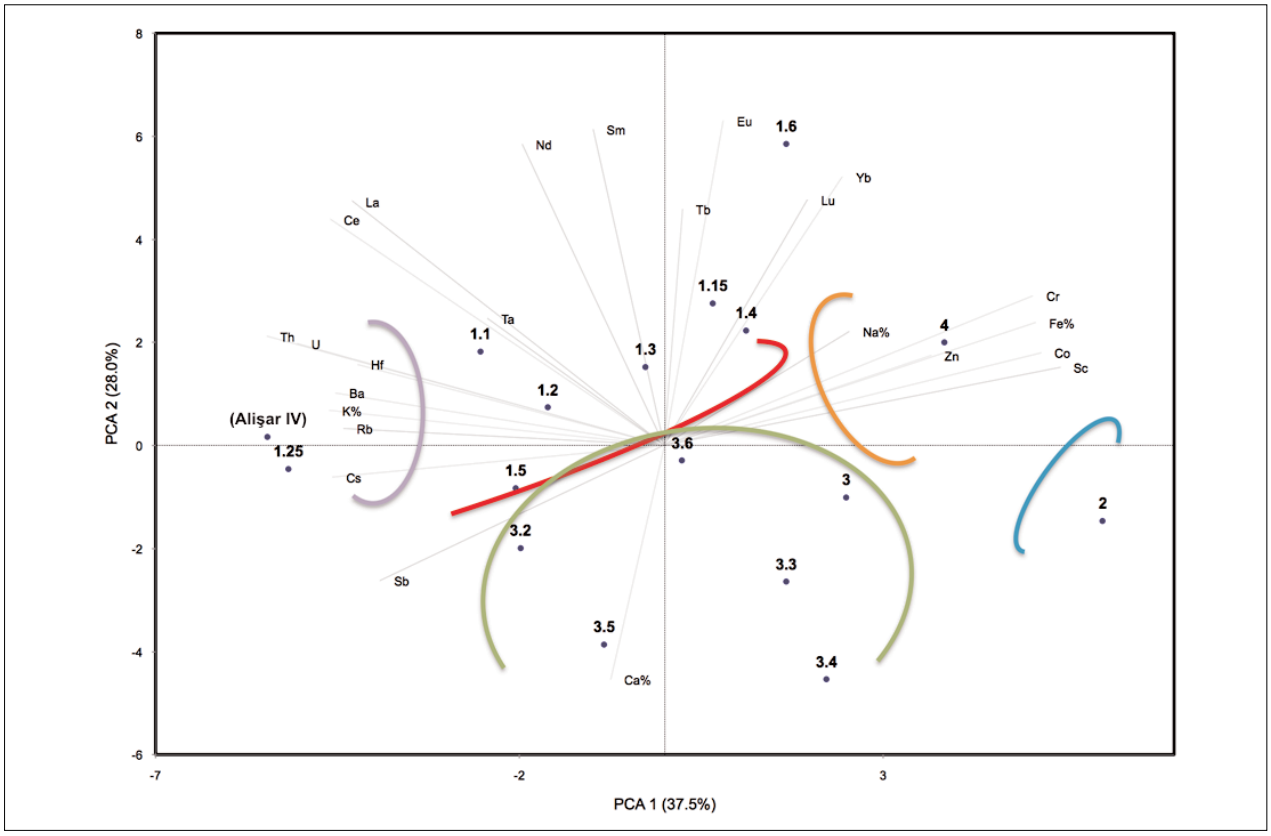

Fig. 3. PCA of ceramic group means for the combined Çadır, Kerkenes and Tilkigediği samples: two dimensional projection of group means and elemental correlations. Graph showing elements in relation to groups. Group 1: greatest elemental diversity (associated sediment samples: 4046 quartzite hillside above Sorgun coal mine area, 10 YR 4/1; 4047 mixed shale, coal dump at Sorgun, granite, quartz bedrock adjacent). Group 2: distinguished by high iron but also by relative elemental impoverishment (marl/basalt mix?) (associated sediment samples: 4044 lake bed below Çadır draining large Sorgun area; 4053 Yozgat Road, soil on shaley bedrock used for brickworks; 4054 Yozgat Road, medium-sized drainage from Eocene uplands; 4055 Çadır area, floodplain of lateral stream in shale area). Group 3: distinguished by high calcium (marls?). Group 4 (predominantly Kerkenes) high Fe, Cr and Zn (volcanic derived?) (associated sediment sample: 4050 high in Eocene section, deep iron-rich material with ash layer). Group 5 (entirely composed of Alişar IV type wares) and related groups (1.25 and 1.2) high K, Th and U (granitic origin?)

	1.1	n=21	1.15	n=2	1.2	n=1	1.25	n=1	1.3	n=14	1.4	n=13
	Avg.	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*
Ba	949.52	11.07	855.00	10.75	570.00	--	1100.00	--	840.71	27.75	671.54	10.37
Ca%	3.91	42.18	4.95	44.28	8.40	--	6.10	--	3.29	59.65	3.98	24.56
Ce	117.71	7.67	112.50	1.89	107.00	--	122.00	--	95.86	8.21	105.00	9.25
Co	10.62	26.71	18.00	7.86	17.00	--	8.00	--	12.93	16.19	22.54	23.66
Cr	89.24	45.08	276.50	3.32	105.00	--	37.00	--	204.07	56.17	205.31	52.24
Cs	10.10	45.21	5.10	5.55	15.00	--	29.00	--	5.77	25.50	12.76	45.04
Eu	1.57	11.05	1.85	11.47	1.30	--	1.40	--	1.40	14.82	1.55	15.68
Fe%	3.12	12.76	3.76	0.19	4.66	--	3.40	--	3.38	12.23	4.66	5.85
Hf	9.38	17.12	5.95	3.57	4.40	--	8.10	--	7.86	18.06	6.33	10.74
K%	3.77	13.60	3.60	19.64	2.30	--	3.10	--	3.91	17.55	2.99	23.25
La	65.22	7.46	61.50	2.30	65.30	--	74.40	--	53.97	8.06	58.40	9.54
Lu	0.32	9.59	0.34	4.16	0.30	--	0.27	--	0.37	29.78	0.38	9.31
Na%	0.89	27.82	1.25	16.97	0.35	--	0.18	--	1.16	17.23	1.07	20.03
Nd	41.62	8.34	42.50	1.66	26.00	--	44.00	--	38.00	7.15	38.77	13.41
Rb	147.62	12.84	110.00	12.86	130.00	--	160.00	--	124.43	12.55	145.38	14.21
Sb	2.20	89.67	0.85	8.32	2.00	--	2.60	--	1.49	34.40	1.62	48.98
Sc	8.20	19.72	10.35	0.68	15.80	--	8.20	--	11.06	25.89	15.68	6.68
Sm	7.93	7.91	8.61	0.90	6.22	--	7.42	--	7.13	5.68	7.32	6.14
Ta	1.66	13.52	1.55	31.93	1.20	--	1.70	--	1.76	33.17	1.38	29.07
Tb	0.94	20.56	0.85	8.32	0.60	--	0.80	--	0.90	16.88	0.94	21.55
Th	29.41	15.61	20.60	3.43	47.10	--	39.50	--	21.89	19.40	26.14	17.18
U	4.91	20.87	2.95	7.19	9.10	--	9.30	--	4.36	26.81	4.88	21.84
Yb	2.38	10.04	2.65	2.67	2.20	--	2.10	--	2.59	24.41	2.62	8.55
Zn	89.00	18.06	100.00	42.43	120.00	--	78.00	--	87.86	18.35	119.77	15.49

