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A Technology Study on the Late Neolithic Pottery of Hakemi Use, Southeastern Türkiye

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ABSTRACT
Hakemi Use is a mound settlement on the right bank of the Tigris, within the borders of Diyarbakır province in southeast Türkiye. Within the scope of the Ilısu Dam Project built on the Tigris River, field studies were carried out between 2001-2012. The existence of two periods, Late Assyrian and Late Neolithic, was determined. The main cultural deposit in the mound covers the period known as *Hassuna/Samarra* in the traditional cultural definition of Mesopotamia. Both material culture and ^{14}C results show that the settlement was inhabited between 6100-5950 BCE. Approximately 25,000 pottery sherds were collected in five building levels of the Late Neolithic Period. Comprehensive studies on these sherds continue both typologically and technologically. In this study, various recipes for pottery paste, mineral, and organic admixture (including dung), different construction methods of ceramics, including using molds (textile and skin prints have been found), and other stages of ceramics manufacturing were studied in the pottery of the Late Neolithic Period of Hakemi Use. The production technology of different ceramic groups and other contemporary Mesopotamian sites were compared.
Keywords: Hassuna, Samarra, Pottery Technology, Late Neolithic, Mesopotamia

Introduction[1]

Hakemi Use consists of two side-by-side mound settlements in southeast Türkiye, approximately 250 km from the Syrian border. These mounds, 70 km east of the modern city of Diyarbakır, are located on the Bismil Plain, on the bank of the old bed to the right of the Tigris River. Bismil Plain, which forms the flat area of the Upper Tigris Valley, has an average altitude of 550 m and is a fertile plain irrigated by the Tigris River and its tributaries. Southeast Taurus Mountains are located 100 km north of this plain, Raman Mountains 70 km east, the volcanic Karacadağ 80 km west, and the Mardin Mountains 50 km south (Figure 1). Today, the Tigris River flows approximately 100 m north of the mound.

Figure 1: The position of Hakemi Use in the Upper Tigris Valley

The excavations in the settlement were carried out between 2001-2013 by a team from Ankara Hacettepe University under the Diyarbakır Museum Directorate, with the financial support of the General Directorate of State Hydraulic Works within the scope of the Ilısu Dam Project. After the field studies were carried out for the last time in 2012, they were only carried out in the form of material studies in the excavation house and Diyarbakır Museum in the 2013 season.

Today, the mound on agricultural land is a person's private property and the cultural deposit on the surface has been badly damaged due to years of agricultural activities. Among the two-mound settlements side by side, the one on the west was named Hakemi Use I, and the existence of the Late Assyrian and Late Neolithic periods was determined. Only

1 This article was prepared within the framework of the research theme of the IA RAS "Interdisciplinary approach to the study of the formation and development of ancient and medieval anthropogenic ecosystems" (No. NIOKTR 122011200264-9)

the medieval (14th century CE) village settlement was named Hakemi Use II in the east. The mound in the west has a width of about 1.2 h. Excavations were concentrated in this mound. Existing cultural deposits in the two building levels belonging to the Late Assyrian period were found in the upper half-metter section of this 4 m settlement. The bottom five building levels were found in the 3.5 m cultural deposits, representing the material culture of Mesopotamia known as Hassuna/Samarra. Both the relative dating of the typological material culture and the radiocarbon results from the intact contexts show that the first inhabitants of the settlement settled on the flat area at the banks of the Tigris River in 6100 BCE and left the settlement in 5950 BCE, after an uninterrupted settlement approximately 150 years. Unfortunately, no reliable data could be found on the reasons for this abandonment during the excavations. However, surveys carried out by the excavation team in the region point to this abandonment originating from the Tigris. In the last years of the settlement, a natural blockage occurred in the narrow valleys beyond the Raman Mountains, causing floods in the Bismil Plain; this may have caused the abandonment. The fact that the settlements after 5800 BCE (Early Halafian period) were at least 100 m inland from the Tigris and on high terraces in the survey conducted in the region supports this view.

An area of approximately 1350 m^2 was opened in the Hakemi Use excavations, and most of the virgin soil was reached (Tekin 2020). Except for one of the architectural remains unearthed, it was determined that there was no stone foundation in all the buildings, and it was determined that the mud was built in the *pisé* technique with a wooden-like mold (Tekin 2011, 152). The buildings mainly consist of a few rooms with rectangular plans, and the doorway is rarely seen. Considering the smallness of the rooms, it is understood that the existing wall remains are the storage areas on the lower floor of the buildings, and the room/rooms that make up the living area are on the second floor.

Approximately 25,000 sherds dated to the Late Neolithic consist of four main groups. These are the *Standard Ware*, the *Dark Faced Burnished Ware* (DFBW), the *Orange Fine Ware*, and the *Fine Ware*, and the main pottery in five building levels consists of vessels collected under the name of the *Standard Ware* (Tekin 2013, 496, Tab. 44.1).

Results of Previous Studies of Hakemi Use Pottery and Its Technological Descriptions

Pottery fragments unearthed during the excavations were divided into four main groups and sub-divided according to the surface quality. *Fine Ware* is categorized into four subcategories in the assemblage of pottery based on their surface decoration: *Simple Fine Ware, Painted Fine Ware, Incised Fine Ware,* and *Samarran Pottery* (İlhan 2022; Tekin 2011,153-156; Tekin 2020, 150-151) (Figure 2). The major pottery group - the *Standard Ware* found in relatively high proportions (69-76% from different building levels), seems to have been produced in Hakemi Use or a nearby settlement. Significantly less is the pottery

