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Early ceramics in Anatolia, implications for the production and use of the earliest pottery: the evidence from Boncuklu Höyük.

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Abstract

Fragments of possible fired clay found at Boncuklu Höyük, central Turkey, appear to derive from rudimentary vessels, despite the later ninth and early eighth millennium cal. BC and thus 'Aceramic' dates for the site. This paper will examine the evidence for such fired clay vessels at Boncuklu and consider their implications as examples of some of the earliest pottery in Anatolia. The discussion will examine contextual evidence for the role of these fragments, consider their relative rarity at the site and the implications for the marked widespread adoption of pottery in southwest Asia c. 7000-6700 cal. BC.

Introduction: the earliest pottery vessels

The earliest ceramics and pottery are currently understood to have appeared within the later Palaeolithic in rather disparate settings. Ceramics are seen in fired clay figurines from c. 26,000 BP in southeastern Europe (Vandiver *et al.* 1990, 34-74) and fired clay vessels (pottery) are known in China and Japan from the later Palaeolithic c. 20/19000 cal. B.P., onwards (Kaner 2010; Wu *et al* 2012; Biton *et al.* 2014 740; Hommel 2010). The early use of fired clay vessels in China and Japan appears highly specific and related to the cooking of particular foods, based on their limited frequency and morphological diversity (Craig *et al.* 2013, 353; Wu *et al.* 2012). Despite these seemingly mundane contexts however, it is suggested that the infrequency of pottery vessels indicates they had a specific ceremonial or prestige role (Hayden 2010, 24).

In contrast, in southwest Asia early pottery, defined here as fired clay vessels, is generally understood to have emerged as a consequence of the development of sedentary, farming societies and there has been little impetus or evidence to change this view. Evidence for rudimentary, fired vessels from Boncuklu Höyük, central Turkey, dating to the later 9th and early 8th millennium cal. BC potentially changes this and challenges us to view the emergence of early pottery in southwest Asia within its global, rather than local context.

The study of early pottery in southwest Asia

Initial studies of early agriculture in southwest Asia forged a strong conceptual link between village life, farming and the making of pottery so that these three Neolithic 'milestones' were regarded as synchronous innovations (Childe 1936, 101). This concept was challenged in the 1950s and 60s when work at sites such as Jericho (Kenyon 1960, 36-57) and Jarmo (Braidwood & Howe 1960, 49-50) developed the idea that for southwest Asia, pottery production began significantly later than the advent of permanent settlement and cultivated crops or herded animals (Mellaart 1966, 225). The established view was that fired pottery vessels emerged quickly around 7000 cal. BC and rapidly became adopted for regular use c. 6700 cal. BC. Examples of sites cited to support this idea include Çatalhöyük in central Turkey (Bayliss *et al.* 2015; Last 2005) and Sabi Abyad I in north Syria (Nieuwenhuijse *et al*. 2010). Although more nuanced discussions of the chronological variation within the emergence of ceramics exist (see Tsuneki, Nieuwenhuijse and Campbell eds. forthcoming), the widespread adoption of fired clay vessels was treated as an almost inevitable event following the economic changes relating to farming and domestication during the PPNA-PPNB (c.9500-7000 cal. BC) (Cauvin 2000, 76). This may also account for the lack of focus on fired clay figures in terms of their relationship to pottery technology, because they derived from traditions established in the Palaeolithic.

The categorisation of pottery production as a consequence of the adoption of a 'Neolithic' way of life appears odd within the global archaeological perspective outlined at the outset of this paper. For some time, people have speculated on the existence of earlier pottery vessels in southwest Asia, for example at sites such as Ganj Dareh, 'Ain Ghazal or Ba'ja but dismissed such instances as intrusive, as instances of burnt storage installations or experiments in clay vessel manufacture and use (Biton *et al*. 2014, 740-741). The earliest pottery in east Asia is clearly associated with foragers and rather distinct from 'Neolithic' forms of subsistence practices (Aikens 1995). There is also evidence for potters among semi-sedentary or completely mobile groups with a subsistence economy almost entirely based on wild resources in areas such as North Africa in the tenth and ninth millennia cal. BC (Huysecom *et al.* 2009; Close 1995). The use of pottery is thus not at odds with a mobile lifestyle, equally sedentism is not tied into a 'Neolithic package' in which pottery, agriculture, and social complexity are each facilitated by the others (Marshall 2006; Jordan

& Zvelebil 2010). The rapid expansion of pottery in a mature, not experimental, form across Anatolia and northern Mesopotamia at the end of the eighth and the beginning of the seventh millennia cal B.C. (Nieuwenhuijse *et al.* 2010; Özdol 2012, 87-88) is therefore increasingly hard to accept without some prior attempts to make fired clay vessels. Firmer evidence for early pottery vessel manufacture now seems genuinely present at PPNB (Aceramic Neolithic) Kfar HaHoresh (Biton *et al*. 2014). Evidence for rudimentary vessels at Boncuklu Höyük, central Turkey, can now be added to this data set, despite the later ninth and early eighth millennium cal. BC and thus 'aceramic' dates for the occupation of the site and we can explore the factors involved in, and social context for, the emergence of small scale and experimental pottery use preceding its more widespread adoption.

Settlement in the Konya plain

Boncuklu Höyük is the earliest settlement at which cultivation is attested on the Konya Plain and dates from 8300 to 7800 cal. BC as directly attested by radiocarbon dates, although stratigraphic and artefactual evidence point to a slightly longer overall occupation span in the eighth millennium cal. BC (Baird 2012b; Baird *et al.* 2012; Baird *et al* 2016). Data from this site combined with evidence from nearby Çatalhöyük East (Hodder 1996; 2000; 2005; 2006; 2007) and Pınarbaşı (Baird 2012a) allows reconstruction of the lifeways of foragers and early cultivators in Central Anatolia over approximately nine millennia (15,000-6000 cal. BC) (Fig. 1). The Boncuklu excavations have uncovered early houses with painted floors, bucrania and clay and plaster relief decoration. The decoration and structured use of space within houses alongside patterns of re-building anticipate practices related to the expression of household memories and identities at Çatalhöyük by about 1000 years (Baird *et al*. 2012, 233-235; Baird *et al* 2016). Notably this includes the structuring of domestic space into 'dirty' kitchen areas and cleaner social and sleeping spaces, where ritual and symbolic behaviours were practised, including burial (Fig. 2). The inhabitants at Boncuklu consumed wild animal resources and fish to a significant degree, while evidence for the use of crop plants is present but sparse, both in terms of carbonised macrobotanical remains and durable phytoliths. Wild nuts, fruits and tubers form a significant proportion of the botanical remains recovered (Baird *et al*. 2012, 228-231). Thus for the Boncuklu community foraging, especially wetland exploitation, was probably more important than farming in their food acquisition tasks and diets. Seasonal evidence suggests occupation of the site was

year-round, but there may well have been some periods when significant elements of the community may have ranged widely (Baird *et al*. 2012, 232); an argument also made regarding the earliest levels at Çatalhöyük (Last 2005, 128).

One phase of occupation at Pınarbaşı, on a small mound, 30 km to the southeast of Boncuklu, dates from before c. 9000 to 7800 cal. BC. However, the bulk of the excavated evidence from Pınarbaşı is contemporary with the phases excavated at Boncuklu. Pınarbaşı shows much less evidence of the distinctive household practices seen at Boncuklu and cultivars are absent (Baird 2012a; Fairbairn *et al.* 2014). There is no evident division into clean and dirty areas, nor the sort of ritual elaboration of the house seen at Boncuklu. At Pınarbaşı there is no evidence for the early fired clay vessels found at Boncuklu.