	1.5	n=4	1.6	n=4	2	n=22	3	n=88	3.2	n=3	3.3	n=8
	Avg.	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*
Ba	880.00	29.21	557.50	6.93	353.64	25.63	613.41	18.65	890.00	17.52	590.00	14.50
Ca%	5.22	60.47	4.25	9.89	4.87	18.52	4.34	25.32	4.37	56.48	8.08	22.09
Ce	100.25	2.06	113.25	3.56	51.14	12.76	72.47	9.61	89.00	3.89	66.75	7.37
Co	9.50	26.49	28.25	9.31	36.82	15.42	25.24	16.66	9.33	16.37	17.13	16.64
Cr	55.25	44.15	332.00	6.96	346.45	30.94	308.03	24.10	89.00	63.27	123.00	15.23
Cs	30.50	13.52	5.25	26.42	4.96	29.14	8.91	68.06	12.67	50.14	10.35	52.18
Eu	1.28	7.51	2.13	5.92	1.28	11.45	1.34	8.43	1.17	9.90	1.10	8.42
Fe%	3.51	5.10	5.06	6.51	6.14	8.04	4.40	13.25	2.63	10.31	3.97	12.67
Hf	5.63	30.22	5.73	6.75	3.70	10.25	5.71	14.90	7.10	16.24	4.65	17.99
K%	3.85	1.50	2.80	12.02	2.49	39.78	2.83	18.47	3.70	10.81	3.03	16.74
La	56.73	2.85	74.52	5.09	27.26	11.96	40.36	9.71	53.07	4.44	36.52	5.28
Lu	0.27	8.00	0.45	10.22	0.30	8.47	0.30	8.13	0.25	10.58	0.35	11.44
Na%	0.46	50.04	0.74	6.72	0.96	20.14	0.91	15.22	0.79	29.47	0.73	28.33
Nd	36.00	9.62	49.75	11.76	24.18	13.36	29.23	10.35	31.00	5.59	27.63	8.85
Rb	185.00	9.36	110.00	12.86	78.55	26.92	106.52	17.62	143.33	14.52	122.50	8.45
Sb	2.30	17.75	0.75	13.33	0.70	32.75	1.07	42.12	1.77	16.34	3.90	69.10
Sc	10.15	9.80	16.35	4.19	21.72	8.68	14.85	15.10	7.03	14.03	14.51	13.12
Sm	6.23	5.10	9.10	7.66	4.96	9.50	5.67	6.18	5.91	3.08	5.43	3.70
Ta	1.10	34.02	1.70	29.22	1.40	30.16	1.36	26.52	1.47	28.39	1.05	57.06
Tb	0.80	17.68	1.22	7.82	0.66	53.56	0.78	23.86	0.67	31.22	0.85	16.64
Th	28.22	6.67	28.47	7.15	8.24	18.83	15.97	16.63	24.57	1.84	14.00	15.27
U	5.75	21.84	5.45	6.27	1.64	29.01	3.03	21.24	5.00	31.24	3.26	27.99
Yb	1.90	4.30	3.20	6.75	2.16	8.29	2.18	6.57	1.83	6.30	2.47	8.57
Zn	97.00	28.69	102.50	8.78	127.27	19.27	96.68	13.41	78.00	5.13	117.25	10.31

Table 2. Çadır Höyük: geochemical results for compositional groups, giving group number, number of members, average (Avg.) and coefficient of variation (C.V.); elements reported in ppm unless otherwise indicated

	3.4	n=6	3.5	n=2	3.6	n=2	4	n=2	5	n=17
	Avg.	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*	*Avg.*	*C.V.*
Ba	476.67	23.12	815.00	0.87	705.00	9.03	575.00	18.45	700.59	16.15
Ca%	8.70	36.60	6.40	6.63	5.10	16.64	4.00	7.07	4.96	44.64
Ce	56.67	9.32	75.00	3.77	87.00	4.88	82.00	13.80	117.18	10.31
Co	14.83	18.30	10.00	0.00	13.00	21.76	40.00	3.54	7.94	16.94
Cr	140.33	27.92	58.00	2.44	76.00	3.72	389.00	40.35	31.24	55.69
Cs	6.37	36.06	9.10	3.11	16.50	4.29	8.30	80.08	51.79	19.00
Eu	0.95	18.65	1.10	0.00	1.30	10.88	1.70	8.32	1.30	14.65
Fe%	3.36	7.87	2.69	2.63	4.29	11.39	6.72	13.68	2.73	7.66
Hf	4.28	7.15	6.40	2.21	6.15	24.15	4.80	32.41	6.40	7.03
K%	2.35	6.45	3.60	3.93	3.00	4.71	3.10	13.69	6.39	20.37
La	30.83	10.27	41.85	0.84	49.05	1.59	39.90	4.61	68.41	9.60
Lu	0.28	5.98	0.26	0.00	0.34	6.33	0.40	5.37	0.39	5.67
Na%	0.70	16.33	0.78	1.81	0.57	19.85	0.74	51.60	0.69	13.31
Nd	23.67	11.55	25.50	2.77	32.00	4.42	38.50	1.84	34.82	12.53
Rb	83.33	19.40	150.00	0.00	140.00	10.10	130.00	21.76	437.65	22.51
Sb	2.40	104.32	1.55	4.56	2.05	3.45	1.30	76.15	3.54	58.60
Sc	11.88	10.28	7.30	1.94	15.10	8.43	21.25	13.64	5.48	21.82
Sm	4.54	12.57	4.89	1.16	6.37	2.11	7.52	5.18	5.88	9.64
Ta	1.08	17.91	1.30	0.00	1.35	15.71	1.90	37.22	2.50	19.49
Tb	0.77	15.80	0.60	0.00	0.85	8.32	1.00	14.14	0.57	51.12
Th	11.10	30.61	20.00	0.00	25.15	8.72	10.50	20.20	45.17	11.11
U	2.40	20.58	3.35	14.78	4.80	5.89	2.10	40.41	5.51	40.51
Yb	2.07	3.95	1.90	0.00	2.45	2.89	2.90	4.88	2.51	11.93
Zn	97.50	24.02	75.50	2.81	114.00	19.85	150.00	28.28	104.65	17.45

Table 2 (continued). Çadır Höyük: geochemical results for compositional groups, giving group number, number of members, average (Avg.) and coefficient of variation (C.V.) (group 5 refers to Alişar IV style ceramics); elements reported in ppm unless otherwise indicated

Form x Period	**Chalco.**	**EIA**	**MIA**	**MIA/ LIA**	**LIA**	**Iron Age**	**Later**	**Total**
Body	1	1	1		1			**4**
Bowl	16	4	17	4	10	1	4	**56**
Jar	14	1	35	5	28	7	7	**97**
Jar/jug		4	1	2	2		1	**10**
Fruitstand	4							**4**
Jug	1	5	4	1	5		2	**18**
Cooking pot		2	1	1	1		1	**6**
Cup				2				**2**
Basin		1						**1**
Handle		1		1				**2**
Unidentified (rim+pot)	5	1	1	2			1	**10**
Total	**41**	**20**	**60**	**18**	**47**	**8**	**16**	**210**

Table 3. Çadır Höyük: breakdown of ceramic forms by periods, showing the preponderance of bowls and jars in the sample

NAA x Period	Chalco.	EIA	MIA	MIA/LIA	LIA	Iron Age	Later	Total
1.1	16		1		1	2	1	**21**
1.15	2							**2**
1.2							1	**1**
1.25							1	**1**
1.3	10		1		3			**14**
1.4			2	3	7		1	**13**
1.5	1		1		1		1	**4**
1.6			2	1		1		**4**
2		4	6	3	7	1	1	**22**
3	10	13	32	10	13	1	9	**88**
3.2	1	1	1					**3**
3.3		1	3		3	1		**8**
3.4	1		1		3		1	**6**
3.5			2					**2**
3.6			1		1			**2**
4					1	1		**2**
5		1	7	1	7	1		**17**
Total	**41**	**20**	**60**	**18**	**47**	**8**	**16**	**210**