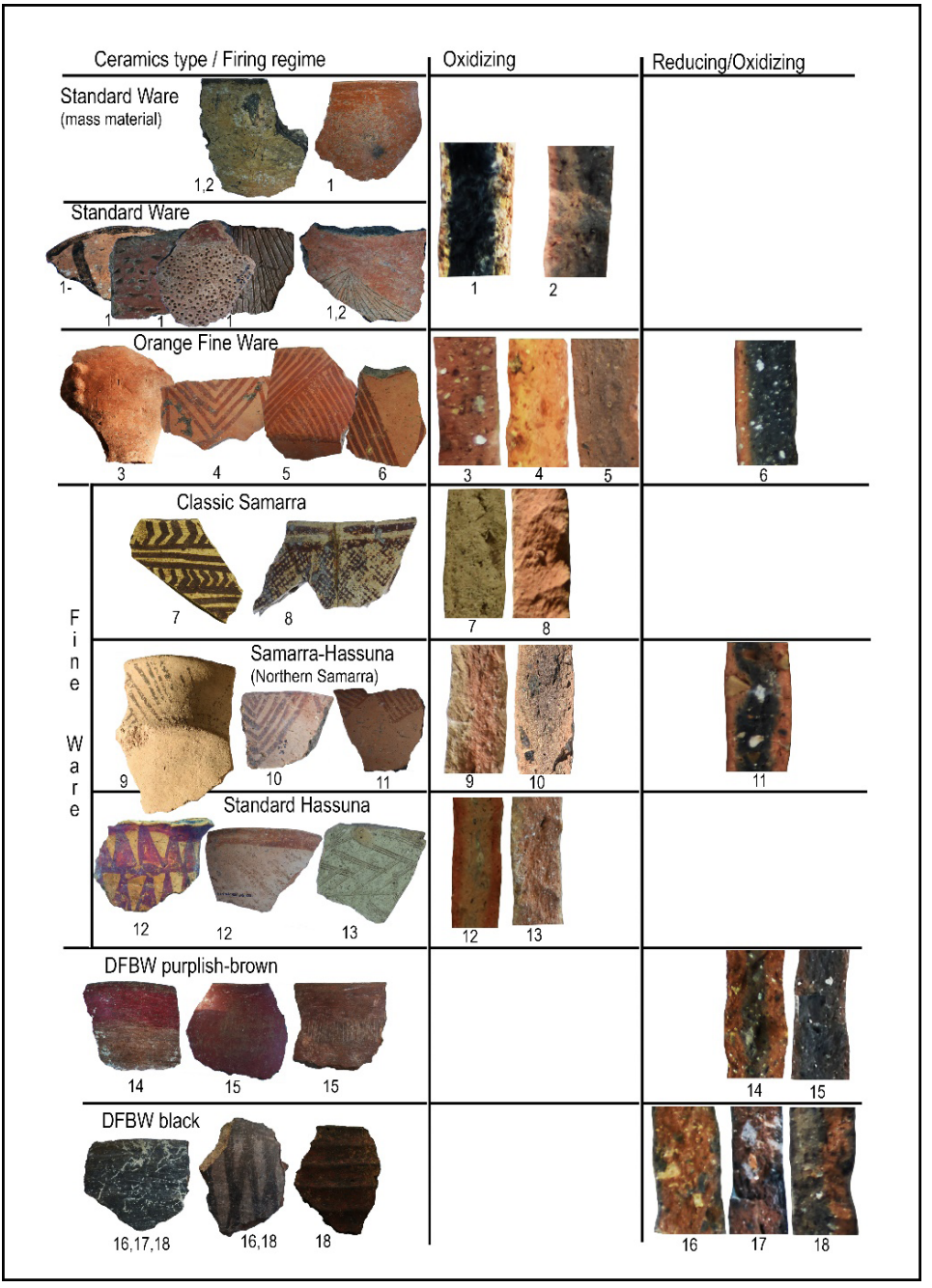

Figure 2: The main pottery groups of Hakemi Use. Numbers in this table-numbers of the cross-sections related to different ceramic types with varying variants of firing regime and mineral inclusions.

the *Orange Fine Ware* (12-13%) and the *Dark Faced Burnished Ware* (9-12%). *Samarran Pottery* is rare and limited to the upper layers, which might have been imported (Tekin 2013; Tekin 2020, 151). *Samarran Pottery* occurs only in the first and second building levels of the settlement, disappearing by the third building level. The number of *Samarran pottery* sherds found at Hakemi Use is only forty, a dozen of which are in the painted "*Classical Samarran*" style. The latter is confined to the uppermost layer. It should be noted that both the *Samarran Pottery* and the *Pattern Burnished Ware* (only in the upper two building levels) are found together and disappear simultaneously.

Standard Coarse Ware is characterized by rough surfaces that are either left untreated, wiped, or wet-smoothed; the most common surface color is buff, while some are light brown. In addition to dense plant temper, grit, and limestone temper are in the fabric of these Ware. The *Slipped Ware* – the external surface has red or reddish slip, and the majority with burnishing, but there are also samples without evidence of polish. *Incised* and *Impressed Ware,* comprising one percent of the *Standard Ware,* has two apparent variants: plain and slipped. The paste includes organic as well as sand and lime temper. The *Standard Painted Ware* (red and bitumen painted) has an extensive organic temper; their surface color is buff, and they are not well-fired, having a thick core of about a centimeter. The *DFBW* has mineral-tempered fabrics.

The vessels were fired at high temperatures, and their surfaces were well-burnished. Sub-groups were defined according to their slip colors: gray/black and purplish-brown. Several sherds within the gray/black slipped the *DFBW* group are pattern-burnished. The *Orange Fine Ware* has lime and sand inclusions; small amounts of organic temper are also present. The vessels are 4-5 mm thick and well-fired at high temperatures. Some are slipped on both surfaces. *Simple* and *Painted Fine* paste is well tempered with fine sand, lime, and organic temper. The colors range from light buff to beige. *Samarran pottery* is very fine textured. Organic temper is either absent or occurs very seldom. The vessels are all well-fired. The wall thicknesses of the sherds rarely exceed 5 mm, and the surface colors are in shades of buff (Tekin 2007, 163-166; Tekin 2008, 273-274; Tekin 2011, 153-156; Tekin 2020, 150-151).

Distributions and Studies of Different Pottery Types

The *Standard Ware* is familiar throughout Upper Mesopotamia in the period under consideration. It varied significantly in surface treatment and ornamentation but always contained many plant impurities. It could be both "Coarse" and "Fine" (Le Mière and Nieuwenhuyse 1996; Nieuwenhuyse *et al.* 2002, 43; Tekin 2007, 163-166). Other pottery types found on Hakemi Use "Fine Ware" distinguished by surface treatment, ornamentation, and fire regimes. Their main distribution is recorded in different territories. The *Orange Fine Ware* is distributed in the western part of Mesopotamia: in settlements of the Euphrates River

and its tributaries – Tell Sabi Abyad (Le Mière and Nieuwenhuyse 1996, 173), Tell Chagar Bazar (Cruells 2008, 676), Tell Boueid II (Nieuwenhuyse *et al.* 2002) and others, as well as at the foothills of the Taurus – Gre Fılla (Ökse 2021, 313). *Painted Fine Ware* is similar to the *Hassuna Standard Painted Ware,* which is common in the eastern part of Upper Mesopotamia – Tell Hassuna (Lloyd and Safar 1945, 279, Fig. 11-14) and Yarim Tepe I (Merpert and Munchaev 1973). *Incised Fine Ware,* as a variant of *Standard Hassuna pottery*, is most widespread in the foothills of Northwestern Zagros –Tell Mattarah (Braidwood and Howe 1960, 26, 35-37; Odaka 2019, 252-259), Shaih Marif II settlement (Odaka *et al.* 2019, 72-76). *Classic Samarran pottery* is conventionally considered specific to Middle Mesopotamia – Tell es-Sawwan (Ippolitoni 1970-71) and Chogha Mami (Oates 1969). But the "northern style" of *Samarra* (Northern Samarra)[2] (Gut 1995, 191) is defined in many sites of Upper Mesopotamia: Tell Chagar Bazar (Cruells 2008, 675), Coba Höyük/Sakçagözü (Taylor *et al.* 1950, 56), Tell Baghouz (Nieuwenhuyse 1999; Nieuwenhuyse *et al.* 2001; Odaka 2003, 25-27), Tell Sabi Abyad (Le Mière and Nieuwenhuyse 1996), Tell Halula (Cruells 2008, 675) and others. *Northern Samarra* type is difficult to distinguish from the *Painted Fine Ware/Standard Hassuna* ceramics: the presence of ornamentation characteristic of *Standard Hassuna*, but the morphology is typical for *Samarra*. The *Dark Faced Burnished Ware* was initially defined at Tell el-Cüdeyde (Tell al-Judaidah) in the Amuq Plain (Braidwood and Braidwood 1960, 73). It is widely distributed in littoral areas of the Mediterranean in Northern Syria and Cilicia (Çukurova). The most famous site presenting this ceramic type is Yumuktepe (Mersin) (Balossi Restelli 2006).

Methodology

The technological analysis includes studying different stages of pottery technology: raw materials, pottery paste, construction methods, surface treatment, and firing. The study is based on a freshly broken cross-section; the relief makes it possible to distinguish the details of impurities better and joints between construction elements.

Raw material and pottery paste: Different types of clay ferrugination and the presence of natural inclusions were recorded. We suggest mineral inclusions are natural if they are less than 0.2 cm and have rounded outlines. Mineral inclusions were added intentionally if they were more than 0.2 cm, not single, and had acute-angled outlines (Bobrinsky 1999; Nieuwenhuyse 2007). In studied ceramics, it can be detected following organic inclusions: dung and straw (Bobrinsky 1999, 18-19, 32-33, 41-44, 86; London 1981; Rice 1987, 82; Tsetlin 2003). Significant quality of plant residues of 0.2-1 mm wide and some millimeters long can tell us about the presence of dung (Petrova 2019; for more detail: Petrova, in press).

2 For "*Northern Samarra*" also use the terms "*Samarra-like*", "*Samarra derivate*", "*Samarra-influenced"* (Cruells 2008, 673, 675).