The Boncuklu assemblage

The inhabitants of Boncuklu made a variety of objects from clay, including figurines and a large number of other, geometric and amorphous objects (Bennison-Chapman 2014), for which parallels can also be found at Çatalhöyük (Bennison-Chapman 2013; Atalay 2005; 2013; Hamilton 2005; Meskell 2007; Meskell *et al*. 2008; Nakamura & Meskell 2009; Nakamura & Meskell 2013). Other examples of fired clay figures prior to 7000 cal. BC include figures and models from Late PPNB Çayönü (7500-7100 cal. BC) (Bıçakçı 1995; Broman-Morales 1990; Özdoğan 1995; Özdoğan 1999) and Middle PPNB Nevalı Çori (8500-7900 cal. BC) (Morsch 2002; Hauptmann 1999). The clay figurines at Boncuklu are of interest to the study of the pottery from the site because they demonstrate choices made in the sourcing of a particularly fine marl (calcareous clay) as their raw material (Fig. 3). Marl surrounds the site at Boncuklu, underlying the alluvium. Most of the alluvium was deposited following the site's Neolithic occupation. Firing made the Boncuklu figurines relatively durable and their subject matter is similar to that of figurines at Çatalhöyük (Meskell *et al*. 2008, 141-144) with a dominance of zoomorphic figure fragments at Boncuklu (77%) The remainder are considered anthropomorphic. More abstract clay forms are categorised separately (see Bennison-Chapman 2013). The techniques used suggest the occupants of Boncuklu understood the potential uses for local geomorphic sources and could be selective in their choice of clays for specific purposes.

Examining pottery on an aceramic site

The recording system used at Boncuklu was based on ceramic investigations conducted by Campbell (1992, 12-27), Irving (2001, 100-120) and Last (2005). The assemblage was divided into the ware-types defined during the Konya Plain survey (Baird 1996; 2005). These groupings were counted and weighed according to their context of excavation. Further analyses allowed the identification of five potential categories of Neolithic ware-types (table 1). As the number of Neolithic examples recovered was not large (n=77 between 2006 and 2012), all sherds, both diagnostic (decorated sherds, or those derived from the rim or base of the vessel) and undiagnostic (undecorated sherds from unidentifiable areas of the vessel) were recorded to varying levels of detail. This is not normally considered useful or feasible on sites that have a higher density of ceramic remains (Algaze 1990, 213) but was achievable in this case and gave a better opportunity to assess fully and characterise the selection of pottery believed to derive from such an early phase within the Neolithic.

In the field, ware types were determined through an analysis of sherd fabric, morphology, thickness and decoration. Fabrics were examined on a fresh break using a x7 scale loupe to assess inclusion size. Inclusion densities were determined through comparison with published density charts (Matthew *et al* 1991). Degree of firing was assessed both in the field and through subsequent laboratory analyses. Although all the sherds encountered were lightly fired compared to the later products of established pottery technologies, degree of firing varied. This was categorised in the field through a fingernail test. Hardness (see table 3) was considered to relate to degree of firing. Hard fabrics were not marked by a fingernail and firm fabrics only slightly. As no sherds could be considered to be high-fired, hard and firm fabrics were both categorised as 'medium-fired' relative to the rest of the assemblage. Soft fabrics were easily marked or crumbled by a fingernail. These were categorised as 'low-fired' relative to the rest of the assemblage. None of the examples examined showed significant signs of uneven secondary burning, such as might be seen on cooking pots, however this is difficult to identify in all but the most obvious cases.

Neolithic fine wares formed 9% of this group based on count (6.3% by weight). Vessels were made from fine well-sorted calcareous marl that was medium-fired. No vegetal inclusions were present and mineral inclusions were small (diameter 0.1mm and of low density (c. 1%). Fabrics were firm with a smooth or sub-angular break and colour varied from white (10YR 8/2) to light grey (10YR 7/2), with no dark cores. The fabric and surface appearance

were very similar to those of figurines recovered from the site. Sections of rim were found, from open bowls (diameters varied from 130mm to 280 mm). Vessels appeared to be both coil and slab-built, with some bowl fragments breaking in a manner consistent with poorly smoothed and bonded coils (see Rice 1987, 127-128, fig 5.6). Some rim fragments were decorated with lateral incised lines (Fig. 4) and pierced holes (Fig. 5).

Neolithic coarse wares formed 27.3% of this group based on count (26% by weight). Vessels were made from clay marl and distinguished from Neolithic fine wares through the presence of vegetal inclusions and mineral inclusions with an average density for both types of 10%. . These fabrics were medium- or low-fired and varied from firm to soft with angular, sub-angular and smooth breaks observed. Fabric colour varied from very pale brown, grey, dark grey and pink (10YR 7/3, 5/1, 7.5YR 7/4, 8/4, 4/0, 2.5YR 5/0), with 3 examples having reduced fabrics or dark cores. Seven sections of rim were found from open bowls, holemouth pots and jars all with rounded rims (Fig. 6). Rim diameters varied from 40mm to 220mm. Vessels appeared to be pinched, slab- or coil-built. In some examples thin layers of clay appear to have been slabbed over the vessel body together to create the exterior surface. A similar technique has been identified at Çatalhöyük (Yalman *et al*. 2013, 155-157, fig 9.31).

Neolithic structural wares were so-called because it was not apparent from their shape and surviving sections whether these fragments were remains of large-thick-walled vessels or sections of structures such as ovens, hearths or storage bins. However, it should be noted that there is no *in situ* evidence for such features from which such elements might derive. Hearths are common but show no evidence of upstanding clay walls. Structural wares comprised 19.5% of the Neolithic grouping by count (56.9% by weight). Examples were made from clay marl with high percentages of vegetal (average 15%) inclusions and lower percentages of mineral inclusions (average 5%) than the coarse wares. Fabrics were medium- or low-fired and varied from firm to soft with angular and sub-angular breaks observed. Fabric colour varied white, pinkish white, very pale brown, light grey, light brownish grey and pink (10YR 8/2, 8/3, 7/3, 7/1, 6/2, 7.5YR 8/2, 8/4, 7/4, 5YR 7/4), with eight examples having reduced fabrics or dark cores. Two sections of rim were found, one from an open bowl and one from a straight-necked jar with diameters of 320mm and 250mm respectively, which would provide further evidence against the view that these

were all necessarily such structural elements. Vessels appeared to be both coil- and slab-built with well-smoothed outer and inner surfaces.

Fired marl formed 11.7% of this group based on count (3.7% by weight). Examples within this category are thought to be broken/detached sections of basin and channel linings, which have been found *in si*tu on site. Many of the exterior surfaces are very rough and pitted when compared to the smoothed interior. Others showed impressions of plants, particularly stem impressions on their interior surfaces, suggesting they may have been formed around or over items woven from such material such as basketry. There were no vegetal inclusions within the fabric but mineral inclusions varied in diameter from 0.1 to 0.2 mm with an average density of 5%. Examples were made with medium- to low-levels of firing. Fabrics were firm to soft with a sub-angular or smooth break. Fabric colour varied between white, light grey, very pale brown and grey (10YR 8/1, 8/2, 7/2, 7/3, 7.5YR 6/0, 5/0), with 5 examples having reduced fabrics or dark cores. Two sections of rim/edge were found, from structures of indeterminate shape. These objects, which may have been troughs, basins or vessels, appeared to have been constructed by pressing marl directly into baskets or moulds in the earth with the edges then pinched into shape. They may have performed various functions relating to the movement, settling or draining of liquids in outdoor areas of the settlement used as external work spaces (e.g. Area M), where examples of such troughs have been found *in situ*.