Table 4. Çadır Höyük: breakdown of compositional groups and sub-groups by periods, showing most likely local and non-local groups based on abundance in sample

Form x NAA	1.1	1.15	1.2	1.25	1.3	1.4	1.5	1.6	2	3	3.2	3.3	3.4	3.5	3.6	4	5	Total
Body					1				1		1						1	**4**
Bowl	7		1		7	3	1		5	22		1	2			1	6	**56**
Jar	7	1			6	7	1	3	9	41		6	3	2	2	1	8	**97**
Jar/jug								1	1	6		1					1	**10**
Fruitstand	4																	**4**
Jug	1			1		2	1		3	8			1				1	**18**
Cooking pot	1						1			3	1							**6**
Cup									2									**2**
Basin										1								**1**
Handle						1				1								**2**
Unidentified (rim+pot)	1	1							1	6	1							**10**
Total	**21**	**2**	**1**	**1**	**14**	**13**	**4**	**4**	**22**	**88**	**3**	**8**	**6**	**2**	**2**	**2**	**17**	**210**

Table 5. Çadır Höyük: breakdown of ceramic forms by compositional groups and sub-groups, showing the larger number of NAA groups related to jar samples

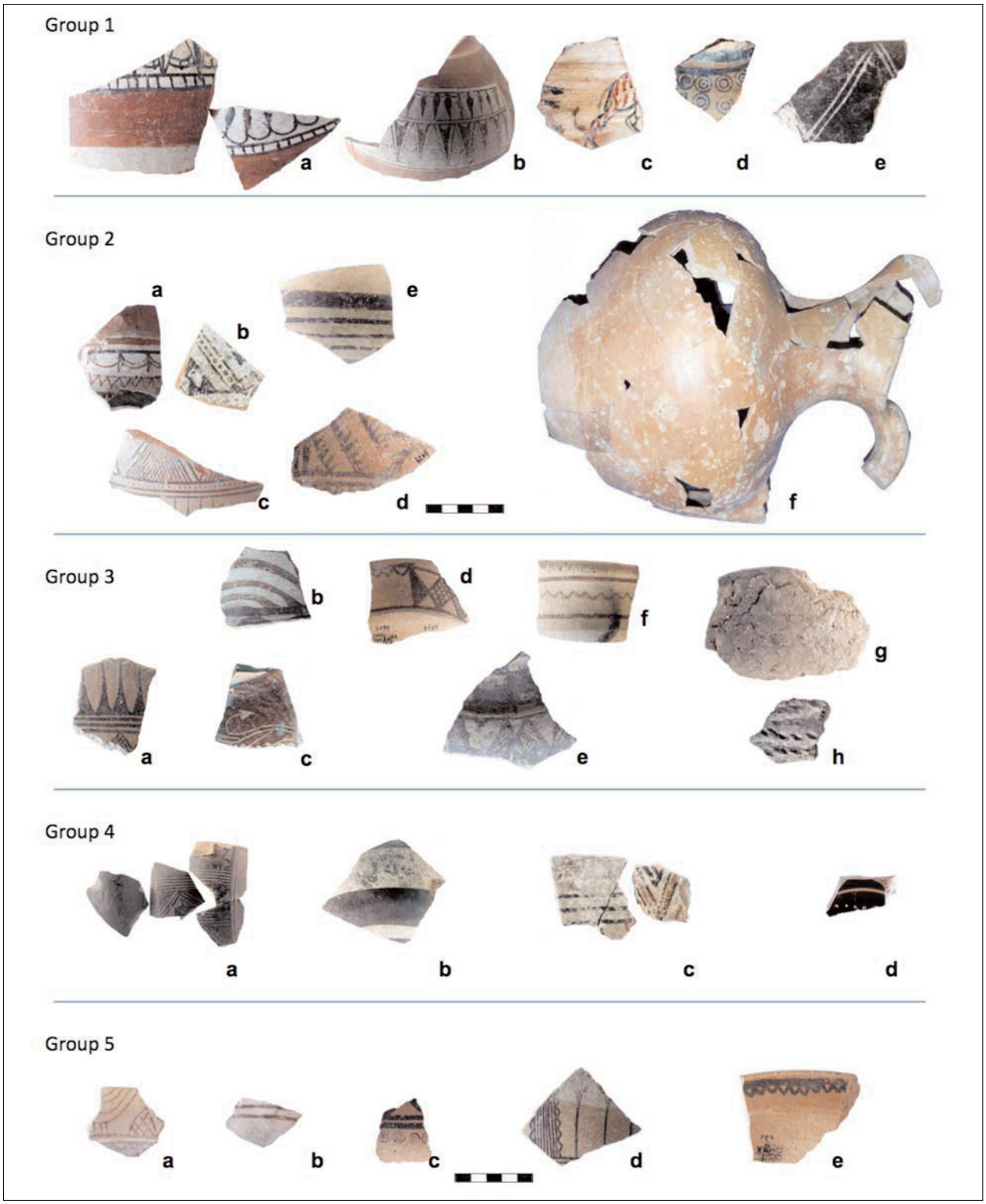

Fig. 4. Examples of typical decorated wares from Çadır and Kerkenes organised by the five major compositional groups identified in the study. In the following concordance for this figure, group number and alpha identification is followed in parenthesis by sub-group number where applicable (for example, G1.3), site designation (Ç for Çadır, K for Kerkenes, T for Tilkigediği) and Anatolian Iron Age Project database number. Group 1: a (G1.4, Ç 720), b (G1.4 Ç 725), c (G1.2 T 1513), d (G1.6 Ç 3384), e (G1.3 Ç 3466); group 2: a (G2 Ç 3463), b (G2 K 1464), c (G2 Ç 719), d (G2 K 1456), e (G2 Ç 3429), f (G2 K 1539); group 3: a (G3 Ç 723), b (G3 Ç 3454), c (G3.3 Ç 3320), d (G3 Ç 3439), e (G3.5 Ç 3338), f (G3.3 Ç 3418), g (G3.2 Ç 3443), h (G3 Ç 3485); group 4: a (G4 K 1441), b (G4 K 1500), c (G4 K 1489), d (G4 outlier Ç 3322); group 5: a (G5 Ç 682), b (G5 Ç 710), c (G5 Ç 3336), d (G5 Ç 721), e (G5 Ç 3412)

Decoration x NAA	1.1	1.2	1.25	1.3	1.4	1.5	1.6	2	3	3.2	3.3	3.4	3.5	3.6	4.05	4.93	5	Total
Attic																1		**1**
Brown-on-buff	2		1		2		4	5	28		2		2				12	**58**
Brown-on-red					1	1		1	3	1		1			1		2	**11**
Brown-on-white/cream									11		4			1			2	**18**
Burnished		1		2	2			4	12									**21**
'Sheen' slip									1									**1**
Red slip								2	1									**3**
Red-on-buff									3									**3**
Black polished									1									**1**
Polychrome					2			3	1								1	**7**
Misc	1			2	1	1			4		1							**10**
Burned	1					1			5									**7**
Undecorated	1				5			7	8	1	1	4		1				**28**
Total	**5**	**1**	**1**	**4**	**13**	**3**	**4**	**22**	**78**	**2**	**8**	**5**	**2**	**2**	**1**	**1**	**17**	**169**

Table 6. Çadır Höyük: breakdown of decorative treatments by compositional groups and sub-groups for Iron Age and later ceramics, showing the preponderance of brown decorated and burnished wares in the sample

During the Iron Age brown-on-buff decoration is most common (n=58; examples are shown in all groups in fig. 4 except group 4; undecorated sherds (n=28) are next most common). Other decorative styles include burnished (n=21), brown-on-cream or brown-on-white (n=18; fig. 4.2b), brown-on-red (n=11) and polychrome (n=7) (table 6). Brown-on-buff styles include a range of decorative elements: hatched triangles, wavy lines, bands, concentric circles, geometric shapes, pendants and combinations of these. A few other unusual forms include a 'bird'. Only one grey ware sherd is included in the sample, and grey wares are rare in this assemblage (two other grey sherds had been burned).

