The development of Neolithic pottery technology in Eastern Jazira and the Zagros Mountains

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ABSTRACT – *The origins of pottery technology in Eastern Jazira and the Zagros Mountains can be seen as a process of several stages, from unfired clay and plaster vessels to the fully ceramic technologies of the Proto-Hassuna period. This paper reviews this process and presents a technological analysis of Proto-Hassuna ceramics to investigate the relationships between the pottery traditions at sites in Eastern Jazira and the western part of the Zagros Mountains.*

KEY WORDS – *Neolithic pottery technology; Near East; Proto-Hassuna*

Razvoj neolitske lončarske tehnologije na območju vzhodne Jazire in gorovja Zagros

IZVLEČEK – *Izvor lončarske tehnologije na območju vzhodne Jazire in gorovja Zagros lahko opazujemo kot proces, ki je potekal v nekaj stopnjah, in sicer od nežgane gline in posod iz mavca do polno razvite tehnologije keramike v obdobju Proto-Hassuna. V članku pregledamo te procese in predstavimo tehnološko analizo proto-hassunske keramike, s katero preučujemo tudi odnose med lončarskimi tradicijami na najdiščih na območju vzhodne Jazire in zahodnega dela gorovja Zagros.*

KLJUČNE BESEDE – *neolitska lončarska tehnologija; Bližnji Vzhod; Proto-Hassuna*

Introduction

The emergence of ceramics in the eastern part of Northern Mesopotamia (Jazira) and the Zagros Mountains (Northern Iraq and Western Iran) is recorded between the 8th and 7th millennia BC. However, the origins of pottery technology in this region began long before the emergence of fired vessels, and went through several stages in its development. This process can be traced at sites such as Ganj Dareh (*Smith 1974*), Ali Kosh vessels (*Hole* et al. *1969*), Tepe Guran (*Mortensen 2014*) in the valleys of the Zagros Mountains and Tell Magzalia in Eastern Jezira. For more than a millennium before the first fired vessels of the Pottery Neolithic there is clear evidence of vessels of both unfired clay and gypsum/lime plaster. The wide distribution of fired ceramics in the region occurred from the middle of 7th millennium BC in Eastern Jazira in settlements related to the Proto-Hassuna period. This paper explores the technological traditions in which these vessels were made.

The Zagros Mountains

Unfired clay vessels (the end of 9th to the 7th millennia BC)

The earliest examples of vessels in this region were found in the Zagros Mountains of Western Iran in the Ganj Dareh settlement (layers E and D). This small, but very important mound not far from Kermanshah, dates from the end of 9th to the beginning of the 8th millennia BC (*Mellaart 1975.78; Darabi 2015.P. 31; Bernbeck 2017.101*). These large