Unfired marl formed 32.5% of this group based on count (7.1% by weight). Examples within this category appear to have been made in exactly the same way with the same materials as the fired marl, except that all the examples recovered in this category were not baked at all. Fabrics were soft and friable once broken with a smooth or sub-angular break. Fabric colour varied white, very pale brown, light grey, grey, dark grey (10YR 8/1, 8/3, 7/1, 7/3, 6/1, 4/1, 5Y 8/1). No sections of rim/edge were recovered, which probably reflects the friable nature of these objects.

Laboratory Analyses

The five Neolithic ware groups were subjected to further analyses to interrogate the categories established through macroscopic techniques and to examine the primary question of whether the clay was fired. Thirteen clay samples were analysed, comprising

four 'potsherds', a figurine, four 'structural' clay samples, three heated clay samples (fired marl) and an unfired sample of clay marl (indicated tables 1, 2). Polished thin sections were analysed using a Leica DMRX and a Leica DM4000M polarised light microscope for optical microscopy, and a Hitachi S-3700N variable pressure (VP) scanning electron microscope with energy dispersive X-ray spectrometry (SEM-EDX) to study the samples' microstructure and their chemical composition (see Spataro *et al.* in press).

The petrographic analysis identified four fabric groups (representing different clay sources, based on the clay type and mineralogy of the inclusions), which cut across the potential function suggested for each sample (vessel, structural ware, figurine, and an unfired marl) (tables 2, 3). Group 1 tended to be finer in character although one example of structural ware was placed in this group. Group 2 encompassed the coarser ware types. Group 3 did not show a strong trend towards any single ware type and group 4 contained a single example of unfired marl. All the samples in petrographic fabric groups 1-3 were fired, based on the presence of voids left by the burning off of plant matter naturally present in the clay and the strong similarities between the optically active (Quinn 2013, 84) vessel fabrics and those of the structural heated material. Phytoliths are present in some of the fabrics, but they survive high firing temperatures, up to 1000°C (Piperno 2006, 89). The firing temperature probably did not exceed 500-600°C, as sintering or the beginning of vitrification was not identified either in the SEM images or using the polarised microscope (see Spataro *et al.* in press). Such temperatures are achievable through bonfire firing (Cardew 2002, 52-56, 187; Rice 1987, 156). The samples analysed are rather rich in carbonates. Experimental work on calcareous clays shows that $CaCO_3$ seems to lower the temperature at which extensive vitrification occurs, further reducing the likely temperature reached (Tite & Maniatis 1975, 22). The low refractive index of bone inclusions, the non-isotropic (non-vitrified) fabric, the preservation of the micas, the microcrystalline calcite, and some charred plant remains, also suggest that the clays were fired at low but variable temperatures that exceeded 350°C (Maniatis & Tite 1981; Reid 1989, 180, fig. 10.1). This temperature would, however, be sufficient for the material to be classed as fired pottery (Valde & Druc 1999, 5).

Scattered fine bone fragments are present in fragments of vessels and clay structures. The bone was lightly heated, as the fragments are not highly refractive (Y. Goren, *pers. comm.*

2014). One example (BK 2, see table 2) had such a high density of bone inclusions it might have been deliberately tempered with bone fragments. It is possible that bone temper was used in the other cases, therefore, but the bone may also have been already inadvertently present in the raw materials. In the second scenario it is likely that the clay was collected or prepared in the same area as bone was worked. Only one structural ware fragment (sample BK 10, table 2) was probably vegetal-tempered.

The SEM-EDX results correspond closely to the petrographic groupings (see for details, Spataro *et al.* in press). The clays of fabric group 1 and its subgroup (reflecting variations in textures and frequency of inclusions) are chemically different to those of fabric groups 2 and 3 and their subgroups, as group 1 and subgroup contain higher percentages of calcium oxide and magnesia, but lower soda, alumina and silica. The SEM-EDX results indicate that fabric groups 2 and 3 are chemically very similar, however. At least three different sources were therefore exploited: fabric group 1 is made of marl, whereas fabric groups 2 and 3 were collected from other calcareous outcrops, most likely an alluvial source, the precise location of which is unknown. It is possible this may not have been distant from the site, even though the area had not yet seen extensive alluvial deposition by the period of its occupation. The unfired clay analysed as a reference material (group 4) is a marl, but very different to that used for the pottery of group 1.

The samples from vessels and clay structures are mineralogically and chemically similar, showing that the community at Boncuklu utilised the same clays to make different things. The manufacturers also used different clays for the making of similar fired clay items, for example, fine ware vessels, when macroscopically examined were seen to be made with different fabrics. At least three different fabrics were used to produce the four vessels and one ceramic figurine analysed. One vessel fragment and the figurine were made of extremely fine marl, almost inclusion-free, which does not seem to have parallels at the other southwest Asian sites with early pottery examined thus far (e.g. Biton *et al.* 2014; Nishiaki & Le Mière 2005; Aurenche *et al.* 2004; Le Mière 2009). The same raw material was identified in the heated sections of marl collected at the settlement, suggesting that the clay was not extensively worked prior to use and that clays suitable for potting were available near the site. Other vessel fragments were made with different clays, and a much coarser

fabric, with abundant inclusions and microcrystalline calcite. These fabrics were also used to make the thick-walled fragments that may be from storage bins or similar structures.

Traditional interpretations, based on the site's date and subsistence economy, would predict that any pottery recovered was fired unintentionally. This has been debated for other early ceramic assemblages at Ganj Dareh (Smith 1990, 324; Cauvin 2000, 225; Smith & Crépeau 1983, 56; Yelon *et al.* 1992), Jarmo (Braidwood & Howe 1960, 43) and Jericho (Kenyon 1957, 56; Amiran 1966, 242; Braidwood & Howe 1960, 43). As the vessels at Boncuklu were made with clays from various sources, were found in low densities, came from disparate contexts and were not usually found in burnt buildings, it seems less likely that their firing was accidental, as this explanation would imply multiple accidents for which there is little evidence.

Potential usage, hardness and degree of firing were therefore important further considerations (table 3). This analysis suggested only the fine and coarse wares were derived from deliberately fired, free-standing pottery vessels. The unfired marls appeared to be broken sections of troughs and basins, created by pressing clays into the ground or into baskets. Fired marls were similar to these, but lightly baked, possibly through processes undertaken during their use-life. The structural wares occupy the middle ground within this continuum. They may be large deliberately fired vessels or storage bins fired *in situ* to make them more robust, although we have no evidence for *in situ* storage bins of such a type. Clay vessels used for hot stone cooking, with their focus on insulation rather than conduction, appear to have similar design requirements (thick porous fabric, straight or flaring walls, wide aperture, low firing temperature) (Reid 1989, 171, 175). Other Boncuklu examples may be sections of fire installations, and thereby be 'fired' during use. Within Area M, an area with deposits of midden material outside buildings, sherds have been found incorporated into the base of hearths, possibly increasing thermal shock resistance and thereby the hearths' use-life (Fig. 7) (Rice 1987, 228-230). It is unclear, however, if they were fired before their incorporation into the hearth, or as a result of it. All these possibilities further complicate the certain identification of deliberately or accidentally fired vessels at Boncuklu.

Within this material therefore, only the Neolithic fine and coarse wares could be considered to be pottery vessels, although some of the structural wares seem also likely to be fragments of such vessels. As at Jarmo and Jericho, the sections of compressed marl can be classed as something different to pottery and may relate more closely in function to 'water-channels' identified for the pottery Neolithic phase at Tell Seker al-Aheimar (Nishiyaki & Le Miere 2005, 57-59, fig 6). The Boncuklu Neolithic structural wares cannot be assigned with complete confidence to either category, and may indeed belong to both categories. Both archaeological and ethnographical parallels suggest they come from a mixture of fired clay items that may have changed their fired/unfired state accidentally or deliberately during their use-life (Smith 1990, 324; Cauvin 2000, 225; Smith & Crépeau 1983, 5; Yelon *et al.* 1992; Reid 1989).