Decorative styles for the Early Iron Age levels are dominated by brown-on-buff and undecorated sherds. A distinctive cream slip with a 'sheen' is similar to an Early Phrygian decorative style found at Gordion. Other Early Iron Age decoration includes brown-on-cream, bichrome (red-on-buff and brown-on-buff) and burnishing. Unlike the assemblage Genz (2001) analysed, none of the excavated Early Iron Age samples included red decorated sherds. In the Middle Iron Age levels, the diversity of decorative styles increases significantly, although the same three styles dominate the assemblage (brown-on-buff, brown-on-cream and burnishing). Brown-on-red, brown slip, polychrome, red slip and red-on-buff are added to the decorative repertoire. Elsewhere, several of these styles are more common in the Late Iron Age than the Middle Iron Age (for example, red decorated buff wares and polychromes at Gordion). The number of Late Iron Age decorative styles is comparable to that of the Middle Iron Age, however, the range is different (black polished, pattern burnished and more polychrome). At Gordion, the Late Iron Age assemblage includes a larger range of red decorated wares, particularly banded wares, which seem to be rare here (indicating either a different interaction sphere or a possibly abbreviated Late Iron Age).

NAA groups (n=17)

The Çadır assemblage is composed of 17 discrete compositional groups (table 4). Group 3 is the largest group at Çadır (42%). Groups 2, 1.1 and 5 are the next most common (10%, 10% and 8% respectively), with 1.3 and 1.4 relatively abundant as well (7% and 6% respectively). Given their abundance, group 3 wares are most likely to have been produced in close proximity to the site.

The Chalcolithic sample contains seven NAA groups, indicating the exploitation of different geological contexts. Group 1.1 is most abundant, with groups 1.3 and 3 very common as well. Four other groups occur in very low numbers. Based on matches with sediment samples, all of these fabrics appear to have been produced in the local region, if not at the site. The relative diversity of groups (compared with the Early Iron Age, for example) suggests a substantial amount of local exchange and interaction. Despite the location of the mound on a limestone ridge, the most common fabric

types derive from more volcanic/granitic sources (groups 1.1, 1.15, 1.3 and 1.5 accounting for ca. 75% of the Chalcolithic assemblage).

In the Iron Age 14 of the 17 NAA groups were in use, with group 3 dominant (only 1.15, 1.2 and 1.25 were not found, being either Chalcolithic or post Iron Age). Group 2 is next most common, followed distantly by 5 and group 1.4. While group 3 is common to both the Iron Age and the Chalcolithic, there is a significant shift toward Ca-rich and Na-rich clays during the Iron Age (all groups 3–3.6).

There are some trends through the Iron Age: the popularity of group 2 increases slightly through the Iron Age and group 3 is most common in the Middle Iron Age, declining substantially from the Middle Iron Age to the Late Iron Age. Other regional (granitic) sources become more popular in the Late Iron Age (1.4 and, to a lesser extent, 1.3 and 3.4). There is a slight increase in imports through the Iron Age as well (groups 4 and 5). The shift in source preference may reflect changes in source availability, either as cultural shifts in the landscape or changes in the accessibility of clay beds.

Only two group 4 samples were found at Çadır, and both are non-local. While group 4 is most common at Kerkenes, it does not appear to be local to Kerkenes. One of the Çadır group 4 samples (4.93) matches Attic black glaze (with 'KALO' inscription; fig. 4.4d) and the other (4.05) is a fine, brown line decoration on red slip (a common west Anatolian Iron Age style). While this sample is a singleton within group 4, its Attic origin is confirmed by comparison with an NAA dataset for Attic samples of known provenance (Harbottle et al. 2005).

Group 5 (n=17), the clearly non-local group, includes a relatively equal number of bowls and jars, all but three of which have either brown-on-buff or brown-on-cream decoration in a range of mainly Middle Iron Age and Late Iron Age styles. Despite the links to Alişar IV ceramics, group 5 does not seem to be from Alişar (based on sediment geochemical profiles from the Alişar catchment; Grave et al. in preparation).

Only one NAA group with more than one or two sherds has a single decorative style, suggesting some degree of specialisation (1.6 and brown-on-buff). Therefore there is little to suggest that NAA groups represent technological styles here rather than provenance. For every NAA group with more than one to two samples there are multiple forms being produced; for example, all but three NAA groups include jars and all but six include bowls. Even when one form, like fruit-stands, comes from a single NAA group (1.1), there is a range of bowl and jar forms with the same composition.

In sum, the large number of NAA groups in use during the Iron Age at Çadır does not support the idea of centralised production, but instead an expanding region of interaction and exchange (much wider than in the Chalcolithic). A clear shift in source use occurs not only from the Chalcolithic to the Iron Age, but also within the Iron Age, as intra-regional exchange increased. Non-local groups 4 and 5 only occur in the Iron Age. While there is some continuity in ceramic geochemistry from the Chalcolithic to the Iron Age, clay preference (as well as technologies) shifts from quartzite/granitic sources to clays with a stronger sodium/calcium signature (marls). While in general these patterns appear fairly robust, clearly, sampling issues may affect them.

Kerkenes (n=57)

Table 7 provides a summary of the NAA groups for Kerkenes. Given the relatively short duration of occupation, this assemblage, while too small to be considered representative, is assumed to be roughly contemporary. The ceramics generally come from burned debris in the Palace and the Cappadocia Gate.

Forms

As at Çadır, open forms (bowls and pots) (n=11) and closed forms (jars and jugs) (n=36) dominate (table 8). As in the Late Iron Age levels at Çadır, at Kerkenes there are many more jars than bowls. This may relate to the nature of the archaeological contexts sampled (public). Other identifiable forms include jugs, pots and one cooking pot.

Decoration/surface treatment

Just under half of the Kerkenes sample assemblage is undecorated (n=26; table 9; see also fig. 4.2d, 4a, 4b, 4c for examples). We note that this proportion may not be representative as the apparent lack of decoration may also be a function of the acidic nature of the granitic soils (excavated ceramics often have a 'cheese-like' texture and preserve only remnant slips and paints). Decorated wares appear to be late Middle Iron Age to early Late Iron Age in character. Many sherds are slipped and burnished. Painted decoration includes red, orange and polychromes; bands are common. More complex geometric combinations are usually on a white background (for example, polychromes) (table 9). There is only one brown-on-white sherd (brown and white bands) and none of the relatively ubiquitous brown-on-buff found at Çadır. Several black polished, faceted and incised sherds are present, consistent with a Gordion Middle and Late Iron Age date.