Construction methods: It is possible to judge construction methods by the presence of traces left unsmoothed on the ceramic surface, changes in the relief of the vessel walls at the places of joints of sequential elements, and the presence of mold or a link between the vessel and the mold. The fact of junctures inside vertical and horizontal cross-sections indicates the manufacture of the vessel from various clay elements (coils, slabs, bands) (Bobrinsky 1978, 174-184; Roux 2019, 164-166; Rye 1981; Shepard 1956, 184; Vandiver 1987, 30-31): coils - the extended slightly inclined line of juncture in the horizontal cross-section, separation into many separate parts by horizontal or oblique or arcuate short joins in the vertical cross-section; slabs - vertical and horizontal cross-sections are divided by junctures at a large angle to the walls of the vessel into many separate parts; and bands -a single horizontal joint along the entire length in a horizontal cross-section, long inclined or curved joint in a vertical cross-section (Bobrinsky 1978, 175-176; Rice 1987, 125; Vasil'eva and Salugina 2010, 72-87; Petrova 2021).

Surface treatment: Various types of smoothing, burnishing, and additional clay coating are determined. In the latter case, characteristic rounded (micro) cracks appeared on the vessel's surface (Rye 1981, 41, 54; Shepard 1956, 67), resulting from uneven shrinkage of the clay, composing the elemental paste composition and coating. We divided the concept of "slip" into two types: "coating of the same clay" of varying thickness - a kind of clay similar to the main raw material without using additional admixtures; while "slip" - applying of the same clay mixed with a pigment or just different clay.

Firing: The firing regime, duration, and temperature are determined based on the thickness of the oxidized and not completely oxidized layers and the quality type of the transition of a margin between them (sharp or gradual) in the cross-sections, as changes in intentionally mixed or natural inclusions. The color of the surface determines the firing atmosphere: orange tones of varying intensity are characteristic of the oxidation regime, and gray tones are characteristic of the reduction regime (Balossi Restelli 2006, 102-103; Bobrinsky 1999, 93-95; Nieuwenhuyse *et al.* 2001; Rye 1981, 118).

Technological Analysis of Hakemi Use Pottery

Our analysis aimed to determine the main technological characteristics that distinguish different types of ceramics in the settlement and to compare the obtained technological knowledge with the data available on other settlements for the subsequent reconstruction of the cultural traditions of the ancient population. One hundred eighty ceramic fragments from the Hakemi Use settlement were studied from different ceramic types from all five building levels. Ceramics will be considered into main groups are the *Standard Ware* (Figure 2.1, 2), the *Orange Fine Ware* (Figure 2.3-6), the *Fine Ware, and DFBW* (Figure 2.14-18), but definable types of the *Fine Ware* will be considered separately "*Classic Samarra*"

(Figure 2.7,8), "*Northern Samarra*" (Figure 2.9-11), the *Standard Hassuna* (Figure 2.12,13). According to the studied ceramics, the most numerous groups of *Standard Ware* consists of vessels of different categories (bowls, jugs, pots, storage vessels, basins, husking trays). The wall thicknesses are between 9 and 18 mm (average of 11-13 mm). All other ceramic groups belonging to tableware (bowls, pots, jugs) are more thin-walled - from 4 to 10 mm. Open forms prevailed among the *Orange Fine Ware* and *Samarran* ceramics, among *DFBW*-closed forms.

Raw Material

It is possible to distinguish some groups of raw materials in the *Standard Ware* group. In most cases (mass material for the settlement), ferruginous, slightly - sandy clay with an admixture of mica is observed. In other types, sometimes ocher, quarts, and lime were fixed in small amounts. The last one is connected with painted types (Figure 2.1-2). In the *Orange Fine Ware*, different variants of ferruginous raw material are noted. It occurs in lime in different concentrations (Figure 2.3, 4, 6) and sometimes big size (up to 0.5 mm), but always has rounded outlines (Figure 2.6). Also, it can fix ocher and sometimes mica. Ceramics of the *Classic Samarra* type were from two kinds of clay: supposedly unferruginous (but there is another explanation, which will be discussed below) without visible inclusions (Figure 2.7) and slightly ferruginous with tiny lime in low concentration (Figure 2.8). In the *Northern Samarra* type, it is also possible to distinguish some variants of clay. It contains lime in different concentrations and sizes of mineral particles, but always with rounded outlines (Figure 2.9-11), sometimes with additions of mica and ocher. Ceramics of the *Standard Hassuna* type also have different clays: partly just lime (in different concentrations but always very small) (Figure 2.13), partly just with mica, and partly with a mixture of lime, mica, ocher, and quarts. In *DFBW*, lime is presented in all samples in different concentrations (mostly high) and minimal size. Also, in some samples, another mineral component could be detected (possibly ocher and some others) (Figure 2.14-18).

Pottery Paste

Two types of intentionally added inclusions are noted in the pottery paste of studied ceramics: organic and mineral.

Organic inclusions are represented by an admixture of dung and coarser plant inclusion (crushed straw) in various concentrations. Dung was noted in all samples of the *Standard Ware*, and its concentration in these products is very high - from half to a third of the volume of the pottery paste, but gradually decreases. It can be said that the dung (from cattle, supposedly) was added there in a slightly dried state since, along with strongly curved prints of the plant (Figure 3.3a), prints with breaks made in a dry state are recorded (Figure 3.3b). Also, dung was noted in a minor concentration in separate fragments of the *Orange Fine Ware* and the *Standard Hassuna* ceramics (no more than 1/10 from all volumes of pottery

Figure 3: The trace of dung in the core

paste). At an even lower concentration, an organic impurity of minimal size was noted in almost all samples of the *DFBW*.

The admixture of straw is represented by larger lamellar plant remains, from 2-3 mm or thicker, most likely associated with the leaves or stems of plants. It is sometimes fixed in the

Standard Ware, supposedly with the combination of dung, and in some cases of *Coarse Ware* without any ornamentation, it was used just straw.

Among intentionally mixed mineral inclusions, is basalt, which is fixed in some fragments of *Northern Samarra* type of ceramics (Figure 2.10). It can also be found in the *Standard Ware* (different types). Different basalt variants were detected (colors and composition: homogeneous and with inclusions) even in one fragment (Figure 4.4-5). Basalt is always combined with clay, which includes an admixture of mica. We also detected beige intentionally added mineral inclusions fixed in *Northern Samarra* type (Figure 2.11), possibly in the *Orange Fine Ware*. Black and light gray intentionally added minerals were found in *DFBW* (Figure 2.16-17).

Construction Methods and Forming

Different construction methods the *Standard Ware* were discovered. In the lower building levels, it was made using coils and short bands or elongated slabs. In both cases, vessels were made accessible – without any molds[3]. They were constructed with elongated slabs in two layers in the upper levels, seen from the multilayer flat junctions, dividing the cross-section into two parts (Figure 5.4-5). Large cracks sometimes occur on the outer or inner surface, passing along the boundaries of the slabs (Figure 5.3).

The same method is fixed in the *Orange Fine Ware* (Figure 6.8-10) and all other *Fine Ware* types: *Classic Samarra* (Figure 6.1-5), *Northern Samarra* (Figure 6.6-7), and the *Standard Hassuna* (Figure 7). The size and form of elements could be varied (Figure 6.3-4). The layering is visible in the break of the fragments related to *Classical Samarra*. The vessel was thrown into apparently incorrect high-temperature firing, as a result of which the clay slabs parted and a void formed between them (Figure 6.5). Also, the presence of various clay structural elements can be determined by the presence of open surfaces of lower elements (Figure 6.6-7). Unfortunately, given the paddling and a dark gray cross-section, it is difficult to say something about the clay elements used for making *DFBW*.