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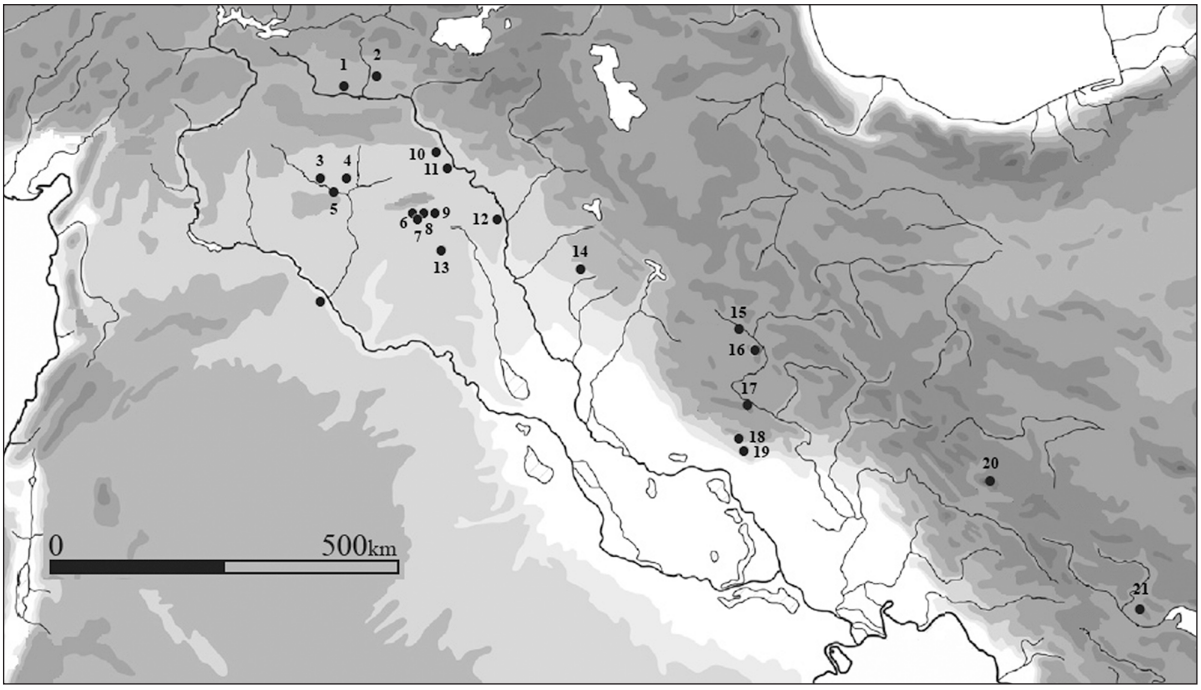

Map 1. Sites mentioned in the text: 1 Salat Cami Yani; 2 Sumaki Huyyuk; 3 Kashkashok; 4 Hazna II; 5 Seker al-Aheimar; 6 Magzalia; 7 Yarimtepe I; 8 Sotto; 9 Kultepe; 10 Ginnig; 11 Telul eth Thalathat; 12 Hassuna; 13 Umm Dabaghiyah; 14 Jarmo; 15 Sarab; 16 Ganj Dareh; 17 Guran; 18 Choga Sefid; 19 Ali Kosh; 20 Qaleh Rostam; 21 Tal-e-Mushki.

vessels (80–100cm high) of unfired clay were often built into the interior walls of the houses. Philip E. L. Smith (*1990*) describes these as either storage vessels or house construction details. One clay fragment from a small vessel with impressions was found in level E (Pre-Pottery Neolithic/PPNB) (*Smith 1974. 207*). The first fired vessels were associated with level D, but these were found only in burned houses and represented by large unfired vessels (*Smith 1974.207; 1990.332*). We have little information about the technology of unfired clay vessels, though it is known that the vessels from Ganj Dareh level D were made from 'clay with plant inclusions' (*Mellaart 1975.78*). Pamela Vandiver (*1987.16*) studied these ceramics in particular, and noted the use of slab construction.

Gypsum and lime vessels (around the turn of the 7th millennium BC)

The calcination of gypsum or limestone to produce a plastic mass with water and some admixtures represents an alternative approach to container technology. Vessels made of gypsum and calcareous clay were found in Ali Kosh settlement in Iran, where the application of slab construction and the use of wicker basket moulds, which left imprints on the surface of some gypsum and lime vessels, has been noted (*Kingery* et al. *1988.219–227; Nilhamn, Koek 2013. 292*). Such vessels were also found at the Magzalia settlement in Northern Iraq, dated to the beginning of the 7th millennium BC (*Bader 1993a.61–62*). The use of these resources was regionally variable. For example, only vessels of gypsum have been identified within the territory of Zagros (Choga Sefid and Ali Kosh settlements) (*Miyake 2016.120*).