NAA Groups (n=4, or 10 with 4 outliers)

Only four NAA groups are present at Kerkenes, although group 4 can be broken down into multiple sub-groups and outliers (all likely imports). Group 1.2 includes only

	1.2	n=2		2	n=25		3	n=1		4	n=29
	Avg.	*C.V.*		*Avg.*	*C.V.*		*Avg.*	*C.V.*		*Avg.*	*C.V.*
Ba	1025.00	37.94		589.20	39.38		980.00	--		691.38	32.73
Ca%	5.45	37.63		3.18	44.24		1.20	--		1.86	80.63
Ce	108.50	12.38		52.60	16.83		98.00	--		76.76	22.75
Co	36.00	7.86		50.08	35.38		14.00	--		33.34	50.40
Cr	120.00	4.71		395.12	53.31		106.00	--		241.66	80.95
Cs	23.00	24.60		5.12	48.04		23.00	--		7.96	50.69
Eu	1.55	4.56		1.27	17.95		1.20	--		1.47	16.28
Fe%	4.43	11.49		6.33	10.26		3.50	--		5.68	16.69
Hf	8.40	26.94		5.60	35.41		6.30	--		6.62	29.58
K%	3.55	5.98		1.82	36.45		2.30	--		2.51	23.93
La	56.00	1.77		28.86	17.07		50.10	--		44.86	20.10
Lu	0.28	7.71		0.32	12.30		0.24	--		0.40	12.92
Na%	0.64	1.10		0.89	23.12		0.65	--		0.70	28.81
Nd	32.00	8.84		25.08	14.87		24.00	--		31.76	14.15
Rb	215.00	3.29		78.16	33.91		130.00	--		109.52	24.19
Sb	8.35	119.40		0.82	59.54		2.60	--		1.07	186.47
Sc	14.80	0.96		22.10	11.73		11.70	--		20.81	16.75
Sm	6.67	19.63		4.97	12.91		5.52	--		6.52	14.59
Ta	2.45	2.89		2.08	54.45		0.00	--		2.20	53.44
Tb	0.50	141.42		0.46	110.05		1.00	--		0.86	63.50
Th	27.50	9.26		8.67	24.21		24.00	--		13.06	31.58
U	7.25	12.68		1.28	70.73		3.30	--		2.47	39.18
Yb	2.40	5.89		2.39	11.12		2.10	--		3.01	12.82
Zn	175.00	12.12		120.76	18.39		130.00	--		135.28	17.43

Table 7. Kerkenes Dağ: geochemical results for compositional groups, giving group number, number of members, average (Avg.) and coefficient of variation (C.V.)

Form x NAA	1.2	2	3	4	4.05	4.1	4.15	4.2	4.3	4.4	4.91	4.92	4.94	4.95	Total
Body		3		1				1	1					1	**7**
Bowl		3		1		1				1	1	1			**8**
Jar	2	11		5	1	5	1	3	2				1		**31**
Jug		3					1			1					**5**
Pot		2													**2**
Cooking pot			1												**1**
Handle		1													**1**
Base		2													**2**
Total	**2**	**25**	**1**	**7**	**1**	**6**	**2**	**4**	**3**	**2**	**1**	**1**	**1**	**1**	**57**

Table 8. Kerkenes Dağ: breakdown of ceramic forms by compositional groups and sub-groups, showing the preponderance of jars in the sample

Decoration x NAA	1.2	2	3	4	Total
Undecorated		10	1	15	**26**
Other	2	4		3	**9**
Polychrome		2		3	**5**
Burnished*		3		1	**4**
Incised (black)		1		2	**3**
Orange-on-buff		1		1	**2**
Plum-red slip		1		1	**2**
Red and white/cream bands		1		1	**2**
Red slip				2	**2**
Brown and white bands		1			**1**
Red-on-buff		1			**1**
Total	**2**	**25**	**1**	**29**	**57**

Table 9. Kerkenes Dağ: breakdown of decorative treatments by compositional groups and sub-groups, showing the preponderance of undecorated wares in the sample (1 grey, 1 black, 2 buff)*

two members, a buff jar rim sherd and a buff jar handle; this group is most abundant locally at Tilkigediği. Groups 2 (n=25) and 4 (n=29) define more than 90% of the assemblage. Group 2 is also represented at Çadır in small but appreciable numbers, suggesting a local source for both sites. The only group 3 sherd (the most common group at Çadır) is from a cooking pot.

The small number of local groups and the relatively low number of local ceramics suggest that the assemblage sampled was both of relatively short duration and likely included a substantial number of 'exotic' or non-local forms (half of the sampled assemblage). While the majority of these 'exotic' wares are undecorated sherds, this at least partly reflects the poor preservation of decoration at this site. Alternatively, the contents of some vessels may have been more significant than the vessels themselves. Beyond the non-local groups, the four outliers (4.91, 4.92, 4.94 and 4.95) include three black wares, and are either bowls or jugs (one is possibly a jar); these outlier examples may have been valued for their social display (during food consumption) value. In some cases, they may have contained valued goods as well.

There is no strong patterning in decorative styles between the two main NAA groups. Both group 2 and group 4 sub-groups include a range of finishing techniques or decoration (incising, burnishing, orange to red slips and bands). As noted above, the specific NAA groups do not relate to specific forms either, and in almost all groups jars are much more abundant than bowls (ca. 3:1).

Tilkigediği (n=30)

This group of sherds was collected as part of a regional survey around Kerkenes, and was sampled because it is primarily Iron Age in date, based on the ceramic styles and forms (tables 10 and 11).

Forms

This small assemblage of diagnostics is comprised of jars/jugs (n=16), bowls (n=10) and basins (n=4) (table 11). The bowls range from medium to large and include a variety of different rim shapes (incurved to everted rims). The jars are mostly narrow-necked forms (see forms drawn in Summers et al. 1995). While bowl and jar distributions are very similar for groups 1.2, 1.5 and 2, group 3 is disproportionately composed of jars. While this is a very small sample, the large number of non-local (group 3) jars may indicate that goods were moved here from Çadır.

Decoration/surface treatment

More than half of the assemblage is undecorated (table 11; n=18). Three sherds have brown-on-buff decoration (hatched triangles, lines on rim, etc.), two are orange slipped, two are polychromes, one is burnished and several have traces of a fugitive white or cream slip. This range of decoration is consistent with a Middle to Late Iron Age occupation and overlaps with both Kerkenes and Çadır ceramic styles.

NAA groups (n=8)

Group 1.2 comprises nearly half of the assemblage from this site (n=14), suggesting it is the most probable local ware. The elemental composition of this group maps well onto the granitic substrate of the site. Groups 2 and 3 are next most common (n=4 and n=5 respectively), both of which seem to be regionally local (group 3 being most common at Çadır). The remaining 'groups' include only one to two sherds, but suggest that a range of local producers contributed to the ceramics in use at this fortified hilltop site, with the group 4 samples most likely to be exotic.

Group 1.2 includes a range of decorative types. While most of the sherds are undecorated (n=9), the orange slipped and polychrome decorated samples are included in this group. There is one undecorated basin rim from group 1.25 (Alişar?). Group 3 has a couple of undecorated sherds, one burnished and the remaining two with a fugitive white surface. This limited range of decoration makes sense if these were mainly functional containers rather than display wares. The brown-on-buff examples are found in group 2 (n=2) and group 4 (n=1), suggesting this style was both locally and non-locally produced. The sherds from the other groups represented are undecorated, as is the second sample in group 4.