Regarding two-slab constructions, it can be assumed that this technique was used to strengthen the joints while paddling on the mold. We have evidence of mold mainly on the inner surface from different materials: skin, wicker prints of thin and rude textiles, or wicker. We can see marks from pulling the bag (thin textiles?) in the *DFBW* and the *Orange Fine Ware* on the inside under the rim (the rim was stuck on top) (Figure 8). It's possible to suggest the bag was used during the construction of *Standard Painted* and *Incised Ware* - several protruding lines are fixed on the inner side, radiating from the rim. The material's contraction creates waviness (Fig. 9.2a). It can be supposed to be the imprint of the cord (Figure 9.2b). In one case, bag prints were found on the outer surface of the *Standard Coarse Ware* (Figure

3 This will be discussed in more detail in the next article.

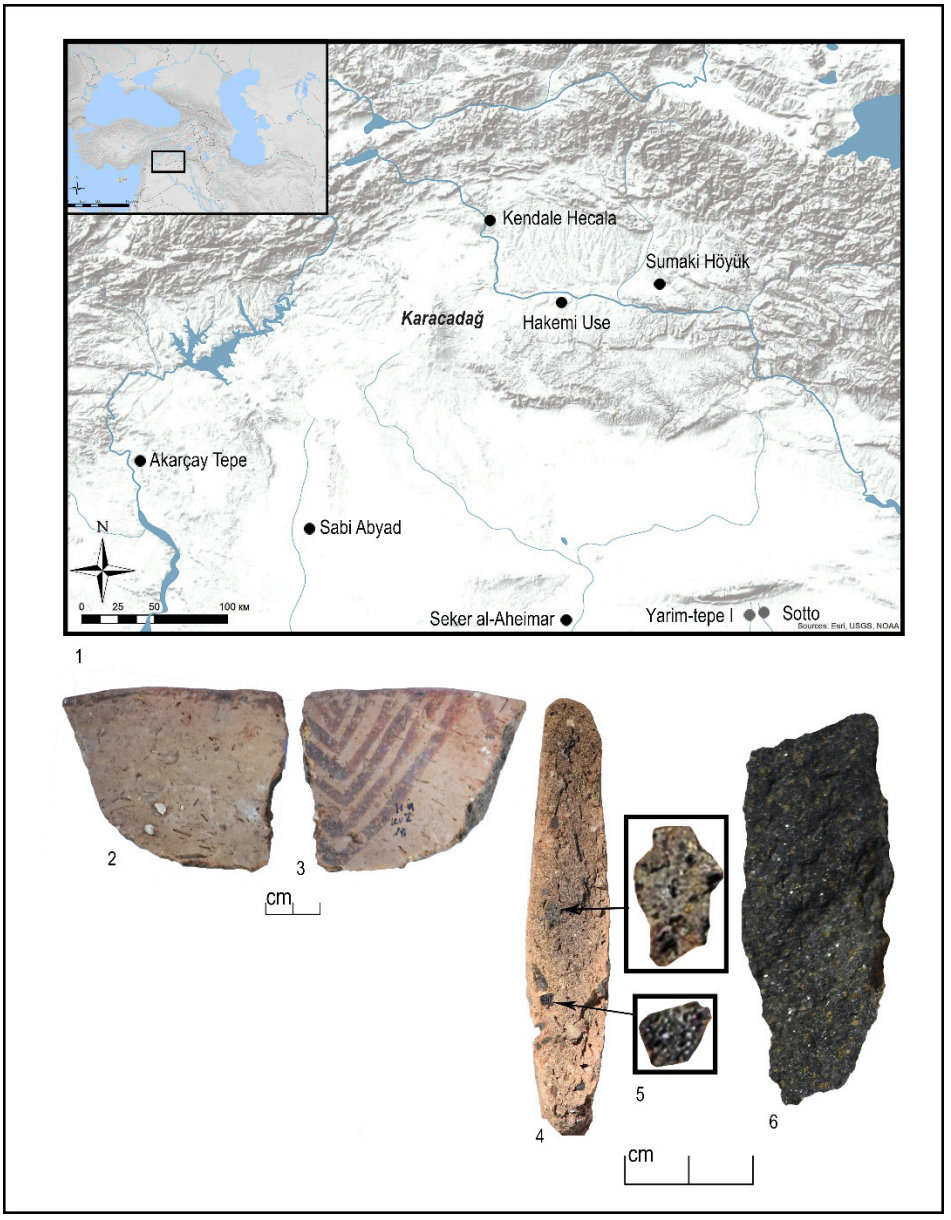

Figure 4: The basalt tempered

9.3). Wicker or knitted prints are located on the inner surface of the *Orange Fine Ware* (Figure 9.5-6). A skin mold on the inner surface of the *Standard Hassuna Ware* (Figure 7.2-3). In all considered cases, these bags could be either an independent mold filled with any soft material or a link between the mold and the clay vessel.

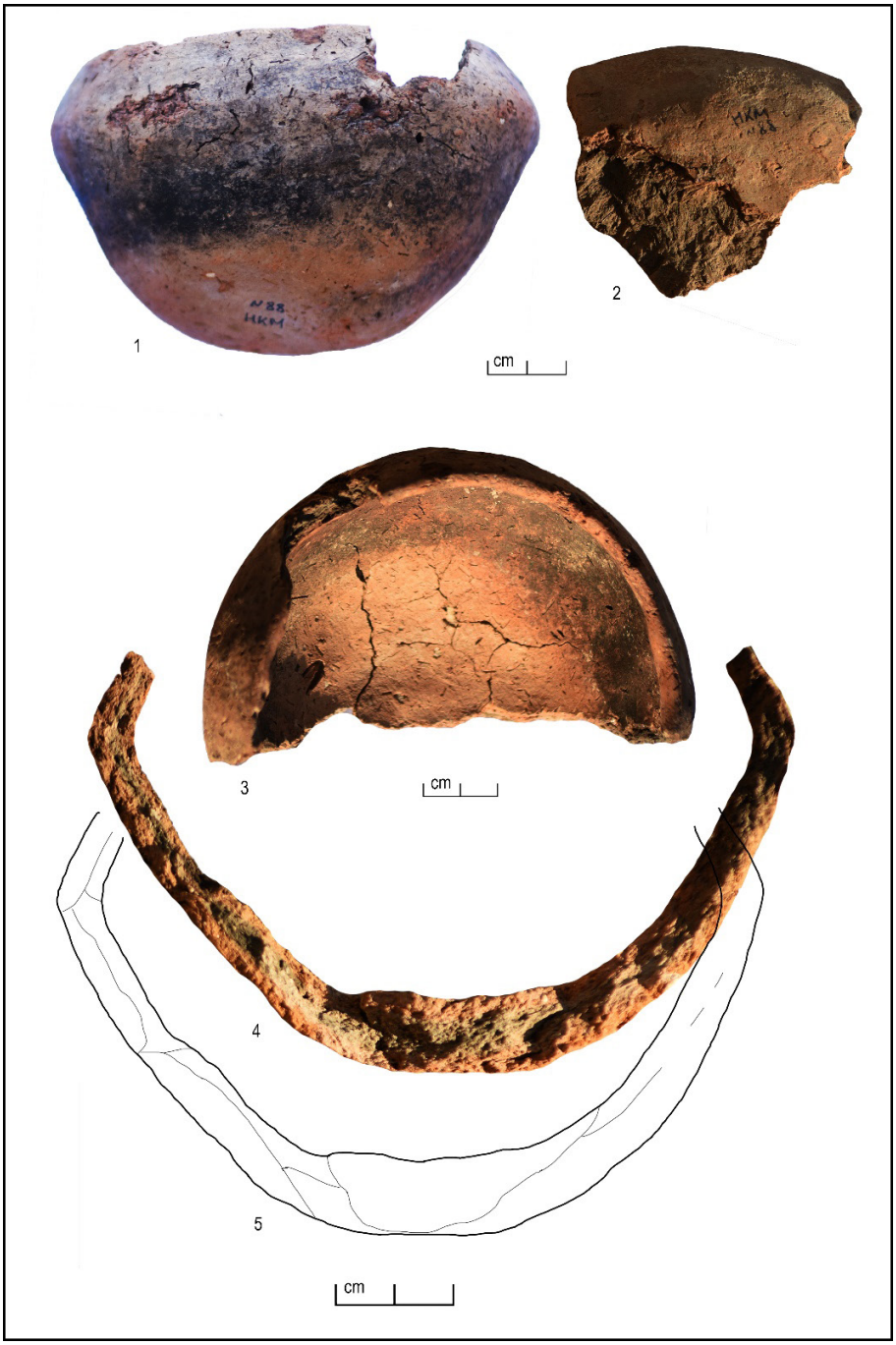

Figure 5: Two-layer slab construction in the *Standard Ware*.