Although the tradition of making vessels from gypsum was short-lived, during the Proto-Hassuna period, the tradition of applying lime to clay vessels remained. A similar coating both on one and on both sides of the vessel is present on containers from the Tell Sotto, Kultepe and Yarimtepe I settlements in Northern Iraq. It was also noted in the settlements of this period in Syria (*Nieuwehuyse, Dooijes 2008. 162, 169*) and on the ceramics of the Jarmo settlement (*Adams 1983.215*). The use of gypsum as a coating for baskets (for example, the settlement of Umm Dabagiya) also continued into the Proto-Hassuna period (*Kirkbride 1972.4, Pl. VI*).

The first fired vessels (around the turn of the 8th to 7th millennia BC)

There is no clear starting point for the appearance of the first fired ceramic vessels at Ganj Dareh. Possibly it happened during the formation of level D at the settlement, which dates no later than 7750 cal BC (*Bernbeck 2017.101*). Early ceramics are also recorded at Tepe Guran, Ali Kosh and Tepe Mahtaj set-

tlements. The finds from Ali Kosh date to the last third of the 8th to 7th millennia BC (*Darabi 2012. 104*). Plant inclusions were noted in the pottery of Ali Kosh as the main temper added to these vessels (*Hole* et al. *1969.109–115*). However, the earliest ceramics on Tepe Guran (7100–6800 cal BC) contained no identifiable admixtures (*Bernbeck 2017. 101; Mellaart 1975.86*).

By the beginning of 7th millennium BC, ceramics were already widespread in the Zagros Mountains, at Tepe Guran (younger layers), Ganj Dareh (layer B), Tepe Sarab, Qaleh Rostam (phases III and II), at Tal-e-Mushki in Western Iran and at Jarmo in Eastern Iraq (*Bernbeck 2017.107–108; Braidwood, Howe 1960.38–49; Mellaart 1975.86*). Published accounts of the ceramics of Tepe Guran and Tepe Sarab note that these vessels were tempered with coarse plant inclusions. James Mellart considered it was a straw tempering (*Bernbeck 2017.101; Mellaart 1975.86–87*). Vandiver (*1987.16, 18*) noted the use of slab construction in the ceramics of Ganj Dareh level B. However, nothing is known about its fabric composition.

Jarmo pottery is divided into early and late phases. Frederick Matson (*1960.68*) studied the Jarmo ceramics in detail. The technology of pottery was similar in both phases and characterized by the presence of dung as the primary temper. Matson identified thin plant inclusions up to 5mm length and *c*. 1mm wide with longitudinal lines and round holes with grain prints in the ceramic body (*Matson 1955.355; 1960.68*). Pottery of the early phase has analogies in Tepe Guran and Tepe Sarab. Later vessels are coarser, having both organic and abundant lime mineral inclusions of large size and high frequency. According to a number of researchers, this type of vessels have close parallels in the Proto-Hassuna ceramics of Northern Mesopotamia (*Bader 1975.105–110; Adam 1983.215; Bernbeck 2017.103, 105*).

Ancient pottery of Northern Iraq

The evidence of transition from the Pre-Pottery Neolithic to the Pottery Neolithic in Northern Iraq is clear in the material from Tell Magzalia in Northern Iraq, and can be dated the beginning of the 7th millennium BC based on excavations carried out by Nikolay Bader (*1993*) in the 1970s. Large unfired storage vessels (65cm high, 45cm in diameter) were identified in the first level of the settlement (720–780cm). These vessels have a circular hole *c*. 10cm in diameter at the bottom, and the author suggested they were used for grain storage (*Bader 1989.61–62, Fig. 18.2; 1993a.12–13*). The first fired ceramics fragments were recorded at a depth of 470cm. Unfortunately, little is known about them. Moreover, large heaps of raw, unprocessed clay were found in the different levels of the tell (*Bader 1989.61, 105, Pl. 41.13, 14, 20, 21;1993a.19, Fig. 2.12; Bader, Le Mière 2013.515*).

