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İçindekiler / Contents

The Techniques of Proto-Hassuna Pottery Production at Sumaki Höyük

Sidar Gündüzalp[a]

Abstract

This paper presents the pottery of the second half of the 7th millennium BCE from the Upper Tigris Basin, focusing particularly on the assemblage from Sumaki Höyük. This site is known by its large excavation area and its sizable pottery assemblage which provides the opportunity to address a wide range of research questions related to the presence of Early Mineral Tempered and Proto-Hassuna pottery. Proto-Hassuna pottery is well known from previous research conducted in the Jezirah, but is less well understood along this region's northern fringes (the Upper Tigris Basin). This paper examines various aspects of pottery production by examining raw materials and pastes, building methods, surface treatment, and estimated firing conditions to provide a better understanding of the regional character and techniques of production and how it differed from production techniques in the south.

Keywords: Upper Mesopotamia, Neolithic, Proto-Hassuna, pottery, technology

Öz

Bu çalışma Yukarı Dicle Havzası'ndaki Sumaki Höyük'te bulunan ve MÖ 7. binyılın ikinci yarısına tarihlenen bitkisel katkılı Proto-Hassuna çanak çömleğini ele almaktadır. Mevcut çalışmanın odağı bitkisel katkılı çanak çömlek olsa da Sumaki Höyük sahip olduğu büyük çanak çömlek örneklemi sayesinde MÖ 7. binyılda ortaya çıkan Erken Mineral Katkılı ve Proto-Hassuna çanak çömlek grupları hakkında detaylı çalışmalar yapılmasına imkân vermektedir. Her ne kadar Yukarı Dicle Havzası'ndaki kültürler hakkında detaylı çalışmalar yayınlanmamış olsa da Proto-Hassuna kültürü Cezire Bölgesi'ndeki yerleşimlerden iyi bilinmektedir. Bu makale, bölgesel özelliklerin ve güneydeki üretim tekniklerindeki olası farklılıkların daha derinlikli anlaşılmasını sağlamak için ham madde kullanımı, hamur özellikleri, biçimlendirme teknikleri, yüzey işlemleri ve yaklaşık pişme koşullarını ele alarak çanak çömlek üretiminin farklı yönlerini incelemektedir.

Anahtar Kelimeler: Yukarı Mezopotamya, Neolitik, Proto-Hassuna, çanak çömlek, teknoloji

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Introduction

The emergence of pottery production is one of the oldest research questions in Neolithic archaeology. A considerable literature has been published on the invention and development of pottery technology since it was first identified as an indicator of the Neolithic way of life. According to research conducted in the first half of the 20th century, the Halaf group was the first prehistoric pottery in this region. Later, Dark Faced Burnished Ware uncovered during excavations in the Amuq Plain (Braidwood and Braidwood 1960) and Hassuna-Samarra pottery found in the Tigris Basin (Lloyd and Safar 1945) indicated that earlier pottery-making groups had also resided there. The later discovery of an even earlier pottery group named Proto-Hassuna, showed that the Hassuna-Samarra group was not the initial pottery in the region. The coarse, unburnished, buff Proto-Hassuna pottery was first found in the layers just above virgin soil at Tell Sotto, Kültepe (Bader 1989), Yarım Tepe (Merpert and Munchaev 1987), Telul et-Thalathat (Fukai and Matsutani 1981), Tell Kashkashok (Furuyama 1991) and Umm Dabaghiyah (Kirkbride 1972) dating back to the beginning of the Pottery Neolithic. This group was accepted as the predecessor of Hassuna and was named Proto-Hassuna[1] (Merpert et al. 1978, 49). Nonetheless, research conducted in the last twenty years clearly shows that the Proto-Hassuna begins only after the emergence of an even earlier, mineral tempered pottery type (Early Mineral Tempered Pottery) in the first centuries of the 7th millennium BCE, now understood to be the very first ceramic type in Upper Mesopotamia and the Northern Levant (Campbell 2017, 147-148; Le Mière 2017).