	1.2	n=14		1.25	n=1		1.5	n=2		2	n=4
	Avg.	*C.V.*		*Avg.*	*C.V.*		*Avg.*	*C.V.*		*Avg.*	*C.V.*
Ba	834.29	19.49		710.00	--		840.00	13.47		605.00	24.90
Ca%	4.80	23.10		5.80	--		4.50	12.57		5.52	16.74
Ce	114.07	7.36		121.00	--		102.00	8.32		53.25	18.61
Co	25.64	18.96		9.00	--		24.00	41.25		40.75	25.45
Cr	153.86	68.20		56.00	--		74.50	16.14		321.00	25.39
Cs	13.81	18.03		19.00	--		23.00	73.79		4.90	37.26
Eu	1.36	10.31		1.00	--		1.35	5.24		1.35	15.42
Fe%	4.27	10.99		2.54	--		3.79	5.60		5.75	7.42
Hf	8.86	25.03		16.00	--		7.40	34.40		5.08	19.99
K%	2.82	16.87		3.20	--		3.20	13.26		2.03	15.81
La	65.59	6.71		60.80	--		55.65	5.72		27.40	23.13
Lu	0.29	8.38		0.17	--		0.31	6.73		0.32	11.32
Na%	0.78	23.14		0.50	--		0.58	27.80		1.03	42.97
Nd	30.29	8.44		35.00	--		28.00	20.20		24.75	16.62
Rb	164.29	13.01		170.00	--		155.00	13.69		70.75	12.07
Sb	1.87	22.90		3.90	--		2.15	29.60		0.55	23.47
Sc	13.45	14.37		8.40	--		12.70	6.68		20.13	10.19
Sm	6.29	6.02		6.42	--		6.14	0.81		4.96	13.03
Ta	2.57	38.96		2.20	--		2.95	16.78		2.20	36.74
Tb	0.74	57.29		1.00	--		0.85	8.32		0.20	200.00
Th	42.79	14.65		41.30	--		29.70	20.95		8.35	35.11
U	6.74	19.79		6.00	--		4.50	47.14		2.60	57.13
Yb	2.31	8.45		1.50	--		2.25	15.71		2.38	6.32
Zn	108.00	15.93		69.00	--		105.00	6.73		106.25	10.43

	3	n=5		3.5	n=1		3.6	n=1		4	n=2
	Avg.	*C.V.*		*Avg.*	*C.V.*		*Avg.*	*C.V.*		*Avg.*	*C.V.*
Ba	722.00	12.29		780.00	--		650.00	--		635.00	3.34
Ca%	5.26	26.12		8.10	--		6.00	--		3.05	44.05
Ce	83.40	13.50		71.00	--		93.00	--		91.50	5.41
Co	28.00	24.61		11.00	--		30.00	--		40.50	8.73
Cr	170.60	63.15		63.00	--		67.00	--		302.00	58.54
Cs	10.86	21.88		16.00	--		15.00	--		6.45	29.60
Eu	1.26	9.05		1.00	--		1.20	--		1.65	4.29
Fe%	4.71	11.64		2.86	--		4.33	--		6.58	9.13
Hf	7.80	20.93		5.30	--		10.00	--		6.85	9.29
K%	2.78	15.76		2.70	--		2.90	--		2.10	6.73
La	45.98	16.33		42.00	--		51.20	--		49.50	11.00
Lu	0.31	6.78		0.23	--		0.34	--		0.41	13.80
Na%	0.83	17.73		0.65	--		0.89	--		0.95	12.59
Nd	26.40	12.45		26.00	--		29.00	--		31.50	15.71
Rb	115.20	14.66		100.00	--		170.00	--		120.00	11.79
Sb	1.44	20.01		1.80	--		1.10	--		0.70	0.00
Sc	15.80	15.51		8.00	--		14.90	--		21.40	12.56
Sm	5.67	7.02		4.84	--		6.01	--		7.27	3.31
Ta	1.96	36.00		2.00	--		1.80	--		2.20	19.28
Tb	0.80	57.96		0.50	--		0.90	--		0.55	141.42
Th	22.30	25.95		20.60	--		25.90	--		16.50	21.43
U	4.00	27.50		3.30	--		5.60	--		2.35	45.13
Yb	2.20	4.55		1.90	--		2.40	--		2.95	16.78
Zn	96.80	9.19		68.00	--		120.00	--		105.00	6.73

Table 10. Tilkigediği: geochemical results for compositional groups, giving group number, number of members, average (Avg.) and coefficient of variation (C.V.)

Form x NAA	1.2	1.25	1.5	2	3	3.5	3.6	4	Total
Bowl	6		1	2				1	**10**
Jar	6		1	2	4	1	1	1	**16**
Basin	2	1			1				**4**
Total	**14**	**1**	**2**	**4**	**5**	**1**	**1**	**2**	**30**
Decoration x NAA	1.2	1.25	1.5	2	3	3.5	3.6	4	Total
Brown-on-buff				2				1	**3**
Burnished					1				**1**
Orange slip	2								**2**
Polychrome	2								**2**
Misc	1				2		1		**4**
Undecorated	9	1	2	2	2	1		1	**18**
Total	**14**	**1**	**2**	**4**	**5**	**1**	**1**	**2**	**30**

Table 11. Tilkigediği: combined table showing breakdown of ceramic forms (upper) and decorative treatments (lower) by compositional groups

Discussion

Establishing the significance of the compositional and typological diversity at these sites is closely tied to defining the duration of occupation represented. The three sites provide distinct windows on the Iron Age in this area of the Anatolian plateau. Unsurprisingly, at Çadır the greater diversity of forms and styles, as well as compositional groups, both reflects the longer term occupation of this site and also suggests a more regionally integrated economy than at the other two sites. While the stratigraphic contexts are identified as Middle Iron Age and Late Iron Age, the very small number of polychrome samples, or any other samples with distinctive Late Iron Age decoration, suggests a more limited Late Iron Age occupation (or sample). Kerkenes' ceramics look primarily late Middle Iron Age. The Tilkigediği assemblage is too small to be conclusive, but appears to include both Middle and Late Iron Age styles. The stratigraphic dating of Çadır ceramics to the Late Iron Age is somewhat problematic given the limited evidence of Late Iron Age ceramic styles (in this sample) and the lack of absolute dating evidence. This may simply be a sampling/excavation strategy issue or may reflect a response to Kerkenes' rise and demise.

At Çadır, there is a striking increase in non-local ceramics. Non-local group 5 (found only at Çadır) reveals an influx of brown-on-buff decorated jars/jugs and bowls, suggesting the importance of social display rather than the transport of goods in ceramic vessels. Two other non-local samples (group 4), the Attic black-glazed inscribed jar sherd and a brown-on-red jar sherd, provide some evidence that Çadır was at least minimally linked into larger interaction spheres to the west and south. While Çadır is well east of the Phrygian polity, which reached its apogee in the Middle Iron Age, the Middle Iron Age seems to have been an important period of expansion in this region as well. As a region of contention for the Neo-Hittites and Neo-Assyrians, this importance may not be too surprising (see Summers 2009 also).

Tilkigediği's distribution of open and closed forms is more comparable to that of Early Iron Age and Middle Iron Age Çadır, suggesting a similar range of domestic functions. The predominance of local ceramics (group 1.2 in addition to local Çadır groups 2 and 3), as well as the diversity of styles found in this small assemblage, suggests that the site was not just an outpost of Kerkenes, but may have had a slightly longer occupation and greater integration with local networks. Its fortified hilltop location, although much smaller than that of Kerkenes, also suggests that the late Middle Iron Age in this area is likely to have been a period of increased conflict, with the addition of defensive site locations further to the fortification walls common at many Iron Age sites.

Comparisons of the three NAA group distributions relative to local sediments indicate that both the Tilkigediği and Çadır assemblages are dominated by local production (group 1.2 for Tilkigediği, group 3 for Çadır). Kerkenes, on the other hand, shows a much wider non-local catchment for ceramics. The percentage

of imports is much greater and many more imported groups are present. The largest NAA group is group 4 (with its sub-groups and outliers); this does not appear to be a local group and is quite geochemically diverse. In the case of Kerkenes, however, many of the (closed) ceramic vessels may have been brought in for what they contained rather than their decorative or social value. This is supported in some measure by the comparatively greater frequency of jars/jugs than bowls in the Kerkenes assemblage, as well as the limited detectable vessel decoration (except the black polished wares). This high jar/jug ratio, however, is also present in Late Iron Age levels at Çadır, and may also represent a broader pattern of functional changes. Jugs are likely subsumed in 'jars', which would widen the significance of imports to include social display. The unusual nature of this short-lived fortified hilltop city, as well as the limited excavation contexts, may explain this pattern. Nevertheless, Kerkenes was clearly operating in a much larger geographic network, and was much more closely tied to the movement of goods, than either Tilkigediği or Çadır. As an urban centre, Kerkenes likely served as a focus of regional trade and administration, attracting goods from the wider region. The size of the city, as well as the ceramic data, suggest that the population relied on food from the larger region as well (provisioning?), which may account for the high percentage of non-local jar/jug sherds. Other artefacts, such as ivory and copper alloy, also provide evidence of large-scale interaction (Dusinberre 2002; Lehner 2009).