Pottery of the Proto-Hassuna period

The wide distribution of ceramics in the Northern Mesopotamia region is associated with the Proto-Hassuna period. These have been found at Tell Sotto, Kultepe, Yarimtepe I, Umm Dabaghiyah, Tell Hassuna, Telul eth Thalathat, Ginnig, Shimshara in Northern Iraq; Tell Seker al-Aheimar, Tell Kashkashok II, Tell Hazna II, Tell Bouqras in Easten Syria; Salat Cami Yani and Sumaki Huyyuk in the headwaters of Euphrates in Turkey and a number of other sites (*Bader, Le Miere 2013.513; Le Mière 2000; Nieuwehuyse 2013.114*)[1].

There is no consensus regarding the origins of the Proto-Hassuna culture. Various features of material culture, including analogues in ceramic form and ornamentation, were associated with the Jarmo settlement (Zagross) (*Bader 1993b.48*). There is also the opinion that Proto-Hassuna ceramics originated from the ceramics of the Pre-Proto Hassuna period. This is based on the successive occurrence of pottery bearing layers from these periods at Tell Seker-al-Aheimar in Eastern Syria. Researchers note that the ceramics of Pre-Proto-Hassuna period differ from those of the Proto-Hassuna period in both forms and the presence of a large amount of exclusive mineral inclusions (*Bader, Le Mière 2013.520; Nishiaki, Le Mière 2005.67*).

Proto-Hassuna ceramics are usually defined by researchers as 'coarse ware', with red paint, slip and appliqué ornament. The technology used for making the vessels is usually described as follows.

Raw material – it is generally agreed that the material for production was clay with a small amount of mineral inclusions (calcite and sand) (*Bader* et al. *1994; Campbell, Baird 1990.70; Kirkbride 1972.8*). The *pottery paste* contains a large amount of plant

1 Tell Sotto, Kultepe (*Bader 1993*); Yarimtepe I (*Munchaev, Merpert 1993; Bashilov* et al. *1980*); Umm Dabaghiyah (*Kirkbride 1972*); Tell Hassuna (*Lloyd, Safar 1945*); Tell Ginnig (*Campbell, Baird 1990*); Tell Hazna II (*Munchaev* et al. *1993*); Tell Kashkashok II (*Matsutani 1991*); Tell Seker al-Aheimar (*Nishiaki, Le Mière 2005*).

Fig. 1. Proto-Hassuna vessels: 1 Tell Sotto, 1974, II-D-1, 220cm deep, level 3, I.2.a 491 KP-417962; 2 Tell Sotto, 1973, 10-B-1, level 5, I.2.a 636 KP-418107; 3 Yarim Tepe I, level 12, I.2.a483 KP 417954.

inclusions (Telul eth Thalathat, Tell Seker al-Aheimar, tell Sotto, Kultepe and Yarimtepe I (*Bader 1989. 218; Bader, Le Mière 2013.516, 518; Nieuwehuyse 2013.120*), which is sometimes called straw (Tell Sotto, Tell Hassuna, Tell Kaskashok II (*Bader 1989. 138; Lloyd, Safar 1945.276; Maeda 1991.20*). Vessels from Yarimtepe I, Umm Dabagiyah and Ginnig smaller plant inclusions in addition to straw (*Bashilov* et al. *1980.43–64; Campbell, Baird 1990.70; Kirkbride 1972.8*). Oliver Nieuwehuyse suggested the possible presence of dung in the Proto-Hassuna pottery paste (*Nieuwehuyse 2013.125*).

Construction – vessels were made with the coiling (*Campbell, Baird 1990.70; Kirkbride 1972.8*) or slab construction techniques (*Campbell, Baird 1990. 70*). Fuad Safar, who excavated the Tell Hassuna, suggested that the bases of large vessels with ribs were made in pits, and then built up from this (*Lloyd, Safar 1945.277*). *Surface treatment* – vessels were smoothed by grass (*Kirkbride 1972.8*), and sometimes burnished (*Campbell, Baird 1990. 70; Kirkbride 1972.8; Nieuwehuyse 2013.120*). Firing – the vessels were fired at low temperature (*Campbell, Baird 1990.70; Bashilov* et al. *1980.43–66*). During the excavations of Tell Sotto a large vessel burned in a pit was identified (*Bader 1989.140*).