Plant-tempered pottery groups known as the Pre-Halaf, Proto-Hassuna, and Zagros Group were generally produced in higher quantities than the initial mineral-tempered pottery types and spread over a much wider area. In the early stages of pottery production, mineral-tempered vessels share similar characteristics across settlements, while regional differences can be observed in plant tempered pottery. Plant-tempered pottery differs from the pottery of the previous period in terms of the choice of temper, paste colour, surface treatments, form, size, and, hence, the purpose of use (Le Mière and Picon 1998). The plant-tempered pottery seen in Upper Mesopotamia and the Northern Levant between approximately 6500 and 6100/6000 BCE includes Proto-Hassuna and Pre-Halaf. Pre-Halaf pottery has been found in the Euphrates Basin and Northern Levant, whereas Proto-Hassuna pottery derives from the region extending

1 The term Proto-Hassuna mostly refers to plant-tempered pottery that appeared in the Tigris Basin. However, after Braidwood (1945) identified Hassuna Ia as an early Neolithic phase, Proto-Hassuna and its characteristic plant-tempered pottery was adopted by Soviet archaeologists to encompass the initial Neolithic culture as a whole (Bader 1993). Although an earlier Pottery Neolithic phase has been identified over the last few decades, Proto-Hassuna is still a useful term for describing the Neolithic cultures that emerged in the last quarter of the 7th millennium BCE.

from the Upper Tigris Basin, to just east of Habur to the Zagros (Figure 1). Pre-Halaf pottery is characterized by convex bodies, collar necks, painted surfaces, and incised decorations (Le Mière 2013, 325-327). The Proto-Hassuna pottery includes various sizes of carinated (double-ogee form) and everted-rimmed red slips, paint, or appliqué-decorated vessels. Aurenche and Kozlowski (1999, 141) suggested that closed-form vessels were dominant in the Proto-Hassuna, and open forms were dominant in Pre-Halaf. Nevertheless, some researchers have argued that the morphological differences between the two traditions may be related to vessel function rather than culture (Nieuwenhuyse 2013). Finally, Zagros Group pottery found in western Iran is a unique painted, plant-tempered pottery. However, it shares some features with Neolithic pottery groups in Mesopotamia (Bader and Le Mière 2013). As very few sites have multiple continuous layers, the relationship between mineral and plant-tempered pottery traditions is not fully understood.

The focus of this study is on a Proto-Hassuna pottery assemblage uncovered at the site of Sumaki Höyük, located in the Upper Tigris Basin, north of the primary area occupied by the Proto-Hassuna culture. Previous analyses of the pottery from the site gave insight into the emergence of pottery in Southwest Asia (Gündüzalp 2021a), where ongoing debate questions the continuity of pottery production through the 7th millennium BCE.

The Site

Sumaki Höyük is situated northwest of the lower Garzan River Basin, one of the longest tributaries of the Tigris River. The altitude of the settlement is 700-710 masl, and its dimensions are approximately 160 m (N-S) x 140 m (E-W). The Neolithic settlement is located on low terraces of seasonal streams that flow north and south of the site. Today, the Kani Huşur Stream flows in a deep valley in the north. The Kıradağı basalt flow composed of Upper Miocene claystone, sandstone, and conglomerates located south of the settlement currently extends over the Şelmo Formation. The Neolithic layers are situated just below a Middle Age occupation. The average thickness of the Neolithic layer is 1.90 m, and it covers 2180 m^2 in three sectors (Figure 2).