The earliest pottery in Anatolia, context and comparison

It is unlikely that all the examples examined were intrusive later sherds within the Neolithic levels, as around 75% came from well-stratified contexts where the presence of intrusive material could be considered unlikely. The number (77), size, weight and thickness of most examples also minimised the likelihood that the majority moved into Neolithic levels through processes such as bioturbation. More specifically, there are 10 fine and coarse ware sherds that derive from contexts where very precise observations were made in reference to the location of those sherds in the deposits. Animal burrows, created by ground squirrels, are present at the site. During excavation we aim, and are usually able, to isolate and remove the fill of these burrows; where this proves difficult we treat such contexts as potentially contaminated. In the case of these 10 sherds it was very clear that they were embedded in undisturbed Neolithic deposit. Misidentification of later sherds is possible but only Early Bronze Age (EBA) coarse wares were potential candidates, as the other handmade pottery types had distinctive fabrics and/or surface treatments. EBA coarse wares have notable amounts of vegetal temper (typically around 20%) meaning they could only be confused with the Neolithic coarse and structural wares. When compared, (table 4), EBA wares had consistently smaller mineral and vegetal inclusions. This may be due to the use of chopped crop waste as temper in the EBA, alongside developed techniques for levigating clay. In contrast, plant inclusions were incorporated into Neolithic fabrics with little or no preparation, resulting in long uneven voids and impressions created by

grass/sedge stems, and lacking cereal chaff/grains. It is therefore unlikely that EBA pottery was mistakenly categorised as Neolithic.

In terms of the context of the sherds it is also worth reflecting on how much they might represent the redeposition of material from one very short phase of activity earlier in the life of the settlement. Whilst this is possible for some of the material in the midden deposits, the contexts yielding sherds in houses, typically near hearths, were thin occupation deposits related to activity in the houses, especially in the 'dirty' areas, so redeposition from earlier deposits is unlikely in these cases. These are important considerations in the interpretation of the significance of this early pottery discussed below.

When other potential early pottery is considered, the earliest vessels at Çatalhöyük occur after the first century of occupancy in the earlier part of the seventh millennium cal. B.C. (Bayliss *et al.* 2015, 16). A century or so of Aceramic Neolithic occupation of 2.6 m depth, was, of course only exposed in an area 5 by 1.2 m (Farid 2007, 48). It might be that pottery as infrequent as that at Boncuklu would not be found in such a sounding (Yalman *et al.* 2013, 177). Canhasan III is another late Aceramic site in the Konya Plain. No pottery was reported for this site, but again fully excavated material only came from a deep narrow sounding. Pottery could easily be missed in such a small sounding, judging by the Boncuklu evidence. Parallels at other sites in the region (Suberde, Erbaba, Alan Höyük, Yumuktepe, Tarsus, Pınarbaşı-Bor, Kösk Pinar, Musular) are linked to the later ceramic Neolithic phases at Çatalhöyük (Last 2005, 127, 137-138; Özdöl 2012). Re-assessment of the ceramics from rock shelters at Beldibi, Belbaşı, and settlements at Kuruçay and Hacılar, along with the earliest levels at Höyücek and Bademağaci, has produced a date range of 6900-6400 cal. BC (TAY, Beldibi; TAY, Belbaşı; ASPRO, Belbaşı; ASPRO, Beldibi; Schoop 2002; Last 2005 ,138). Thus it would seem that at present, the pottery recovered at Boncuklu (8300-7800 cal. BC) is the earliest known for central Anatolia and is contemporary with the other early instance in southwest Asia, at Kfar HaHoresh (Biton *et al.* 2014).

Why was pottery made at Boncuklu?

The adoption of pottery was traditionally connected with the spread of agriculture within a narrative that linked a settled lifestyle, earlier weaning and population increase with cooked foods; especially cooked domesticated plants (Hoopes & Barnett 1995, 5; Bandy & Fox 2010,

8-12). In addition, the potential importance of pottery for grain storage fitted a narrative that understood its proliferation in the context of communities reliant on farming. In turn, the spread of agriculture was explained using diffusionist models relating to ecological or demographic stress. It was assumed that pre-agricultural societies lacked social structures relating to wealth or status and that sedentism did not exist without agriculture. Studies of foragers with significant social differentiation and hierarchy and complex hunter-gatherers (Arnold 1993; Aldenderfer 1993; Ames 1994) alongside reviews of this area of anthropology (Lee 1992; Arnold 1996; Rowley-Conwy 2001; Sassaman 2004) and studies of pottery use by hunter-gatherers (Jordan & Zvelebil 2010) have challenged these assumptions, creating new questions concerning the adoption of both domesticates and pottery.

When the early appearance of pottery has been studied elsewhere, it does not often appear to have been adopted for purely practical or utilitarian purposes, namely food storage and cooking, but rather to have been taken up in prestige contexts such as competitive feasting (Gebauer 1995; Hayden 1990; 1995; Barnett 1995, 80-85; Nieuwenhuijse 2007, 223-226; Nieuwenhuijse *et al*. 2010). It has been proposed that at Ganj Dareh and early Çatalhöyük, vessels with organic temper were less suited for cooking (Yelon *et al.* 1992, 592; Last 2005, 128-130; Yalman *et al.* 2013, 177-179); a factor reflected in residue analyses (Copley *et al.* 2005), which appear to indicate storage of animal fats at early Çatalhöyük. However, recent work on lipids indicates that the early Çatalhöyük pottery with organic inclusions was occasionally used for cooking (Pitter *et al.* 2013, 198). In summary therefore, it seems likely that in some cases pottery adoption served quite utilitarian practices, in others pottery may have emerged as a prestige item linked to ritualised commensal practices (Hayden 2010) we should therefore also consider the possibility of other socially charged roles. Pottery at Boncuklu, in particular the Neolithic fine wares with decorated rims, rather than being solely created for use in food processing may have been also, or even alternatively, utilised within contexts designed to establish or maintain social relationships. Indeed the presence of processed bone may suggest a ritualised element to their production, given the highly unusual use of bone as a temper in the early ceramic production record from southwest Asia. This would of course be very pertinent to a role for the vessels in ritual practices. This is especially so given the use of animal bones in what are clearly symbolically significant

structured depositions and installations both inside and outside buildings and figurine evidence for the symbolic significance of some animals (Baird *et al* 2016).

Insights at Boncuklu into the role of pottery can also be provided by a contextual analysis. There is a range of context types in which the pottery was observed unequivocally embedded in Neolithic deposits. Around half of the well-stratified coarse and fine ware fragments come from areas outside buildings, incorporated as isolated sherds within ashy midden deposits. Associated as they are with ash and, on occasion, concentrations of animal bone, these deposits seem to be derived, as dumped waste material, from activities involving food preparation and consumption, both carried out in those external areas (as attested by external hearths and burning areas) and from the cleaning of the 'dirty' kitchen areas of the houses. The other half of these fragments were found directly associated with buildings we believe to be houses, predominately in the 'dirty' ashy areas surrounding and closely associated with the hearths. One sherd was found in a grave fill in a house but seems to be part of the general redeposited material used as backfill for the grave. An approximate indication of the low frequency of vessel occurrence can be seen in the number of stratified Neolithic sherds relative to building numbers. We have excavated all or part of 24 Neolithic buildings, albeit some preserved only over limited areas. In terms of volume of excavation, the deposits from outdoor areas between and surrounding the houses represent an even greater volume of excavation than deposits from the houses. We have 19 Neolithic fine, coarse and structural type sherds from these deposits. Currently therefore, the stratified Neolithic sherd to building ratio is c. 0.8:1. Bayesian analysis of C14 dates suggests buildings had an average life of c. 15 years. This suggests very few vessels were ever in use by any particular household over the life course of an individual house and indeed some households may never have possessed or even used pottery.