Pottery of Tell Sotto and Yarim Tepe I

Technological analysis according to the method of Alexander Bobrinsky

The settlements of Yarim Tepe I and Tell Sotto were excavated by the Soviet archaeological expedition in Northern Iraq under the authotity of Rauf M. Munchayev, Nikolai Ya. Merpert and Otto N. Bader from 1969 to 1976 (*Merpert 1993; Merpert, Munchaev 1993; Bader 1993b*). Both settlements may be dated to the second half of the 7th millennium BC. Recent ^{14}C dates obtained for the Proto-Hassuna period in the lower level of the Yarim Tepe I settlement are 6220 to 6071 cal BC (7280 ± 30BP) (*Yutsis-Akimova* et al. *2018.51*).

The technology of ceramics of the Tell Sotto and Kultepe settlements was first analysed by Bobrinsky, who considered both the qualities of the raw materials and the pottery paste. As a result, several types of medium and high plasticity clays with limestone as a supplement to local clays were identified. The main additive to the clay during production was dried animal dung of goats, sheep and cows. This was identified from the remains of very small organic inclusions up to 0.5mm long and 0.1–0.2mm wide, with smooth rounded margins. The concentration of these remains and voids from them in the ceramic fabric ranged from 40 to 70% (mostly 50 to 60%) (*Bobrinsky 1989.327–334*). Bobrinsky (*2006. 415*) noted that in addition to dung, straw and hay were often added to the pottery paste. Firing is characterised by a rapid rise in temperature and short duration, which corresponds to the conditions typical of pit firing (*Bobrinsky 1989.334*).

My technological analysis of Proto-Hassuna ceramics based on materials from Yarim Tepe I (levels 12–11; fragments from 149 vessels and one whole vessel) and Tell Sotto (level 2; fragments from 40 vessels and two whole vessels[2]) found dates earlier than the Proto-Hassuna levels of Yarim Tepe I, and two whole vessels from levels 3 and 5 (Fig. 1)[3]. Microscopic[4] analysis of the surface and of cross-sections

2 Forty ceramics samples previously studied by Aleksandr Bobrinsky.

3 The ceramics collection of Yarim Tepe I and Tell Sotto is located in the Russian Institute of Archaeology. Three whole vessels stored in the Pushkin State Museum of Fine Arts in Moscow (Yarim Tepe I - I.2.a483 KP 417954; Tell Sotto - I.2.a 491 KP-417962; I.2.a 636 KP-418107).

4 Binocular microscope MBS-10, stereo microscope Carl Zeiss 2000-C and metallographic microscope Olympus MX 51.

of ceramic samples from all stages of pottery production was conducted according to the method of Bobrinsky (*1978; 1999;* see also *Tsetlin 2017*). A study of raw materials and pottery paste, methods of construction, vessel surface treatment, and firing was performed. During the study of clay selection the degree of ferrugination as well as quantity and composition of natural inclusions were determined. The organic temper was classified according to its type. The quantity and size of the mineral inclusions influences the plasticity of clay, so this was taken into account by potters when choosing clay. The methods of temper processing and temper concentration were determined. Analysis of ceramics included the re-firing of samples in a muffle furnace under identical conditions (850°C) to determine the relative degree of clay ferrugination. At this temperature clay ferrugination reaches its maximum level and does not change with an increase in the firing temperature.

Besides this, ceramics from excavations were compared with experimental samples. A series of experiments was carried out with different kinds of organic tempers containing the following plant residues: fresh grass, hay, straw, and the dung of cows, sheep and goats in different concentrations. In addition, experiments with different types of construction and surface treatment methods were performed (*Petrova 2012; 2016*).