The Neolithic layers of Sumaki are divided into seven architectural phases (N1-N7). Radiocarbon analyses show that the site was inhabited during the 7th millennium BCE. The excavated area of the earliest Phase (N7) covers only c. 250 m^2. Hearths, fire pits, and a few traces of post-holes suggesting the presence of simple tent-like shelters, were found in this phase. A single ^{14}C date ascribes this phase to 7327-7036 cal. BCE. However, Phase N7 is more accurately dated to the first quarter of the 7th millennium BCE according to statistical modelling of ^{14}C dates, given the plateau of the carbon curve between approx. 7100 to 6700 BCE (Évin et al. 1995; Aurenche et al. 2001). Approximately 956 m^2 of the overlying Phase N6 was dated between 6965 and 6648 BCE. In this period, cell-plan structures characterized the site; the rectangular rooms of these structures are arranged on both sides of long L- or T-shaped corridors, while smaller single-room structures were located on natural terraces in the lower parts of the site. There are no fire pits in this phase, and all of the six stone-paved hearths are located in open spaces. Phase N5 was excavated over an area of 865 m^2 and was dated to 6689-6454 cal. BCE. The architectural tradition and settlement pattern did not change significantly in this phase. In addition to cell-planned or single-room structures, some structures have two or more rooms. *Kerpiç* blocks were used as a new element in the construction of the walls of some buildings. *In situ* basalt ground stones are noteworthy. After a short break, the settlement plan changed in Phase N4, dated to 6595-6370 cal. BCE. The cell-planned buildings disappeared. Structures with two or more rooms were erected around the courtyard. Structures comprised of only a single room, likely represent temporary buildings that may have been covered with tents or other light materials. Hearths and fire pits were located in open spaces with similar features to the former examples. Phase N3 was excavated over an area of approx. 693 m^2 and dated to 6534-6368 cal. BCE. The architecture of Phase N3 consists entirely of temporary, oval-shaped 'tent type' structures. As in the earliest phase at Sumaki, the settlement of N3 was temporary, and the fire pits, hearths, and broken potsherds indicate that open spaces were intensively used. Phases N2 and N1 cover approx. 1204 m^2 and belong to the Proto-Hassuna culture of Upper Mesopotamia. The buildings of Phase N2 were temporary, rectangular, and single-roomed. The hearths and fire pits were similar to those in preceding phases. Finally, Phase N1 corresponds to the end of the Neolithic period at Sumaki. The architecture of this phase differs from that of the earlier layers in its use of stones as building materials. Large basalt grinding stones from Phase N5 were reused to construct rows of stone buildings. No fire pits were found in this phase, and the lower floors of seven oval or round hearths were paved with stones. Although no absolute dates have been obtained from phases N2 and N1 thus far, pottery assemblages and small finds suggest that they belong to the last quarter of the 7th millennium BCE (Erim-Özdoğan 2011; Erim-Özdoğan and Sarıaltun 2018).

General Features of the Proto-Hassuna Pottery of Sumaki

Mineral-tempered pottery with only minor changes in temper choice and surface treatments was produced for approximately 500 years from Phases N7-N3 at Sumaki. Plant-tempered (Proto-Hassuna) pottery was found in Phases N1 and N2, dating back to the last quarter of the 7th millennium BCE. The Proto-Hassuna pottery of Sumaki is divided into two groups according to its typology, size, and the condition of its paste: Plain Ware (28,031 sherds) consists of relatively large vessels with thick-walled and coarse paste; and Red Slipped Ware (4153 sherds) which can be distinguished from the Plain Ware by the red slip applied mainly on the exterior surface of these ceramics. The Red Slipped Ware vessels are small, quite elaborate and have thin walls. Small carinated bowls, oval- and open-shaped bowls, carinated jars, oval cooking wares, and trays are other typical forms in the assemblage. The carinated vessels and open forms are characteristic of Proto-Hassuna pottery, and small numbers of lump decorations located close to the vessels' mouths is remarkable (Figure 3).

Raw Materials and Paste

Proto-Hassuna pottery is technologically and typologically distinct from Early Mineral Tempered Pottery. The most apparent change is in the use of plants instead of volcanic minerals as temper. This choice must have significantly changed the production cycle and the raw material supply. Chemical analyses showed that the plant-tempered pottery of Sumaki was produced from calcareous clays containing various types of calcium and high amounts of Fe, Ni, and Ba. (Gündüzalp et al. forthcoming). Although the clay resources around the site have not been analysed, the Lower Garzan Valley, where Sumaki is located, has a calcareous lithology and is rich in calcareous clay deposits (Karadoğan 2018). The use of a local calcareous clay source, the large number of sherds (32.184 sherds, 639.75 kg), and that the large vessels in the assemblage were unsuitable for transportation suggests that the plant-tempered pottery was produced locally. This article describes the production of plant-tempered pottery in the Tigris Basin at the end of the 7th millennium BCE by considering the paste characteristics, surface colours, temper choice, and building techniques of the Sumaki Proto-Hassuna assemblage.