The contexts of the coarse and fine pottery vessels suggest they were closely associated with food preparation and consumption, both in household contexts and also possibly in contexts where inter-household food preparation and consumption may have occurred. However, the very low frequency of this pottery suggests it was not used in large numbers in either within-household or inter-household consumption activities, perhaps only the order of one or two vessels used during the lifetime of some of the houses. Thus it may well have been used in preparing and serving of very distinctive foods that were neither common

nor consumed in large quantities. This likely included some diversity of foods including types that were intrinsically rare or those that might only occasionally have seen special forms of processing to produce as exceptional or seasonal meals. Special food products resulting from the low-level agricultural production of wheat and barley, or products from the rare managed caprines at the site, might fit this latter category. It seems very likely that other foods were involved as well. Use of pottery in this way was unlikely to reflect practical necessity, but rather may have carried important social signals or symbolic meaning by visually emphasising the consumption or preparation of special foods (see Fairbairn 1999; 2000; Asouti & Fuller 2013).

The vessels are also small, which again might argue against large-scale consumption or indeed storage. This echoes the situation in east Asia and at Kfar HaHoresh. In terms of shapes and decoration, the Boncuklu material seems quite idiosyncratic, and may well have been produced for the consumption of very particular food or drink types. Alternatively, vessels may have been associated with consumption of food and drink in special and uncommon circumstances, sporadic ritual practices perhaps. Indeed they may have been manufactured specifically for a particular use event. This would explain their rather low frequency and variable and idiosyncratic character as individual items. Indeed that very idiosyncrasy and rarity may have been important in their role, each would have very identifiably carried with it the story of the social relations caught up in manufacture, use and possible exchange of the items (Jordan & Zvelebil 2010a, 50-65). Similar explanations have been voiced to explain the low frequency of fired clay vessels at Çatalhöyük (Yalman *et al*. 2013, 179-182), suggesting the use of pottery for mundane subsistence tasks was a relatively late development.

In addition, it is important to think about the role of pottery vessels relative to other types of material that may have been used in associated or related ways. Early pottery might have been influenced by other already well-developed technologies, such as the preparation of lime for plaster (e.g. Goren & Goring-Morris 2008). It also seems quite likely that there were wooden food preparation, consumption and serving vessels, judging by preserved items at Çatalhöyük (Mellaart 1967, 215). Clay balls were also used to heat food and/or water, albeit the evidence for this at Çatalhöyük is later than Boncuklu (Atalay 2005; 2013, 247; Yalman *et al*. 2013, 178). In addition, another category of rare finds that seems analogous in use to

these Boncuklu pots, are the stone vessels. Stone vessels too were infrequent at Boncuklu, obviously not due to preservation factors, and were typically small food preparation, serving or consumption items or used for pigments. Pottery, like stone, would have been relatively durable compared to many organic containers made of basketry, of which there is evidence at the site (Baird *et al.* 2012). Boncuklu is located in an alluvial and marl plain. Stone sources for the ground stone tools and vessels were at some distance, 30-50 km away minimum, partly accounting for their rarity. The light grey to dark grey range of colours and the shapes of the pottery and occasional decorative features are not dissimilar to these stone vessels, perhaps this early pottery in the Boncuklu context might be seen as a stone vessel equivalent or alternative, a theory also voiced by Nieuwenhuijse *et al.* (2010, 80-83) regarding early pottery in north Mesopotamia.

Connections to Çatalhöyük and Pınarbaşı

Baird has argued that at seventh millennium cal. BC Pınarbaşı, connections with the surrounding landscape were expressed symbolically (Baird 2012a, 202-205). At Boncuklu, as demonstrated by the SEM-EDX results, different clay sources were selected when making pottery. It can therefore be suggested that the making and usage of clay items both created and expressed a link between people and landscape through their deliberate selection of one particular resource, such as clay, marl, plant matter, animal bone or fuel over another. At Çatalhöyük, cereal straw used as temper may have served as a symbolic statement, linking the production of early ceramics with the cyclical timeframe of an agricultural year (Fairbairn *et al*. 2005, 147-148; Last 2005). This point requires careful study, as the availability of wetland vegetation year-round means that the deliberate selection of crop-chaff would be significant, but Last is not clear regarding how certain is such an identification. His argument that the change to grit-tempered pottery (Level VII) indicates a strengthening of symbolic links with the surrounding landscape (Last 2005, 128-130) could equally be applied to the selection of different resources observed in the earlier pottery from Boncuklu. Boncuklu and Pınarbaşı are contemporary communities located only c. 31 km apart. At Pınarbaşı there is not the same evidence for the emergence of long-lasting households, nor associated highly structured domestic and ritual space use, nor associated ritual practice, nor the use of crops. The apparent disinterest in pottery at Pınarbaşı is perhaps also telling of the social contexts in which its use seemed attractive.

Given the direct connections between the Boncuklu community and Çatalhöyük in use of domestic space, ritual and symbolic practice, it is pertinent to ask if there could be any relationship between pottery making at Boncuklu and at Çatalhöyük. There are similarities between the Boncuklu pottery and that at early phases of Çatalhöyük East, notably the drab surface finishes, shapes and very specific techniques such as the application of thin layers of clay over the whole vessel body discussed above. Its occurrence in the dirty areas at Çatalhöyük and Boncuklu may also hint at some continuities. Whilst hardly conclusive, this strongly hints at the likelihood of continuity in a regional Konya plain pottery making tradition which contrasts with other regions where in the early 7th millennium cal BC mineral tempered pottery represent the earliest ceramic vessels (see for example Nishiyaki & Le Mière 2005, 61). Why did pottery then proliferate only after 7000 cal. BC? This early Çatalhöyük pottery was used for storage of animal fats, occasional use for dairy products and cooking, so it may well have been the increasing scale and importance of herds of domestic animals and processing of their products from the end of the eighth millennium, that saw a slow increase in pottery manufacture and use in the first three centuries of the seventh millennium cal. BC in the Konya Plain specifically, although probably not in other parts of southwest Asia. It is potentially interesting that the common occurrence of pottery in the mid-seventh millennium cal. BC in northwestern Anatolia seems strongly associated with dairy product use (Evershed *et al*. 2008).

Conclusions

The discovery of a relatively small number of fragmentary fired clay vessels at Boncuklu Höyük appears to be amongst the earliest pottery found within Anatolia to date and has raised some interesting questions regarding our perception of the place of ceramic technology within southwest Asian prehistory. Further excavation of other sites is needed to fully assess these findings but this study has demonstrated that in the later ninth millennium cal. BC local clays were being deliberately shaped and fired to make pottery that was then used by the inhabitants of Boncuklu. This situates the appearance of pottery production not only within the context of the adoption of sedentary behaviours and farming in central Anatolia, but also within a context where traditional local foraging practices were predominant aspects of behaviour. It seems likely that the important factors in the adoption of pottery production in this context must relate to features of the Boncuklu community

that made it distinct from proximate contemporary communities lacking pottery, such as Pınarbaşı. Notable features of Boncuklu in contrast to contemporary Pınarbaşı include the emphasis on ritual and symbolic practices and related institutionalisation of the household (Baird 2012b) . The rarity of the sherds within the deposits excavated at Boncuklu also perhaps points to the use of some of this pottery assemblage as rare items with specialized and significant functions. It is likely that the vessels were used within a range of practical and symbolic behaviours, possibly involving food preparation and consumption during sporadic but important ritual events both within and external to the houses. Thus pottery seems to have had a role in the way in which newly distinct households marked special events and also integrated with each other in the community.