Figure 6: *Samarran (1-7)* and the *Orange Fine Ware (8-10), made with slabs.*

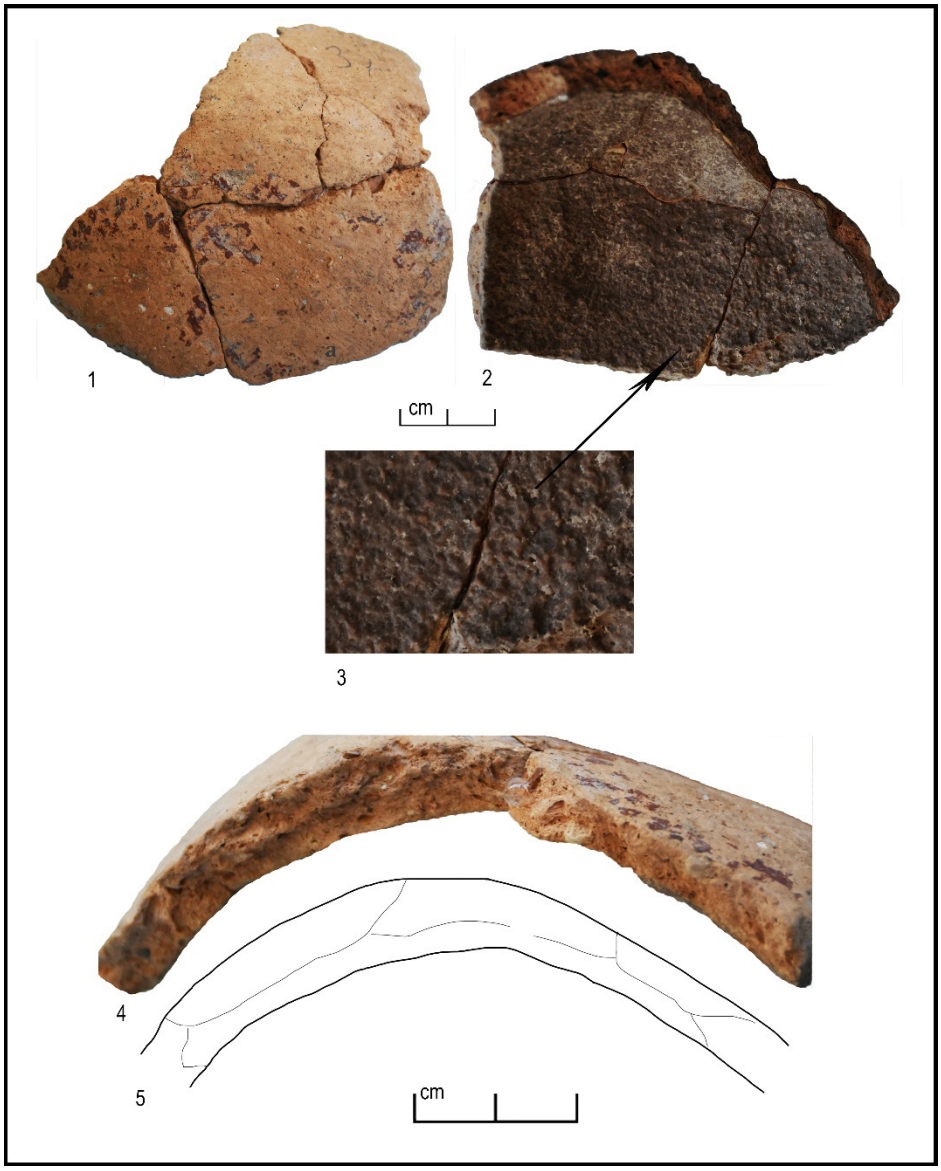

Figure 7: The prints of two-layer slabs in the horizontal cross-section (4, 5) and skin mold (or link) (2, 3) on an inner surface of *Standard Hassuna Ware*

Surface Treatment

In most cases, on the surfaces of the *Standard Ware,* the *Orange Fine Ware*, and the *Northern Samarra,* fixed additional covering with the same clay was found. This layer peeling (Figure 10.2, 7; 5.2), curly cracks of this layer (Figure 10.5; Figure 5.1), and small

Figure 8: The prints from pulling the bag (thin textile?) in *DFBW* and *Orange Fine Ware*

curly losses of this layer were found along the cracks (Figure 10.9). Most often, the clay covering is combined with dung in pottery past, which is visible under this layer. It could be suggested that vessels containing the dung in the pottery paste in high concentrations were deliberately covered with an additional layer of clay, probably to reduce the porosity. Cases of using a slip-clay solution that differs from the raw material's main composition are rare: just in instances, the *Standard Hassuna*. It was the admixture of clay with light pigment

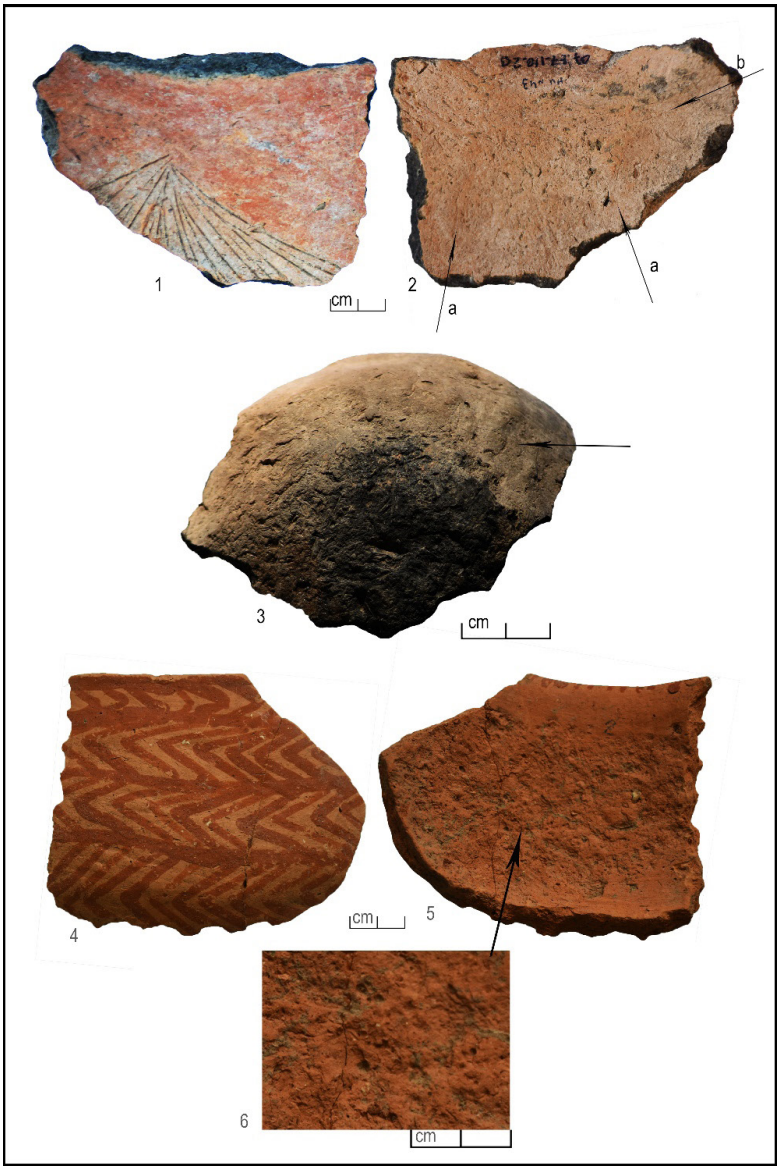

Figure 9: The traces of mold on the *Standard Ware* and *Orange Ware* (wicker prints knitted link)

(Figure 10.1). In two cases, it could suggest the presence of red slip (clay + pigment) in the *Standard Ware*. But the mostly red color is achieved by burnishing on a hard-dry surface, sometimes covered with red paint.