Porosity

The pottery from Sumaki is generally porous. Different types of clay maintain a porosity rate of 30-40%, even when fired up to 1300°C. This ratio is usually higher for vessels fired at lower temperatures. Depending on their size, shape, position in the ceramic body, whether they open to the vessel surface, and if they are interconnected, the pores may affect the durability, permeability, density, and thermal shock resistance of the vessel. The porosity of a vessel can be adjusted by the manufacturer to suit its intended purpose. Clay selection, sieving, and temper choice are important manufacturing decisions that can affect the porosity of the vessel paste and thus its performance characteristics. For example, porous pastes increase thermal shock resistance because they can better withstand rapid changes in temperature, and thus increased porosity is preferred in cooking vessels. Similarly, paste density impacts heat conductivity. Less porous pastes conduct heat faster than porous ones since they facilitate higher evaporation keeping stored liquids fresh and cool. In contrast, the higher rate of evaporation enabled by high porosity is a disadvantage in containers used for the long-term storage of liquids (Shepard 1956, 126; Rice 1987, 231).

The paste texture of Proto-Hassuna pottery is influenced by the intensive use of plant tempers. The plant temper burns away when the vessel is fired, causing the paste to become more porous.

At Sumaki porous pastes were probably selected deliberately to increase the permeability of the vessel body. The Proto-Hassuna pottery from Sumaki can be categorized into three groups, based on the size of the voids (pores) left by the burned plant temper. Most of the sherds (51.98%) fall into Group 1 (0-2.5 mm pores), while 39.54% of the sherds have pores between 0-1 mm (Group 2). In the remainder of the assemblage (8.48%, Group 3), the pores could not be identified with the naked eye. The porosity rates of the Plain wares are much greater than the Red Slipped Ware. The porosity is likely related to their function, as chemical and mineralogical analyses do not show differences in the raw material sources (Gündüzalp 2021b). Relatively small, thin-walled, and elaborately made Red Slipped Wares have denser pastes. Large, thick-walled, and coarsely made Plain Wares are more porous and have more inclusions. Porosity is also related to the hardness of sherds, and more porous sherds are more fragile than others.

Mineral Inclusions

Except under rare conditions, clay is not a pure material. Minerals, such as quartz, calcite, and mica, occur naturally in clay or become mixed with clay sediment when it is transported by wind and water. It is difficult to determine which of the materials found in ceramics were added by the potter and which were naturally present. The size and quantity of mica particles provides clues about whether it was added as a temper or not. If the particles are small and scarce, then mica is considered to be a natural clay component of the paste. Calcite can also be used as a temper. Natural transported calcite particles are rounded whereas those added as temper are angular. Determining whether sand and quartz were added consciously to the paste is more difficult. In most cases, the angular structure of quartz indicates that it was added by crushing. Sand is much more difficult to examine because it is often associated with quartz, and its particle size is tiny. If the shape of the sand grains can be determined, then a tentative idea can be obtained (Rice 1987, 409-410). Sand grains are present in 53% of the Proto-Hassuna pottery from Sumaki and are less than 0.5 mm in diameter. Sand grains were found in 54.55% of Plain Ware sherds and 39.69% of Red Slipped ones. It is uncertain whether sand was deliberately added to the vessel paste.