This brings into question long-lived models of social and chronological development within southwest Asia. The findings at Boncuklu challenge enduring models of social and chronological development within southwest Asia, which place the development of pottery after the development of Neolithic populations with very substantive mixed farming economies, and closely link the purpose of making fired clay vessels to the storing and cooking of domesticated plants. Pottery should therefore perhaps be seen less as a mundane utilitarian product and more as the result of transformative pyro-technology, that may embody the landscape and natural resources required to make it and can help to negotiate social relationships between the people who use it. Like other complex hunter-gatherers or foragers with evidence of social differentiation studied elsewhere, the population living at and around Boncuklu do not appear to have *needed* a large scale commitment to farming to have the technical resources and social stimuli to make pots. Therefore, in re-examining why pottery first emerges it can be argued that our focus needs to move away from pottery as a practical means of extracting the most nutrition from subsistence resources, domesticated or otherwise, whether plant or animal, and re-connect with a more nuanced appreciation of its symbolic associations and social agency. It is interesting that the first sporadic occurrences of pottery occur at about the same time in Anatolia, the southern Levant and possibly the Zagros before c. 8000 cal. BC, hinting at far-flung interactions and similar social contexts for initial pottery creation over a wide area. Its delayed widespread proliferation c. 6700 cal BC may then be associated with both changing

symbolic and particular food preparation and storage practices, explaining the surprising diversity of roles for early seventh millennium cal. BC pottery.

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Andrew Stephen Fairbairn is an archaeologist and archaeobotanist specialising in the analysis of ancient plant food production and trade systems. His research spans southwest Asia, Europe and Australasia, but for the past decade he has focused mainly on understanding long term economic and environmental change on Turkey's high plateau. He is co-director

of the Boncuklu project and has ongoing archaeobotanical projects at Boncuklu, Kaman-Kalehöyük, Büklükale, Canhasan III and Kültepe in Turkey, as well as Pompeii and various sites in Australia and Papua New Guinea. Based in Brisbane, he is currently an Australian Research Council Future Fellow.

Figure captions:

Fig. 1. Map to show the location of Boncuklu Höyük, Çatalhöyük East and Pınarbaşı.

Fig 2. House at Boncuklu Höyük with the 'dirty' kitchen areas in the foreground and ‘clean’ social and sleeping spaces towards the back. Photograph Boncuklu project (D. Baird).

Fig. 3 Part of an anthropomorphic figure before and after preparing a thin section showing the fine calcareous clay fabric. Photographs, S. Denham, M. Spataro.

Fig. 4. Decorated Neolithic fine ware (fabric groups 1 and 3) rim sherds from Boncuklu Höyük. Photographs Boncuklu project (D. Baird). Drawing Boncuklu project.

Fig. 5. Neolithic fine ware vessel (fabric groups 1 and 3) from Boncuklu Höyük with pierced rim. Photograph Boncuklu project (D. Baird). Drawing Boncuklu project.

Fig. 6. Neolithic coarse ware vessels (fabric groups 2 and 3) from Boncuklu Höyük. Drawing C. Hebron.

Fig. 7. Hearth base at Boncuklu Höyük incorporating fragments of pottery. Photograph Boncuklu project (A. Fletcher).

Table 1. Categories of Neolithic ware type and their principal characteristics.

Table 2. Boncuklu Höyük: schematic description of tempers and clay types used at the site derived from petrographic and SEM-EDX analyses. Fabric groups represent different clay sources, based on the clay type and mineralogy of the inclusions. Subgroups represent variations in textures and frequency of inclusions.

Table 3. Comparison of fabric, durability, usage and firing across the Neolithic pottery assemblage.

Table 4. Comparison of fabric inclusions observed across Neolithic and Early Bronze Age sherds from Boncuklu Höyük.

Table 1. Categories of Neolithic ware type and their principal characteristics.

Ware category	Count	Weight (g)	Description	Thickness of vessel walls (mean value mm)	Morphology
Neolithic fine Samples BK: 1, 2	7 (9%)	101.4 (6.3%)	Fine, well-sorted fabric and surface, similar to figurines from the site.	12.7	Open bowls with flat profiles. Some rims decorated with lateral incised lines (fig 5). Vessels both coil and slab-built.
Neolithic coarse Samples BK: 4, 5	21 (27.3%)	420 (26%)	Medium- or low-fired fabric with vegetal and grit inclusions.	14.8	Open bowls, holemouth pots and jars that were pinched, slab- or coil-built. Some examples had thin layers of clay slabbed over the vessel body to create the exterior surface.
Neolithic structural Samples BK: 6, 7, 9, 10	15 (19.5%)	917 (56.9%)	Medium- or low-fired fabric with prominent vegetal and grit inclusions.	20	Thick sections of vessel/bin/oven wall. Coil- and slab-built sections with well-smoothed outer and inner surfaces.
Fired marl Samples BK: 11, 12, 13	9 (11.7%)	59.6 (3.7%)	Compressed marl. Very lightly baked.	9.7	Basins/channels with very rough exterior surfaces, some marked with plant impressions, when compared to the smoothed interior; suggesting they were made by pressing clay marl directly into baskets or moulds in the earth
Unfired marl Sample BK 14	25 (32.5%)	113.8 (7.1%)	Compressed marl but unfired and therefore highly friable.	7.7	As above.

Table 2. Boncuklu Höyük: schematic description of tempers and clay types used at the site derived from petrographic and SEM-EDX analyses. Fabric groups represent different clay sources, based on the clay type and mineralogy of the inclusions. Subgroups represent variations in textures and frequency of inclusions.

Fabric group	Sample number	Ware type (s)	Tempered/Not-tempered	Clay type
Group 1	BK: 1, 7, 11, 12	Neolithic fine Neolithic structural Fired marl	Not-tempered	Marl
Group 1 *subgroup a*	BK: 13, 15	Fired marl Figurine	Not-tempered	Marl
Group 2	BK: 5, 6	Neolithic coarse, Neolithic structural	Not-tempered	Calcareous clay
Group 2 *subgroup a*	BK: 9	Neolithic structural	Not-tempered	Calcareous clay
Group 3	BK: 2	Neolithic fine	Bone tempered (?)	Calcareous clay
Group 3 *subgroup a*	BK: 10	Neolithic structural	Vegetal-tempered (?)	Calcareous clay
Group 3 *subgroup b*	BK: 4	Neolithic coarse	Not-tempered	Calcareous clay
Group 4	BK: 14	Unfired marl	Not-tempered	Marl

Table 3. Comparison of fabric, durability, usage and firing across the Neolithic pottery assemblage

Ware category	Fabric colour (assessed Munsell soil-colour chart)	Cores or reduced fabric	Hardness (assessed with finger-nail test)	Potential usage	Deliberately fired?
Neolithic fine Fabrics: 1, 3	Varies white to light grey 10YR 8/2, 7/2	None	85.7% firm 14.3% hard	Vessels	Yes
Neolithic coarse Fabrics: 2, 3	Varies very pale brown, grey, dark grey and pink 10YR 7/3, 5/1, 7.5YR 7/4, 8/4, 4/0, 2.5YR 5/0	37.5%	25% soft 50% firm 25% hard	Vessels	Yes
Neolithic structural Fabrics: 1, 2, 3	Varies white, pinkish white, very pale brown, light grey, light brownish grey and pink (10YR 8/2, 8/3, 7/3, 7/1, 6/2, 7.5YR 8/2, 8/4, 7/4, 5YR 7/4	61.5%	53.8% soft 46.2% firm	Vessels Grain bins Fire-installations	Yes – but possibly as a consequence of usage.
Fired marl Fabric: 1	Varies white, light grey, very pale brown and grey 10YR 8/1, 8/2, 7/2, 7/3, 7.5YR 6/0, 5/0	62.5%	75% soft 25% firm	Basins Channels	Yes – but possibly as a consequence of usage. No - broken sections fired accidentally either by being in close proximity to a fire.
Unfired marl Fabric: 4	Varies white, very pale brown, light grey, grey, dark grey 10YR 8/1, 8/3, 7/1, 7/3, 6/1, 4/1, 5Y 8/1	None	All soft	Basins Channels	No

Table 4 Comparison of fabric inclusions observed across Neolithic and Early Bronze Age sherds from Boncuklu Höyük.