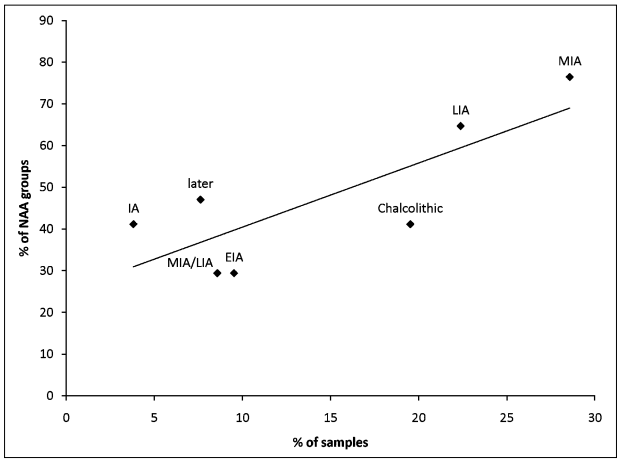

Fig. 5. Relationship between a number of NAA groups and sample size organised by period. In general, there is a positive and linear correlation between sample size and number of NAA groups (the sample size/group diversity rule). There are two notable exceptions. The Chalcolithic and Early Iron Age samples are less compositionally diverse than the overall trend, while the 'later' sample is more diverse

The Iron Age patterning at Çadır can be usefully compared to the earlier Chalcolithic profile. Based on the matching sediment samples, the Chalcolithic sample appears to represent comparatively diverse local/regional production. While evidence from both styles and forms suggests links to other regions of Anatolia (see Steadman et al. 2008), the character of these links appears to reflect a shared cultural tradition/emulation rather than direct ceramic exchange. Comparisons of Chalcolithic and Early Iron Age ceramics reveal that while both periods were dominated by local production, a more diverse range of local sources was used during the Chalcolithic than the Early Iron Age (fig. 5). The nature of interaction, both social and political, changed substantially by the Iron Age. While the Late Bronze Age collapse of the Hittite Empire undoubtedly had major repercussions for subsequent economic and political organisation in this core region, the significant differences between Chalcolithic and Iron Age production and exchange patterns suggest that the political and/or economic scale of interaction at Çadır was comparatively more complex than the intra-regionally embedded patterns of the Chalcolithic (with many more NAA groups and more non-local NAA groups). This suggests some degree of specialisation/standardisation in Early Iron Age ceramic production, even during a period of political decentralisation.

To summarise, while absolute dating remains problematic for the Iron Age of this region, the ceramic data provide some evidence that occupation at Çadır continued uninterrupted across the Late Bronze Age to Early Iron Age transition. The Early Iron Age levels contain a mix of burnished forms and brown-on-buff wares, with brown-on-buff wares becoming more common over time. Substantial Iron Age features, including walls, gates and production areas, occur in the earliest Early Iron Age phases of the site (Gorny 2006). It would appear that Çadır remained an important regional site at least into the Middle Iron Age, if not later. Summers (2001) suggests that Tilkigediği is an Achaemenid period fortification. The founding of hilltop fortified sites by the Late Iron Age indicates that the region was unstable at the end of the Middle Iron Age, as historical records indicate (Summers 2006). The limited nature of Late Iron Age decorated ceramic material at Çadır may be evidence of a settlement contraction at this time, after the destruction of Kerkenes.

Conclusion

The patterns of interaction at these three sites provide a regional perspective on economic and political change during the Iron Age that is difficult to obtain from a single site. The nature of Iron Age political and economic formation in the region encompassed by the Kızılırmak

river bend appears anomalous compared to other regions of western and central Anatolia. While Boğazköy clearly endured dramatic population and organisational changes, recent evidence suggests some occupational continuity from the Late Bronze Age into the Early Iron Age at both Boğazköy and Çadır. However, a high degree of Middle Iron Age political volatility (the short-lived foundations of Kerkenes and neighbouring Tilkigediği) suggests quite a different trajectory of Iron Age political and economic development. For Çadır, architectural features and the ceramic evidence from the Early Iron Age and into the Middle Iron Age show a slow transition and continuity across the period of apparent collapse. Evidence not only for continuity of occupation but also for continuity of economic organisation is extremely unusual and clearly warrants further study. Kerkenes, not surprisingly, stands out as a unique settlement in the region. This analysis underscores the extent to which it was linked to larger exchange and interaction spheres, as well as the limited amount of local ceramic exchange evident in the contexts sampled.

Understanding the nature of social and political reformation after political collapse in the central Anatolian Iron Age will require a much broader regional dataset than presented here. However, our analysis for this region already suggests intriguing continuities in population and economy across this transition. If we turn to the larger region, the extent of continuity appears highly variable across areas previously united under Hittite rule. When the larger dataset of the Anatolian Iron Age Project is fully analysed, we anticipate it will provide a more extended and detailed picture of local and regional interaction. Such patterns of interaction should substantially advance both the understanding of Iron Age political and economic processes across central Anatolia and the more general issue of societal regeneration in the wake of political collapse.

Acknowledgements

This research was funded by the Australian Research Council (DP0558992) and the US National Science Foundation (0410220 and 0513403).

We would also like to thank the anonymous external referees and the editors for their constructive comments.

Bibliography

Branting, S. 2005: 'Kerkenes Dağ project' *Oriental Institute Annual Report '04–'05*: 69–73

Branting, S., Summers, G.D. 2002: 'Modelling terrain: the Global Positioning System (GPS) survey at Kerkenes Dağ, Turkey' *Antiquity* 76: 639–40

Brixhe, C., Summers, G.D. 2006: 'Les inscriptions Phrygiennes de Kerkenes Dağ (Anatolie centrale)' *Kadmos* 45: 93–135

DeVries, K. 1997: 'The Attic pottery from Gordion' in J. Oakley, W.D.E. Coulson, O. Palagia (eds), *Athenian Potters and Painters.* London: 447–55

DeVries, K., Kuniholm, P., Sams, G.K., Voigt, M.M. 2003: 'New dates for Iron Age Gordion' *Antiquity* 77/296 Project Gallery: http://www.antiquity.ac.uk/projgall/devries296/

Draycott, C.M., Summers, G.D., Brixhe, C. 2008: *Kerkenes Special Studies 1: Sculpture and Inscriptions from the Monumental Entrance to the Palatial Complex at Kerkenes Dağ, Turkey* (Oriental Institute Publication 135). Chicago

Dusinberre, E.R.M. 2002: 'An excavated ivory from Kerkenes Dağ, Turkey: transcultural fluidities, significations of collective identity, and the problem of Median art' *Ars Orientalis* 32: 17–54

Efe, T. (ed.) 2001: *The Salvage Excavations at Orman Fidanlığı. A Chalcolithic Site in Inland Northwestern Anatolia.* Istanbul

Erentöz, C. 2002: *Jeoloji Harıtaları. Kayseri Sheet* (geological map, 1:500,000 scale). Maden Tetkik ve Arama Genel Müdürlüğü, Ankara