Another prevalent surface treatment is burnishing, which reduces porosity and increases

Figure 10: The traces of clay covering

moisture resistance (slightly). Burnishing could be carried out on an almost dry surface (the so-called "leather-hard" state). This situation is fixed on the *Standard Ware*, and burnishing gives a "red" effect (Figure 11.1). On the *DFBW,* both burnishing on a "leather-hard" surface and a not completely dry were found - while grooves from the polishing tool remained on the surface (Figure 11.2). The complete covering of the surface with burnishing is fixed in not big-size vessels of *Standard Ware* and *DFBW* ceramics (Figure 11.1-2). Burnishing is

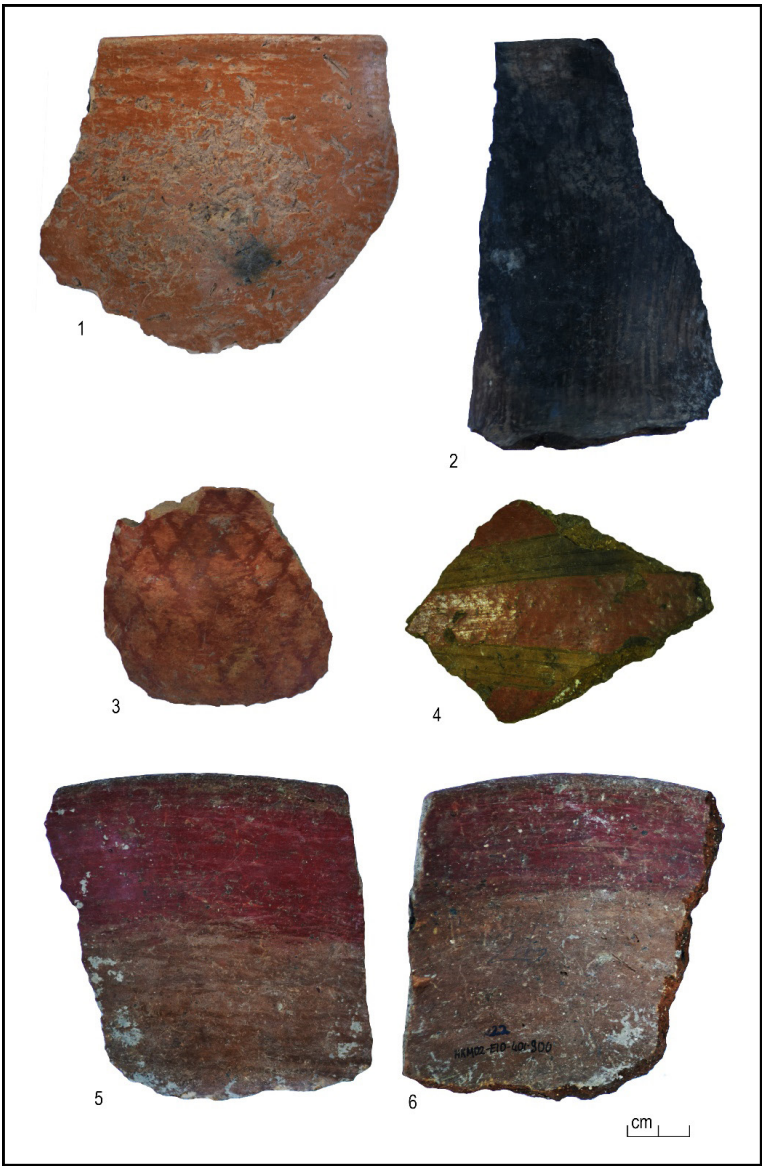

Figure 11: Surface treatment (burnishing).

like ornamentation on different ceramic types (Figure 11.3-6). Smoothing of the surface with various tools (presumably fingers, grass, cloth, and stone tools) is also periodically recorded.

Firing

During the firing of the *Standard Ware* group, an oxidative atmosphere was used. In most

cases, the *Standard Ware* ceramics of all types were exposed to high temperatures (700-800°C) for a short time, after which it was abruptly removed from the fire. This is evidenced by thin oxidized (orange) layers near the surface, as well as a thick (black) inner layer (core) that has not been exposed to high temperatures (Figure 2.1). In some cases of the *Standard Ware*, the use of these temperatures was longer, and the vessel was under their influence for a longer time, which gives a gradual transition of colors from orange to light gray (Figure 2.2).

The *Orange Fine Ware* and the *Fine Ware*, in most cases, were exposed to high temperatures for a long time (Figure 2.3-5, 7-8, 9-10, 12-13), in some cases exceeding the specified temperature values for a short time resulting in a highly oxidized (bright orange) layer near the surface (Figure 2.12). Interestingly, the firing was fixed in *Classic Samarra* (Figure 2.8), *Northern Samarra* (Figure 2.9), and *Standard Hassuna incised* (Figure 2.13), when light layers of different thicknesses appeared near the surface of the vessel subjected to high-temperature oxidative firing. This situation is highlighted by "self-slip" - the covering of the vessel, which "consists of the same material that constitutes the body clay", which "results from carefully wiping the vessel surface". It also noted that this "treatment brings the finer particles and salts present in the clay to the surface. In combinations with neutral firing conditions, this may contribute a pale surface color" (Rice 1987, 151; Nieuwenhuyse 2007, 70). In cases studied by us, the suggestion that salts present in the clay rise to the surface due to treatment is contradicted by the fact that the lighter layers of the cross-section near the outside and inside surface of the vessel wall are of different thicknesses. The outer layer is always thicker. We assume that this situation is related to the achievement of high firing temperatures, probably around 1000°C, when the next stage should be the greening of the surface, which is known on the ceramics of the *Standard Hassuna* and the *Samarra* (Nieuwenhuyse *et al.* 2001, 153; Petrova 2022, 34). It is possible that the ceramics of *Classical Samarra* were also subjected to such firing, only for a longer time (Figure 2.7). The desired color contrasts were achieved by firing the vessels at sufficiently high temperatures for the pigments to melt in alternating reducing-oxidizing circumstances (Courtois and Velde, 1984; Nieuwenhuyse *et al.,* 2002, 40).

We discovered exciting groups of *Orange Fine Ware* and *Northern Samarra Ware*, where the vessels were initially fired in a reducing atmosphere (without access to oxygen), as their core has an intense dark gray-blue core (not light gray) (Figure 2.2), as in the case of gradual firing in an oxidizing atmosphere, and not be black, and as in the case of full firing in an oxidizing atmosphere, when the core remains not fully fired (Figure 2.1), and then subjected to oxidized firing - resulting in an outer orange layer (Figure 2.6,11).

DFBW black was mainly fired in a reducing/oxidizing atmosphere from the beginning because its core has a dark orange hue. But in the end, such vessels were subjected to short-term firing in a reducing atmosphere (Figure 2.16-18). *DFBW purplish-brown*,

on the contrary, has a core, indicating the initial reductive firing, but at the end of it, the atmosphere became reductive-oxidative (Figure 2.14-15). However, the exposure time to such final temperatures was different (oxidizing or reducing), which is also the reason for layers of different thicknesses near the surface. In the case of prolonged firing in a reducing atmosphere, a dark gray-blue color is also fixed (compare Figure 2.15 with Figure 2.6 and Figure 2.11).

General Discussion of Technological Stages

In general, the collected data showed a wide variety of cultural traditions in the field of ceramic technology, which provided many opportunities for further study and raised many interesting questions. For example, mica is a characteristic mineral inclusion of the raw materials of the Taurus foothills and is the typical impurity of the Hakemi Use *Standard Ware* mass material clays. It is not common in *Standard Ware* pottery originating from the more southerly settlements of Upper Mesopotamia – Tell Sabi Abyad and Tell Boueid II, where the natural clay inclusions are calcium carbonate of microfossil origin and quarts (Nieuwenhuyse *et al.* 2002, 44; Nieuwenhuyse 2007, 74). The presence of a significant amount of natural admixture of limestone in such ceramic types as *Orange Fine Ware, Standard Hassuna,* and *Samarran* is not surprising and points to the Mesopotamian plain (Nieuwenhuyse 2007, 85; Petrova 2021). But the existence of mica in the *Orange Fine Ware* and the *Samarra Ware* in Hakemi Use ceramics and in the *Samarra Ware* from Tell Boueid II (Nieuwenhuyse *et al.* 2002, 40) gives rise to different assumptions: some of the pottery was imported from the southern regions, but some could have been produced in the foothills of Taurus. It is also interesting that on the Tell Sabi Abyad settlement, the *Orange Fine Ware* ceramics and Hakemi Use were made from different types of clay: both with limestone (microfossil origin) and without it (Nieuwenhuyse 2007, 74).