Ware	Mineral inclusions	Vegetal inclusions	
	Maximum grit sizes (mm)	Length (mm)	
	range	range max	range min
Neolithic coarse	0.2-6	1-24	0.5-7
Neolithic structural	0.2-3	3-12	1-4
Early Bronze Age coarse	0.2-2	1-8	0.5-3

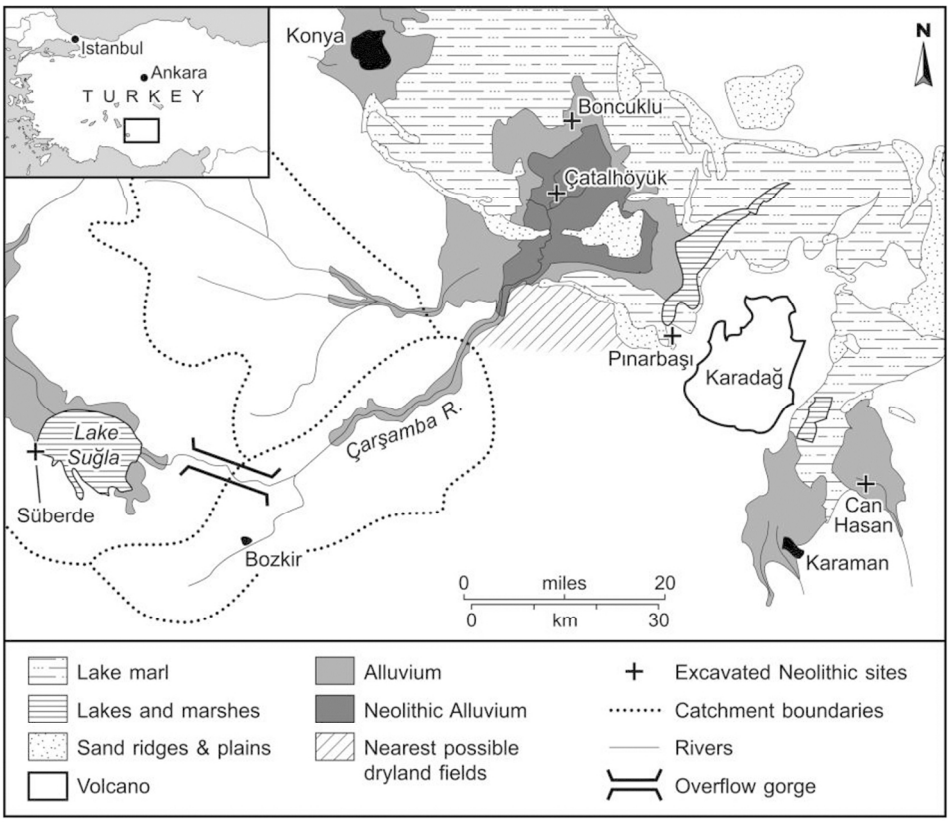

Fig. 1. Map to show the location of Boncuklu Höyük, Çatalhöyük East and Pınarbaşı.

227x190mm (150 x 150 DPI)

Fig 2. House at Boncuklu Höyük with the 'dirty' kitchen areas in the foreground and ‘clean’ social and sleeping spaces towards the back. Photograph Boncuklu project (D. Baird).

180x134mm (300 x 300 DPI)

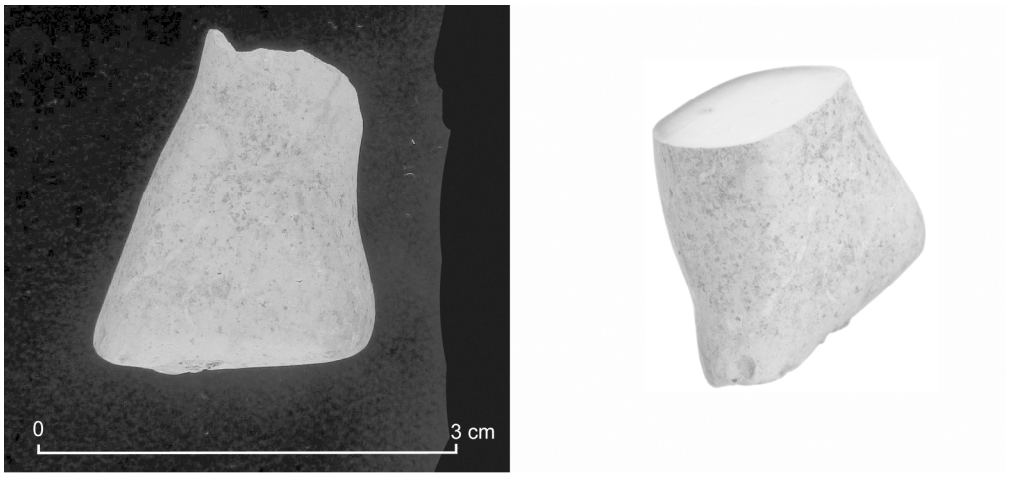

Fig. 3 Part of an anthropomorphic figure before and after preparing a thin section showing the fine calcareous clay fabric. Photographs, S. Denham, M. Spataro.

246x115mm (300 x 300 DPI)