Genz, H. 2001: 'Iron Age pottery from Çadır Höyük' *Anatolica* 27: 159–70

— 2003: 'The Early Iron Age in central Anatolia' in B. Fischer, H. Genz, E. Jean, K. Köroğlu (eds), *Identifying Changes: The Transition from Bronze to Iron Ages in Anatolia and its Neighboring Regions. Proceedings of the International Workshop Istanbul, November 8–9, 2002.* Istanbul: 179–92

— 2004: *Buyukkaya I: Die Keramike der Eisenzeit. Boğazköy-Hattuša.* Mainz

— 2006: 'Die eisenzeitliche Besiedlung im Bereich der Grabungen am mittleren Büyükkale-Nordwesthang 1998-2000' in J. Seeher (ed.), *Ergebnisse der Grabungen an den Ostteichen und am mittleren Büyükkale-Nordwesthang in den Jahren 1996–2000* (Boğazköy-Berichte 8). Mainz: 98–158

— 2007: 'Late Iron Age occupation on the northwest slope at Boğazköy' in A. Çilingiroğlu, A. Sagona (eds), *Anatolian Iron Ages 6: The Proceedings of the Sixth Anatolian Iron Ages Colloquium, 16–20 August 2004, Eskişehir.* Leuven: 135–52

Glascock, M.D., Neff, H. 2003: 'Neutron activation analysis and provenance research in archaeology' *Measurement Science and Technology* 14: 1516–26

Gorny, R.L. 2006: 'The 2002–2005 excavation seasons at Çadır Höyük' *Anatolica* 32: 29–54

Gorny, R.L., McMahon, G., Paley, S., Steadman, S., Verhaaren, B. 2002: 'The 2000–2001 seasons at Çadır Höyük in central Turkey: a preliminary report' *Anatolica* 28: 109–36

Grave, P., Kealhofer, L., Marsh, B. (in preparation): 'The provenience of Alişar IV ceramics'

Grave, P., Kealhofer, L., Marsh, B., Gates, M.-H. 2008: 'Using neutron activation analysis to identify scales of interaction at Kinet Höyük, Turkey' *Journal of Archaeological Science* 35: 1974–92

Grave, P., Kealhofer, L., Marsh, B., Sams, G.K., Voigt, M., DeVries, K. 2009: 'Ceramic production and provenience at Gordion, central Anatolia' *Journal of Archaeological Science* 36/10: 2162–76

Gürtekin-Demir, R.G. 2002: 'Lydian painted pottery at Daskyleion' *Anatolian Studies* 52: 111–43

Harbottle, G., Hughes, M.J., Seleem, S. 2005: 'The origin of black-figure Greek ceramics found in Naucratis (Nile Delta)' *Archaeometry* 47/3: 511–18

Henrickson, R. 1994: 'Continuity and discontinuity in the ceramic tradition of Gordion during the Iron Age' in D.H. French, A. Çilingiroğlu (eds), *Proceedings of the Third International Anatolian Iron Age Symposium.* Oxford: 95–129

— 2005: 'The local potter's craft at Phrygian Gordion' in L. Kealhofer (ed.), *The Archaeology of Midas and the Phrygians.* Philadelphia: 124–35

Kealhofer, L., Grave, P., Genz, H., Marsh, B. 2009: 'Post-collapse: the re-emergence of polity in Iron Age Boğazköy' *Oxford Journal of Archaeology* 28/3: 275–300

Knapp, A.B., Cherry, J. 1994: *Provenience Studies and Bronze Age Cyprus: Production, Exchange and Politico-Economic Change (Vol. 21).* Madison WI

Lehner, J. 2009: 'Metallurgy and the provenance of metals' *Kerkenes News* 12: 5–7

Mommsen, H., Beier, T., Hein, A. 2002: 'A complete chemical grouping of the Berkeley Neutron Activation Analysis data on Mycenaean pottery' *Journal of Archaeological Science* 29: 613–37

Sams, G.K. 1994: *The Early Phrygian Pottery, Volume IV, The Gordion Excavations 1950–1973: Final Reports.* Philadelphia

Schaus, G.P. 1992: 'Imported west Anatolian pottery at Gordion' *Anatolian Studies* 42: 151–77

Slane, K.W., Elam, J.M., Glaskcock, M.D., Neff, H. 1994: 'Compositional analysis of Eastern Sigillata-A and related wares from Tel-Anafa (Israel)' *Journal of Archaeological Science* 21/1: 51–64

Steadman, S.R., Ross, J.C., McMahon, G., Gorny, R. 2008: 'Excavations on the north-central plateau: the Chalcolithic and Early Bronze Age occupation at Çadır Höyük' *Anatolian Studies* 58: 47–86

Stronach, D., Summers, G.D. 2003: 'The Ashlar Building at Kerkenes Dağ: an interim report' *Anatolia Antiqua* 11: 111–29

Summers, G.D. 2001: 'Keykavus Kale and associated remains on the Kerkenes Dağ in Cappadocia, central Turkey' *Anatolia Antiqua* 9: 39–60

— 2006: 'Aspects of material culture at the Iron Age capital on the Kerkenes Dağ in central Anatolia' *Ancient Near Eastern Studies* 43: 164–202

— 2008: 'Periodisation and technology in the central Anatolian Iron Age, archaeology, history and audiences' *Ancient Near Eastern Studies* 45: 202–17

— 2009: 'Between Urartu and Phrygia, the north-central Anatolian plateau in the Iron Age' in H. Sağlamtimur, E. Abay, Z. Derin, A.Ü. Erdem, A. Batmaz, F. Dedeoğlu, M. Erdalkıran, M.B. Baştürk, E. Konakçı (eds), *Studies in Honour of Altan Çilingiroğlu: A Life Dedicated to Urartu on the Shores of the Upper Sea.* Istanbul: 657–71

Summers, G.D., Summers, F. 1998: 'The Kerkenes Dağ project' in R. Matthews (ed.), *Fifty Years' Work by the British Institute of Archaeology at Ankara.* London: 177–94

— 2008: 'A preliminary interpretation of remote sensing and selective excavation at the Palatial Complex, Kerkenes' *Anatolia Antiqua* 16: 53–76

— 2010: 'From picks to pixels: eighty years of development in the tools of archaeological exploration and interpretation, 1927–2007, at Kerkenes Dağ in central Turkey' in P. Matthiae, F. Pinnock, L. Nigro, N. Marchetti (eds), with the collaboration of L. Romano, *Proceedings of the 6th International Congress on the Archaeology of the Ancient Near East, May, 5th–10th 2008, 'Sapienza' – Università di Roma. Volume 2. Excavations, Surveys and Restorations: Reports on Recent Field Archaeology in the Near East.* Wiesbaden: 669–83

Summers, G.D., Summers, F., Ahmet, K. 1995: 'The regional survey at Kerkenes Dağ: an interim report on the seasons of 1993 and 1994' *Anatolian Studies* 45: 43–68

Summers, G.D., Summers, F., Baturayoğlu, N., Harmanshah, O., McIntosh, E. 1996: 'The Kerkenes Dağ survey: an interim report' *Anatolian Studies* 46: 201–34

Summers, G., Summers, F., Branting, S. 2004: 'Megarons and associated structures at Kerkenes Dağ: an interim report' *Anatolia Antiqua* 12: 7–41

Voigt, M.M., Young, T.C. 1999: 'From Phrygian capital to Achaemenid entrepôt: Middle and Late Phrygian Gordion' *Iranica Antiqua* 34: 191–241

von der Osten, H.H. 1937: *The Alishar Hoyuk, Seasons of 1930–1932.* Chicago

Yellin, J. 1995: 'Neutron activation analysis: impact on the archaeology of the Holy Land' *Trends in Analytical Chemistry* 14/1: 37–44