Two minerals, mica and lime, were identified in the cross-sections and surfaces of the Proto-Hassuna pottery from Sumaki. The mica group consists of potassium aluminium silicate minerals with a three-layered crystal structure and is extensive in metamorphic, igneous, and some sedimentary rocks. It has various forms, depending on the formation of K^+, Ca^{++}, and Na^{++} between the crystal layers. In addition to transparent types, brown, pink, yellow, grey, black, and silver coloured mica types are also found in nature (Chesterman and Lowe 1993, 531). Mica was detected in 92.6% of the sherds using the naked eye. Preliminary XRD results of the Sumaki pottery revealed two mica minerals (Figure 4). The first is muscovite, which is generally a white and silvery potassium aluminium silicate that is quite common in metamorphic and igneous rocks (Nesse 1986, 239-240). The second type, vermiculite, is much rarer. Vermiculite is a magnesium, aluminium iron silicate formed from hydrothermal activity or in groundwater solutions when the structures of the silicates are transformed through heating (Haase et al. 1963). The low density of minerals indicates that they were not added but were naturally present in the clay. Given the types of metamorphic rocks found around Sumaki Höyük, mica minerals are expected in the vessel pastes.

The second most common mineral found in the paste of the plant-tempered pottery is lime (calcium carbonate). Although lime particles differ in size, they are generally larger than the mica particles. The proportion of lime particles ranges between 4 and 6% of both the Plain and Red Slipped wares. The existence of lime particles in the pastes may be related to the vessel function. The porous structure of the Proto-Hassuna pottery of Sumaki allows water to evaporate and pass through the body of the vessel when it is used for liquid storage or boiling. However, as some evaporated water will condense in the pores, minerals that precipitate from the water will fill the pores over time. Calcium carbonate may have also precipitated in the pores after the sherds were buried. Regardless of the process, it is clear that evaporation was responsible for the increased amount of lime in the paste of the plant-tempered pottery.

Temper

Tempers are substances intentionally added to clay by the potter before or after firing. They may be added when the clay is wet or dry and serve to support the structure of the vessel bodies. According to M. Magetti (1982, 123), all particles larger than 0.15 mm in diameter should be defined as temper. Archaeologists use different terms to describe the materials added to vessel paste. The possibility that the potter may have deliberately selected clays containing various particles makes it difficult to determine the constituents of vessel paste. The presence of larger, angular shaped materials is assumed to indicate a conscious activity (Rice 1987). In this study, "temper" refers to materials deliberately added to the vessel paste, and "inclusion" refers to natural minerals in the clay. Tempers vary according to the intended use of the vessel, its form, and the accessibility of the raw material. Adding a temper to the paste is necessary to increase the durability of wares fired at low temperatures in open fires. Therefore, temper choice is a vital technical characteristic that distinguishes pottery groups from one another.

The shrinkage of the ceramic body is negligible when heated in a bonfire because the clay expands very slowly at low temperatures and becomes more porous. Shrinkage is only caused by firing at temperatures around 900-1000°C. Because temperatures rise instantly in bonfires, tempers create voids in the paste that allow water to evaporate rapidly in the early stages of firing. Otherwise, evaporation will create fractures on the surfaces of vessels, called fire spalling.

Depending on type and abundance, tempers increase the resistance of ceramic vessels to thermal stress and surface tension that may occur when the container is repeatedly heated and cooled, or when the inner and outer surfaces are heated at different temperatures. In particular, temper increases porosity which protects the vessel against breakage and cracking when the ceramic body expands due to heating (Rye 1976, 115; Gibson and Woods 1990, 27-30).

The transition from mineral-tempered to plant-tempered pottery critically changed pottery technology in the 7th millennium BCE. Plant-tempered pottery appeared approximately 500 years after mineral-tempered pottery first emerged in Upper Mesopotamia and the Northern Levant. Research on mineral-tempered and Proto-Hassuna pottery, especially at Tell Seker al-Aheimar, which has continuous layers from the PPNB to the Proto-Hassuna (Nishiaki and Le Mière 2017), shows that plant tempers were initially used in small quantities. At first, they were combined with volcanic minerals, but were then gradually replaced by them (Le Mière 2009). Nevertheless, plant tempers were never added to the Early Mineral Tempered Pottery; thus, it is impossible to discuss the gradual transition from mineral to plant tempers at Sumaki Höyük.