Of no less interesting is the study of intentionally included impurities. The presence of dung in ceramics connected us with Upper Mesopotamia and Zagros, where this tradition was spread in the second half of the 7th Millennium BCE. But in the period under study, it has been recorded everywhere in the eastern and southern parts of Fertile Crescent (Petrova 2019; in press). The presence of the dung is fixed in the *Standard Ware,* the *Orange Fine Ware,* and the *Gray-Black Ware*[4] ceramics of Tell Sabi Abyad settlement of this period (Transitional or Proto-Halaf in term of Sabi Abyad) and Tell Boueid II (Nieuwenhuyse *et al.* 2002, 43, 55; Nieuwenhuyse 2007, 75). By the definition O. Nieuwenhuyse, no vegetal temper was added to *DFBW* pastes from Tell Sabi Abyad (Nieuwenhuyse 2007, 86). It is different from Hakemi Use data. In addition to dung, more significant plant residues are often recorded in the coarse vessels of all named settlements. However, their interpretation

4 *Gray-Black Ware* – ceramic type close to *Standard Ware with* grey surface colour (Nieuwenhuyse 2007, 75).

is difficult. The only case when extensive plant remains can be confidently associated with threshing waste was recorded at Tell Koshak Shamali, where many impressions of husks were noted in ceramics (Le Mière 2001, 182; Petrova in press).

The study of specially added mineral impurities can also help discover the place of origin of various ceramics types. For example, basalt is relatively common in the Taurus foothills and nearest regions (Figure 4). It is found in *Northern Samarra* and, possibly, in the *Standard Ware* of Hakemi Use pottery. Coarse admixture of basalt to ceramics is known as the first half of the 7th mil. BCE on this territory: *Mineral Coarse Ware* – Kendale Hecala (Ökse 2021, 309) the *Early Mineral Tempered Pottery – Sumaki Höyük (*Erim-Özdogan 2011, 29; Gündüzalp 2021, 30). A small admixture of basalt is also recorded in ceramics of this time in Akarçay Tepe (Cruells *et al.* 2017, 31) on the river Euphrates and its tributaries: Khabur River – Tell Seker al-Aheimar (Basalt Tempered Ware) (Nishiaki and Le Mière 2017, 46); the Balikh River – Tell Sabi Abyad I and II *Early Mineral Ware* (EMW) (Nieuwenhuyse *et al.* 2010, 77). In the "Transitional" period at Hakemi Use, basalt-temper is also noted in *Mineral Coarse Ware* type, among others, deliberately added temper in Tell Sabi Abyad (Nieuwenhuyse 2007, 80). Not far from the Hakemi Use settlement, numerous outcrops of basalt are associated with the activities of the volcano Karacadağ (Lustrino *et al.* 2012) (Figure 4). Also, it's possible to add that when basalt is combined with an admixture of mica, it indicates the local origin of ceramics. A detailed study of the mineral impurities composition in the future will help with different questions, including understanding *Northern Samarra* ceramics.

We also documented intentionally added dark (black and light-gray) mineral inclusions in *DFBW* from Hakemi Use. Some of them are probably amphibole[5], which were in the *DFBW* "Pre-Halaf" and "Transitional" periods of Tell Sabi Abyad settlement (Le Mière and Nieuwenhuyse 1996, 126, 147; Nieuwenhuyse 2007, 52, 82) and Boueid II (Nieuwenhuyse *et al.* 2002, 62).

In the *Orange Fine Ware* paste of Tell Sabi Abyad and Tell Boueid II ceramics, we documented large (more than 2 mm) and angular to sub-angular orange, reddish-orange, dark-gray, and black colored inclusions, mudstone, sandstone, and calcium-carbonate particles (Nieuwenhuyse *et al.* 2002, 55-56; Nieuwenhuyse 2007, 86). In studying *Orange Fine Ware* from Hakemi Use, reddish-orange inclusions (ocher?) and calcium-carbonate particles (lime) look like natural inclusions and can be more extensive but consistently rounded outlines. But we also documented beige (or light orange) angular inclusions, which can be intentionally added.

The study of construction methods also can tell us about relations between populations of the region, in studied period coils noted in ceramics from Tell Halula (Calvo *et al*. 2018, 158)

5 Deposits of amphibole is hundreds of kilometres of Sabi Abyad (Nieuwenhuyse 2007, 52, 82).

and Tell Sabi Abyad. In *Standard Ware*, *Gray-Black Ware*, and *Mineral Coarse Ware*. For *Orange Fine Ware* and *Samarra Ware,* the construction method is described as follows "the base was pressed out in a mold, after which the wall was built with coils" (Nieuwenhuyse *et al.* 2002, 45; Nieuwenhuyse 2007, 77, 79, 80, 86). The last method is also suggested for the *Samarra Ware* from Tell Baghouz (Nieuwenhuyse *et al.* 2001) and Tell Boueid II (Nieuwenhuyse *et al.* 2002, 39). Along with slab construction in two layers on a base mold, coils are also noted for *Proto-Hassuna* and *Archaic Hassuna* pottery in the eastern part of the Fertile Crescent. During the *Standard Hassuna* period, coils almost wholly disappeared in this area. Ceramics of the *Standard Hassuna* and *Samarra* are made using a base mold using a two-layer slab construction (Petrova 2021; Petrova 2022).

The usage of the mold was found in the manufacture of *Samara* ceramics in all studied cases (Nieuwenhuyse *et al.* 2001; Nieuwenhuyse *et al.* 2002, 45; Nieuwenhuyse 2007, 77, 79, 80, 86; Petrova, 2022).

Construction methods of ceramics, referred to as the *Standard Ware* require a more careful study in various territories since they can differ significantly and testify to different relationships. In Hakemi Use, we documented three construction methods in the *Standard Ware*. Coiling and making vessels from elongated slabs or short bands without mold, were found in the lower part of the settlement. On the upper level, we also discovered a two-layer slab construction of *Standard Ware* vessel on a base mold. Possibly it happened under the outside influence because this method is also fixed on ceramics of *Orange Fine Ware*, the *Samarra,* and the *Standard Hassuna* from Hakemi Use. It may be indirect evidence of the direct contact of the bearers of different technological traditions and that ceramics came to the settlement not only in finished form.

We found the prints of the mold (or link to the mold) of different types on Hakemi Use: from the skin, coarse textile, and possibly thin textile (bag). Such prints are known on the ceramics of Upper Mesopotamia from the Proto-Hassuna period (Nieuwenhuyse *et al.* 2012, Fig. 4, 5; Berghuis 2018; Petrova 2019, Fig. 5). Weaving prints are also known on the lid of a vessel originating from Hakemi Use (Tekin 2017, Fig. 20).

Details of surface treatment, require clarification, especially the question associated with different types of additional clay coating of the vessel surface. The presence of slip (red slip or lightly-colored 'self-slip') was found on Tell Sabi Abyad and Tell Boueid II ceramics *Standard Ware,* sometimes *Gray-Black Ware* and *Orange Fine Ware* (Nieuwenhuyse *et al.* 2002, 56; Nieuwenhuyse 2007, 76, 79, 86). We also assume the presence of an additional clay coating on these types of vessels. Still, we propose to single out the coating from the same clay and the slip itself (as a changed composition or different from the composition of the clay from which the vessels were made). Previous authors have probably used the

term “wash” for the first case. But it seems unfortunate since “wash” involves a skinny clay coating highly diluted with water. While on the ceramics we studied, the clay coating is thick enough to cover all inclusions (organic and mineral), often in high concentrations.