The raw materials

The vessels from the Tell Sotto settlement were made from ferruginous clay with limestone with a small amount of rounded fine-medium sand: 0.1–0.25 and 0.25–0.5mm (for coarse vessels) and with average quantity of mineral inclusions – rounded fine and medium quartz sand (0.1–0.25 and 0.25–0.5mm), white/light grey colour in a concentration of no more than 1:5 (for thinner vessels) (*Lopatina, Kazdim 2010.47*). The vessels from Yarim tepe I – mainly from moderately ferruginous clay with the addition of limestone and an average quantity of mineral inclusions.

The pottery paste

Ceramics were divided into two groups. The first group (90% of the collection) contains pottery with a mixture of clay and dung. At Tell Sotto the concentration of the dung in ceramics ranged from 40 to 70% of all pottery paste, and at Yarim Tepe I from 20 to 40%, depending on the type of vessel. The dung is indicated with the presence of various types of very small plant residues and voids with rounded

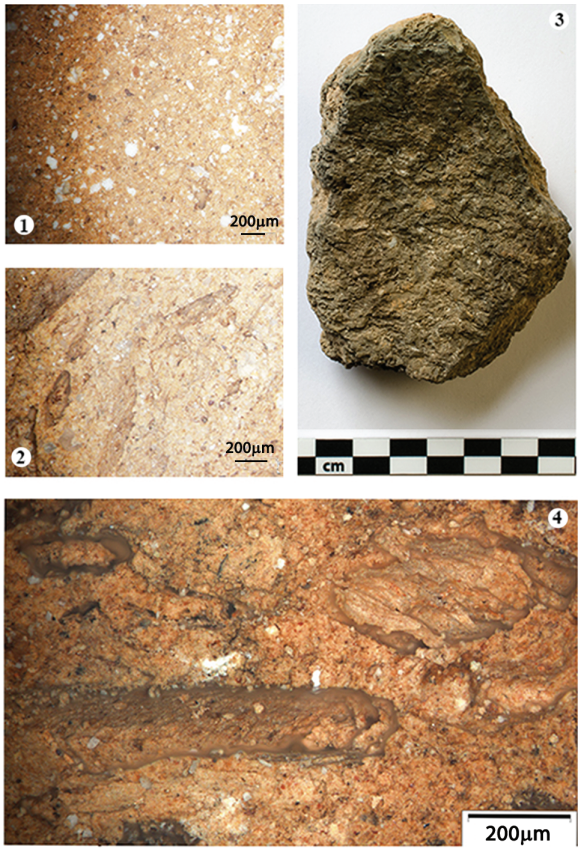

Fig. 2. The raw materials and pottery paste: 1 the Proto-Hassuna ceramics without any specially added temper; 2, 4 the presence of dung in Proto-Hassuna ceramics: Microscopic photo – very small plant residues with rounded ends and a degree of disintegration – Yarim Tepe I, pit 73 in the virgin soil, pocket 232 No. 10; Tell Sotto, 1974, Level 2; 3 the presence of dung in Proto-Hassuna ceramics: various types of very small plant residues in pottery paste in high concentration: Tell Sotto, 1974, II-B-4, Level 2, P.75, N.2.

ends and some degree of disintegration (Fig. 2.2–4). The coarser and larger vessels were made with the addition of organic inclusions in a greater concentration. The presence of larger plant residues – hay, dried or fresh grass combined with dung – was identified. The second group includes only thin-walled bowls and does not contain dung in the pottery paste, only clay without any specially added temper (Fig. 2.1).

The construction methods

Vessels built out with coils and slabs. Spiral coils were detected in from 40 to 60% of the studied vessels and were used in the construction of various vessel categories. In most cases, thick-walled (1cm or more) vessels were made of coils (Fig. 3). The coil height is from 1.5 to 3.5cm, depending on the size of the vessel. In two cases it was possible to define

the diameter of the coil as 2.6–2.8cm. Sometimes the torsion introduced during the rolling of the coils can be observed within the section. A single-layer slab construction was used in both thick-walled (up to 20% of cases) and thin-walled vessels of all categories (approx. 60–70% of all cases). The slab size is approx. 1.5 x 3.5–4.5cm (Fig. 4). In some cases the vessels' external surfaces were knocked out with a flat paddle. On the inner surface of some vessels there were various static prints, probably from a model or lining (Fig. 5). The use of coils and slabs together (coils – in the lower part of the vessel, slabs – in the upper part) was detected once at the Tell Sotto settlement.