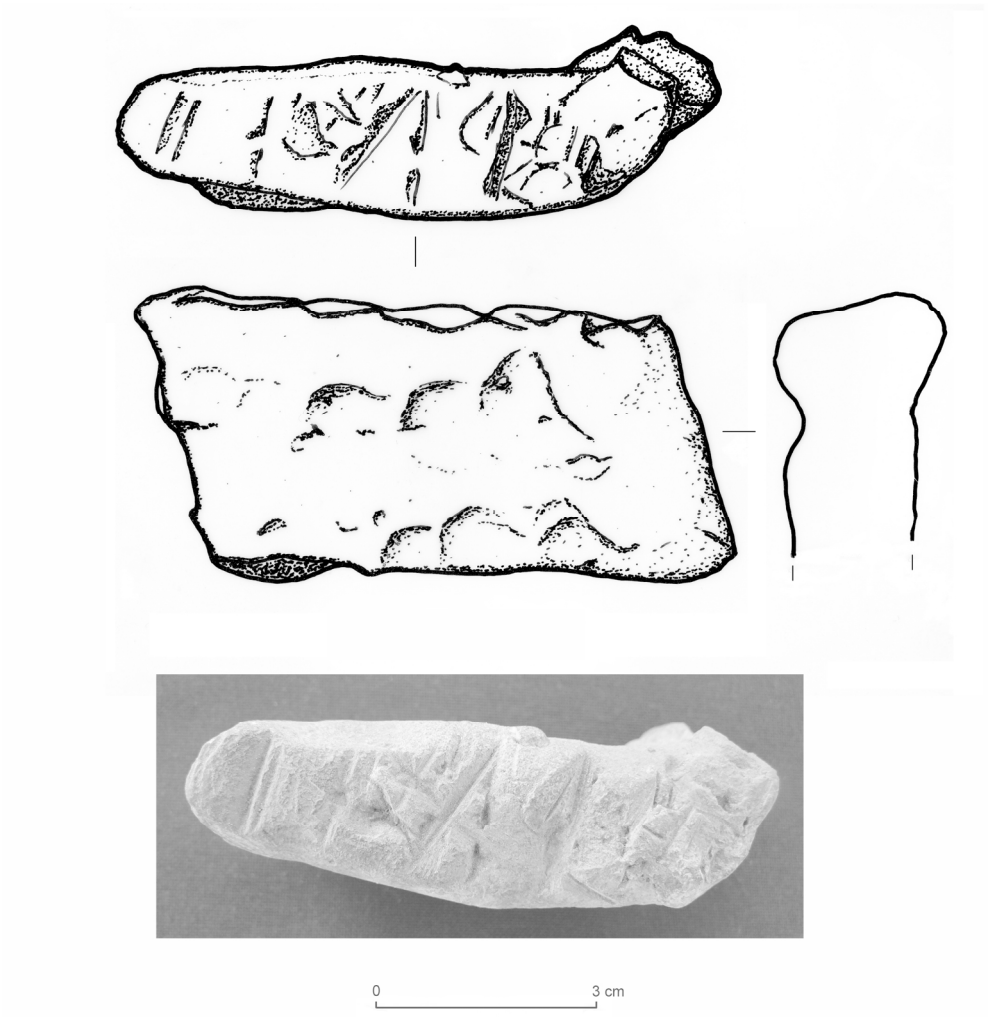

Fig. 4. Decorated Neolithic fine ware (fabric groups 1 and 3) rim sherds from Boncuklu Höyük. Photographs Boncuklu project (D. Baird). Drawing Boncuklu project.

561x576mm (96 x 96 DPI)

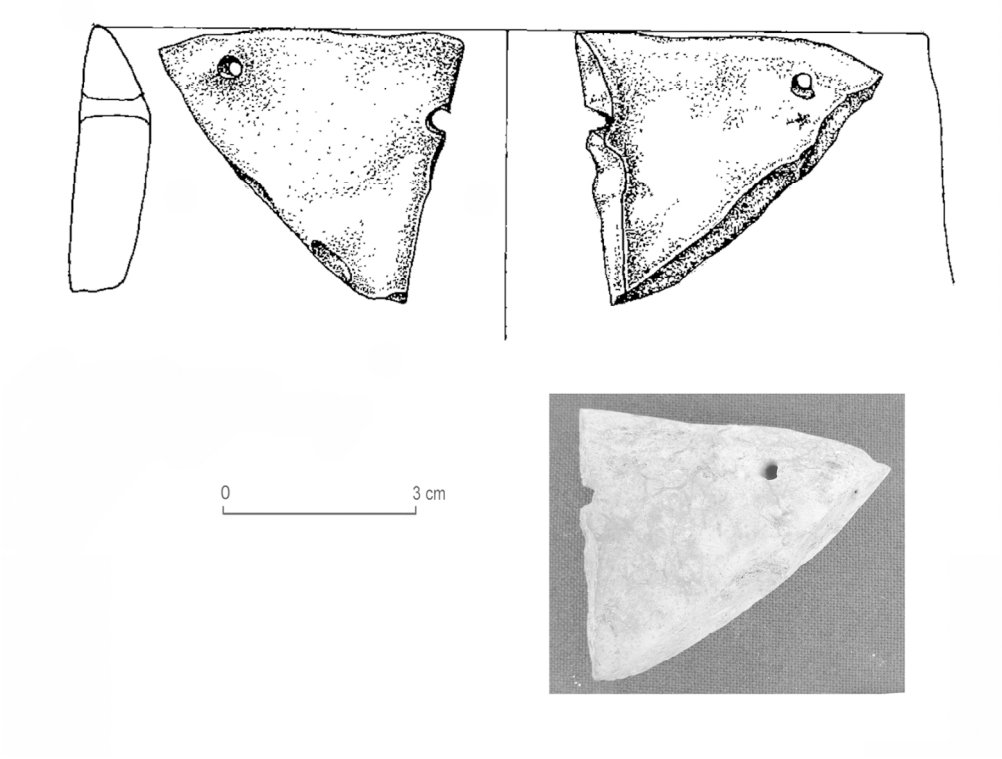

Fig. 5. Neolithic fine ware vessel (fabric groups 1 and 3) from Boncuklu Höyük with pierced rim. Photograph Boncuklu project (D. Baird). Drawing Boncuklu project.

445x339mm (96 x 96 DPI)

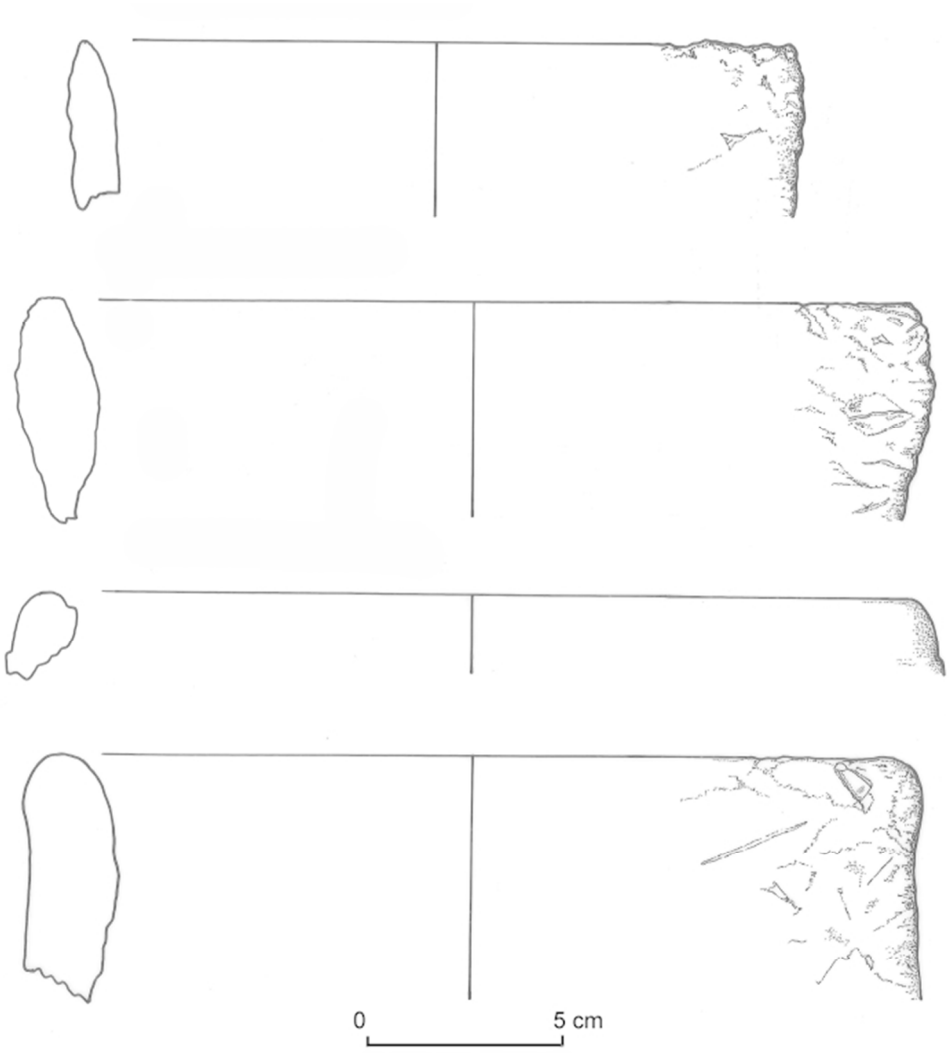

Fig. 6. Neolithic coarse ware vessels (fabric groups 2 and 3) from Boncuklu Höyük. Drawing C. Hebron.

256x271mm (72 x 72 DPI)

Fig. 7. Hearth base at Boncuklu Höyük incorporating fragments of pottery. Photograph Boncuklu project (A. Fletcher).

609x457mm (180 x 180 DPI)