Also, explaining the “dark” surface color of the *DFBW* presents a challenge. Le Mière thinks it is generally not a firing result, but it depends on the clay used. Also, she noted that these “vessels were often slipped, which gave a bright, cherry-red color” (Le Mière and Nieuwenhuyse 1996, 126-127). The same is suggested for the *DFBW* from Tell Boueid II (Nieuwenhuyse *et al.* 2002, 62). But for Tell Sabi Abyad *DFBW* ceramics, Nieuwenhuyse noted that some part of it was fired in reducing circumstances, including *Pattern-Burnished Ware* (Nieuwenhuyse 2007, 82-83). F. Balossi Restelli suggested that the dark color of the *DFBW* surface on ceramics from Yumuktepe, both modern for Hakemi Use and later periods, occurred for some reasons: the reduced firing regime, the covers with grits and very watery wash (Balossi Restelli 2006, 19). The ceramics of *DFBW* that we studied (with the black and purplish-brown color on the surface) Hakemi Use don’t show any traces of slip. In this regard, we also want to mention that burnishing is the main characteristic of the *DFBW* (Balossi Restelli 2006, 18; Nieuwenhuyse 2007, 79). It gives a more intense color on the surface: in the case of more ferruginous clay in the oxidized regime, it will be red; in the case of the reductive regime - it will be black.

Studying the details of the firing condition also sets us the vector for searching for ceramic bonds. The oxidative firing regime is typical for the eastern part of the Fertile Crescent. It was used in *Proto-Hassuna* and *Hassuna* ceramics (Petrova 2021; Petrova *et al.* in press), *Orange Fine Ware*, and most *Standard Ware* (Nieuwenhuyse 2007, 76, 86). The reducing firing regime is mainly known in the western part of Upper Mesopotamia and the Mediterranean coast (Balossi Restelli 2006). It is fixed in *Gray-Black Ware, DFBW,* and *Mineral Coarse Ware* in Tell Sabi Abyad. Nieuwenhuyse noted the use of different firing regimes in *Gray-Black Ware* and *DFBW* (Nieuwenhuyse 2007, 79). This is also typical on *DFBW* from Hakemi Use. And just about 20% of ceramics from Yumuktepe are fired in reducing atmosphere (Balossi Restelli 2006, 18).

Interesting is the existence in the collection of Hakemi Use ceramics groups of the *Orange Fine Ware* and the *Northern Samarra* types, initially fired in a reduction firing, and then experienced a reducing atmosphere. This may indicate their Western connections. It was noted already that the main features of *Samarran* pottery found at Hakemi Use are similar to that of the southern regions (Nieuwenhuyse 1999; Nieuwenhuyse 2000); however, there are still some differences between the two areas both “in fabric and designs” (Tekin 2011, 153-156). Therefore, the study of firing and the analysis of raw materials and impurities can tell us that some of the ceramics were local, and some were of southwestern origin.

Discussion of the Problems of *Orange Fine Ware* Connections

It is supposed that *Orange Fine Ware* is common to the *Archaic Painted Ware* (Le Mière and Nieuwenhuyse 1996, 173; Ökse 2021; Tekin 2013) of the eastern part of Upper Mesopotamia – Tell Hassuna (Lloyd and Safar 1945, 278, Fig. 7) and Yarim Tepe I settlements (Merpert and Munchaev 1993, 87-89). But later, Le Mière admitted that she did not identified *Orange Fine Ware* on the Sinjar sites – Yarim Tepe I, Tell Sotto, Kültepe (Le Mière 2000, 132). Nieuwenhuyse also pointed out the resemblance of *Standard Ware* from Tell Boueid II to *Proto-Hassuna* (Umm Dabaghiyah, Tell Sotto, Külltepe, Tell Kashkashok, Tell Hazna II, Tell Seker al-Aheimar) and *Archaic Hassuna* (Yarim Tepe I, Tell Shemshara). Besides this, he noted that *Archaic Hassuna* ceramics from Tell Hassuna and grit-tempered *Red-Burnished Pottery* from Tell Kashkashok II are closer to *Orange Ware* from Tell Boueid II (Nieuwenhuyse *et al.* 2002, 54, 60-61). This is a significant remark and requires a separate study. In any case, in addition to the discussions of *Orange Fine Ware* connections, it emphasizes that *Standard Ware* is a heterogeneous phenomenon; it may differ on different sites.

We can say that judging by the studied *Orange Fine Ware* from Hakemi Use and ceramics of *Archaic Hassuna* pottery from Yarim Tepe I and Tell Sotto (Petrova 2021), there is no complete correspondence between these ceramic types. All the studied groups of this pottery differ either in the composition of the raw materials used or are very similar in raw materials (clay with limestone admixture) but have a different type of firing (Fig. 2.6). The composition of ornaments is parallel (mainly simple lines and triangles). Still, we have to add that the quality of execution is very different. The painted lines on *Orange Fine Ware* are more even, neat, and thicker than on the ceramics of *Archaic Hassuna*. Also, of note is the absence of polished ornament on the last one, characteristic of *Orange Fine Ware* on Hakemi Use and Tell Sabi Abyad (Le Mière and Nieuwenhuyse 1996, 173). Firing of *Orange Fine Ware* is more high-temperature and longer, as evidenced by the bright orange surface noted by all researchers (Le Mière and Nieuwenhuyse 1996, 168; Ökse 2021, 313; Tekin 2013, 496). At the same time, the surface of the *Archaic Hassuna* ceramics is light orange (buff color). On the Tell Sabi Abyad, where *Orange Fine Ware* ceramics were allocated initially, it appears in the period called "Proto-Halaf" (or "Transitional"), which corresponds to Hassuna III "bears strong resemblances to the Hassuna and Samarra cultures known from northern and central Iraq" (Cruells and Nieuwenhuyse 2004, 48-49; Le Mière and Nieuwenhuyse 1996, 168). Therefore, the *Archaic Hassuna* pottery represents an earlier stage, probably existing only in the eastern part of Upper Mesopotamia. But whether there is a connection between these two types of ceramics still requires further consideration. Possibly*, Archaic Hassuna ceramics is the* predecessor of *Orange Fine Ware*.

Conclusions

As was said before, ceramics from Hakemi Use indicate that the Upper Tigris Valley was in interaction with other parts of the Near East, as far as the littoral areas of the Mediterranean, the Upper and Middle Mesopotamia, and the foothills of Northwestern Zagros. We can see the same situation at this region's sites like Gre Fılla (Ökse 2021, 309-314) and Til Huzur/Yayvantepe (Caneva 2011, 176). In addition, the technological study of Hakemi Use ceramics shows that even within the same type, ceramics are not homogeneous and most likely have different places of origin. Indeed, some of the pottery of *Orange Fine Ware, Standard Hassuna,* and *Samarra* types were imported, and some could have been made in the foothills of the Taurus. Just ceramics *DFBW*, *Classic Samarra,* and *Standard Hassuna incised* can be called wholly imported.

The connection between the Upper Tigris region and the southern regions probably ran via the Mardin mountains (with an average elevation of 1000 m), the *Tur-Abdin* via the Tigris River and its tributaries (particularly along the stream of Şeyhan Çay), or through Savur and Derik (province Mardin). Ways to the obsidian sources in the northeast likely took the passes still used today by the most critical land roads, i.e., the Batman-Baykan-Bitlis-Van route. No significant barrier is located to the west since the Karacadağ massif is not an obstacle: it offers an easy course via Viranşehir (province Şanlıurfa) to the south. It can be passed on its sides, enabling travelers to reach the Balikh and Euphrates regions via Şanlıurfa, the Amuq region, and Cilicia. The pottery and small finds of Hakemi Use reflect the inhabitants' relationship to all of these regions (Tekin 2013, 499). However, judging by the analysis of ceramics, the most extensive ties among the population of the Upper Tigris at the beginning of 6th mil. BCE developed precisely in the southeastern direction (ceramics of *Orange Fine Ware*, *DFBW,* and some *"Northern" Samarra* samples).

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