The surfaces

The surfacesof the vessels were first treated with grass, and then sometimes with leather. In many cases lime or plaster coating was applied. Sometimes intentional burnishing is also apparent.

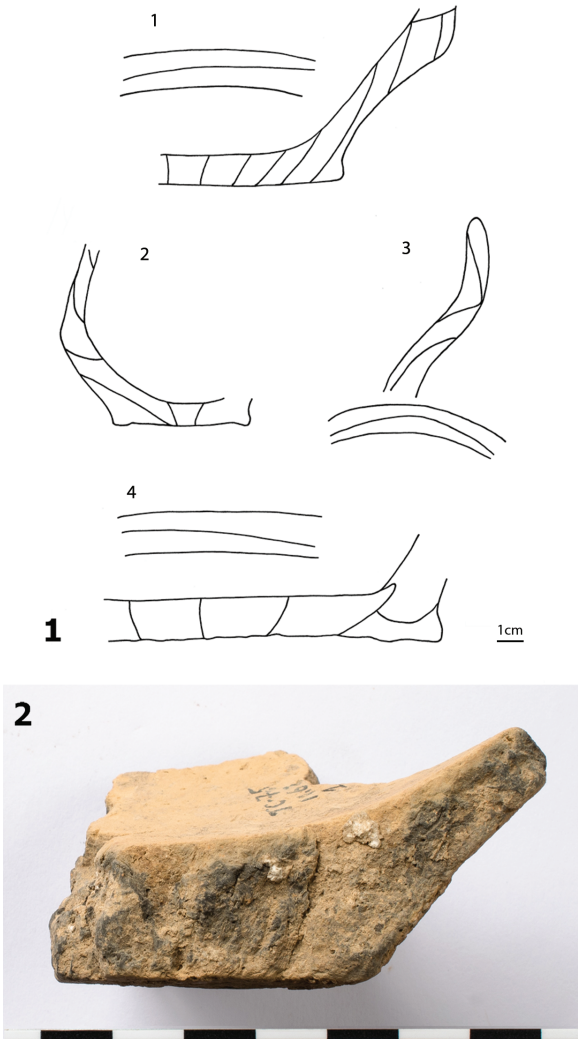

Fig. 3. The construction methods – spiral coils: 1 drawing of cross-sections of samples with spiral coils, Yarim Tepe I, level 12; 2 photo of cross-sections of samples with spiral coils. Tell Sotto, 1975, P. 62, N.1.

Firing

The middle layer of potsherds has a light grey or slightly reddish colour. The transition between layers of potsherds with different degrees of firing of is often indistinct. These features indicate that ceramic products have reached temperatures of at least 650° with a long dwell time at the highest temperature and then a slow cooling rate. These conditions are typical of pit firing but also of simple kitchen ovens, which were found at Tell Sotto (*Bader 1989.140*).

Decoration

Various appliqué ornaments (mainly on storage vessels and pots), red paint, obtained probably on the basis of ochre, and the slip from less ferruginous clay (for decorating bowls and, more rarely, pots) were used.

Ceramics of other Proto-Hassuna sites

In addition to the samples from Yarim Tepe I and Tell Sotto, ceramics samples from Umm Dabaghiyah, Tell Hazna II, Tell Sekeral-Aheimar and Tell Kashkahok II were analysed. All of them contain dung in different concentrations depending on the type of vessel: thinner vessels (jugs and bowls), from 10–20% to 20–30%, and more coarse vessels (pots and griddles), from 30–40%.