The Proto-Hassuna pottery of Sumaki is mostly plant-tempered. Negative plant traces were detected with the naked eye and a 15X zoom lens. Only a few sherds contain small amounts of basalt, lime, and grit in their paste. The plants used for temper were initially chopped in various sizes. The proportion of plants is above 50% in most sherds, and traces of burnt plants can be seen on the inner and outer surfaces of the vessels. This may be because the vessels were not burnished. Studies of other contemporary plant-tempered pottery assemblages in the Tigris Basin have shown that some fine traces may have been caused by the addition of dung (Nieuwenhuyse 2013; Petrova 2019). However, calcified plant remains in the cross-sections of some Plain Ware sherds at Sumaki, indicate that chopped plants may also cause fine negative traces (Figure 5). Thus, it is possible that either the chopped plants were not entirely destroyed by firing and that the vessels were fired at low temperatures or that the temperature increased and dropped rapidly during firing.

The proportion of temper with diameters larger than 3 mm is higher in Plain Ware sherds than in Red Slipped sherds. Nevertheless, the quantity of temper is similar between the two types. Vessel size and wall thickness are related to the size of the temper. There is a direct correlation between wall thickness and the quantity and size of chopped plants. The plant traces are large in the thicker-walled sherds, while thinner-walled vessels were produced with a different paste containing small-sized chopped plants. The use of a smaller temper reduced the amount of raw material required and saved the time needed to produce thicker-walled containers.

Seed traces were also detected in the paste of the Proto-Hassuna pottery from Sumaki. These traces are visible to the naked eye in the cross-section of the sherds (Figure 6). Carbonized seed remains were also found in a sherd that was probably fired at a low temperature. The seeds are smaller than 1 mm, round in cross-section, and have a similar shape, suggesting that they belong to the same species. According to preliminary studies, the fossilized seeds belong to small-seeded wild *Poaceae* (Figure 7), which would have been endemic to the Upper Tigris. The proportion of sherds with seed traces is 2.75% (n=245) in the Plain wares and 2.33% (n=50) in the Red Slipped wares.

The most distinct difference between the two pottery groups is the more frequent use of grit temper in Plain Ware which might have been selected to increase porosity and improve resistance to thermal stress. In addition, Plain Wares are thicker-walled and more carelessly made that Red Slipped Wares. Thus, the Plain Ware is more suitable for cooking and storage. Very few sherds (0.24% of the total) of Proto-Hassuna pottery yielded basalt tempers (Figure 8). The crushed basalt fragments are uncommon and range between 1-3 mm in diameter. The occasional use of basalt indicates that it was an individual practice.

Construction Methods

Shaping is one of the most critical stages in pottery production. The construction techniques affect organisation, raw material choice, amount of water, drying time, firing conditions, and vice versa. Neolithic pottery is handmade or moulded, depending on the vessel's desired form, size, and function, and shaped by a variety of techniques, i.e., pinching, pressing, moulding, slab, ring, or coil construction (Arnold 1999, 60). The hands and fingers must be effectively used to apply these bodily techniques. As markers of pottery production and cultural change over time and among societies, these techniques are central to prehistoric pottery research (van der Leeuw 1993).

Although plant-tempered pottery traditions do not represent the beginning of pottery technology, these traditions have long been recognized as the earliest examples of pottery, and thus the evolution of the technique has been a central research topic. P. Vandiver (1985) offered an important perspective by explaining the emergence of plant-tempered pottery through architectural construction techniques. She suggests that pottery was developed from a technique known as *tauf*, or *cinneh* (Braidwood and Howe 1960, 41; Watson 1979, 119-22) applied in architecture, especially in the hilly flanks of the Zagros. Vandiver analysed Neolithic plant-tempered pottery from Iran and traditional (modern-day) pottery from Turkey and Pakistan, described the techniques used in the Pottery Neolithic in detail and established new diagnostic criteria for slab construction. She demonstrated that the plant-tempered Neolithic pottery of Tepe Yahya, Hajji Firuz, Dalma Pisdeli, Ganj Dareh, Tepe Sarab and Seh Gabi was constructed using a specific technique called Sequential Slab Construction (hereafter SSC). The connection of a large number of oval slabs and the specific forms of the joints between them are the main characteristics of this technique, which allows the construction of small bowls using slabs. Vandiver demonstrated that pores close to joints have unique shapes when this technique was used (Vandiver 1987, 11-14). The joint shape is also a diagnostic criterion for the coil technique. Overlapping coils are attached by shaping them using the same technique that was used for slab construction. The marks on the cross-sections are more regular in shape when similar coils were used, in comparison to the SSC method.