It seems that in many cases, as mentioned above, where the authors wrote about the presence of finer inclusions than straw in the ceramics of the Proto-Hassuna, it could actually have been dung temper (*Bashilov* et al. *1980.43–64; Campbell, Baird 1990. 70; Kirkbride 1972.8*). Indeed, based on the results of ceramics technology studies (*Bobrinsky 1998. 327–334, 2006.415; Petrova 2012; 2016*), we can conclude that the presence of dung was in fact the main tradition of paste preparation for the production of early ceramics in this region. With regard to construction, two different traditions are observed: coiling and mould-based slab building (evidence of which is visible on the inner surfaces of only these vessels).

Conclusion

As a result of studying all available sources (in both the literature and directly by examining fragments of ceramics), it is possible to make a conclusion about the similarity of technological ceramic traditions be-

tween the settlements of the Proto-Hassuna period located in the eastern part of Northern Mesopotamia (Jazira) and settlements located in the western part of the Zagros Mountains. The best example is the Jarmo settlement, where both similar technological traditions (the presence of dung as temper, applying lime to clay vessels), and common features in the morphology and ornamentation of vessels are documented.

The presence of dung in Jarmo ceramics from levels situated lower than the Proto-Hassuna phase (*Matson 1955.355; 1960.68*) is evidence of the deep roots of this tradition in Zagros. The presence of plant or organic matter (probable dung temper) was commonly noted by a number of researchers at settlements in Iran and Iraq (*Bader 1989.218; Bader, Le Miere 2013.516, 518; Bashilov* et al. *1980.43–64; Bernbeck 2017.101; Campbell, Baird 1990.70; Kirkbride 1972.8; Lloyd, Safar 1945.276; Maeda 1991.20; Matson 1960.68; Mellaart 1975.86–87; Nieuwehuyse 2013.125*).

Fig. 5. The static prints, probably from a model or lining. Tell Sotto, 1974, II-D-1, 220cm deep, level 3, N.I.2.a 491 KP 417962 (photo by D. A. Popova).

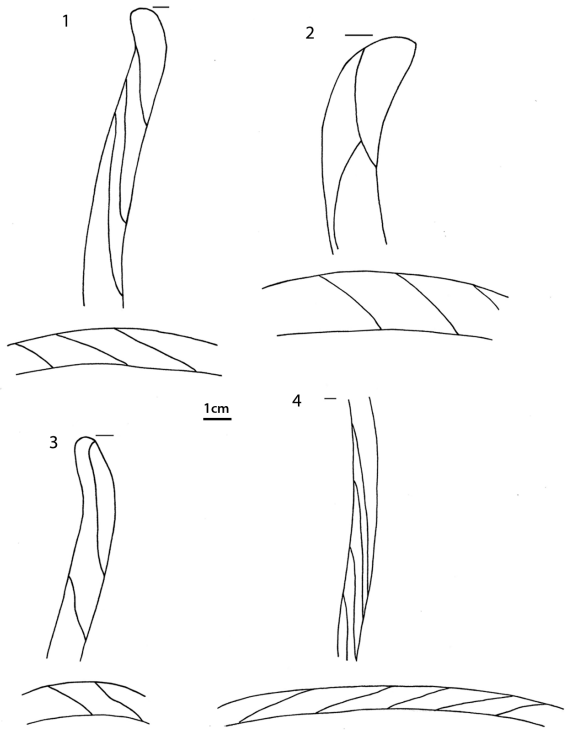

Fig. 4. The construction methods – drawing of cross-sections of samples with slabs construction.

It is also possible that there could have been a link between the Proto-Hassuna ceramics originating from Northern Mesopotamia and the organic-tempered ceramics found at the Taurus Mountain settlements. Further studies are needed to explore this matter in detail. The link between the Proto-Hassuna ceramics and the Pre-Proto-Hassuna ceramics from the territory of Syria, however, looks doubtful, because of differences in morphology and in traditions of ceramic technology, where the exclusive use of mineral temper in high concentrations has been found (*Bader, Le Mière 2013.517*).

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back to contents