The Proto-Hassuna pottery from Sumaki was analysed by examining traces in the cross-sections and on the surfaces of broken sherds. Unfortunately, it is not always possible to identify these marks because the pottery was carefully scraped and smoothened after the construction stage. Slab, joint and coil marks were identified on 16.78% (n=5403) of the Sumaki assemblage. The traces suggest that the plant-tempered pottery was built using SSC and coil techniques. Additionally, some small cups may have been shaped by pinching. There is no difference in the construction technique used for Plain and Red Slipped wares.

The bases of the Proto-Hassuna pottery were made by joining two or more slabs and rotating them to form tongued joints. It can be assumed that the small bases with thicknesses below 1 cm were composed from a single piece of paste. Because the surface of the plant-tempered pottery is not burnished, the outer surfaces of some abraded bases suggest that the plant-tempered vessels were shaped on a flat abrasive surface, except for bases with a large diameter (Figure 9). Two base constructing techniques were identified. The jointing technique was performed on small vessels with relatively upright bodies. In this technique, the vessel's body is rotated by attaching two or more slabs to the base. The outer slab is shaped like a mortise from the base. Two slabs are attached from the inside. One of the slabs is attached at an angle to the base and the outer slab grows thinner as it rises. This creates a tongue shape on which the next piece can be placed. The other slab is thinner and is used to cover the tongue from the inner surface of the base upward from the turning point of the body. This form supports the body that rotates at a relatively wide angle (Figure 10).

In the second technique, the joint is shaped with the base, which is then attached to the corrugated body part and rotated. This technique is typically performed on vessels with large bases and wide body rotation angles. The base, which is formed by joining two or more slabs, is rotated slightly to form a thick tongue. The corrugated part of the slab that provides the body rotation is then added to the base. The rotated bodies rise and open at an extremely wide angle (Figure 11). Since such open forms were not found in the Sumaki assemblage the rotated body must have been narrowed by carination towards the mouth. Open-shaped bodies must be dried before rotation so that they can support the weight placed on them. This means that mould-like supports (e.g., baskets and broken vessels) would have to be used to form the lower half of the convex or carinated vessels that rose at wide angles. However, no traces of this practice were detected on the surfaces of the vessel fragments. Body fragments were added to the base in a grooved shape. The part that rotated from the base to the body was primarily shaped by bending the inner slab. There are also some examples where the outer slab was rotated with the inner slab starting from the base; if the two slabs were the same size, the outer slab was rotated to cover the inner (Figure 12).

The bodies were formed by joining slabs of different thicknesses (0.3-1.7 cm) and sizes (Figure 13). Different types of joints show various patterns related to vessel form and wall thickness. Two joint forms were identified on the thinner-walled sherds. In both cases, the slabs are interlocked along the vertical axis. The upper part is thinner and serves as a negative for the thicker and tongued lower piece. Thus, the two slabs are attached without any other addition or coating (Figure 14a-b). In the second form, the thicknesses of the superimposed pieces are very similar and the joints are S-shaped. The lower piece is thinned by forming a concave groove towards the inner part of the body. The upper part is convex to fit the thinner part (Figure 14c). The third form is a pseudo-rimmed joint. This form was observed in thicker-walled body sherds. The lower sherd is thinned and shaped to form a false rim towards the top. The upper part is grooved to fit the false rim. The false rim is located at the centre of the body. Thus, the upper piece could be placed in a balanced position (Figure 14d).

One of the distinguishing features of Proto-Hassuna pottery is the appearance of carinated forms. The wide-angled carinas are built in three parts. The lower part is usually constructed of two or more slabs and rises at a wide angle. The upper part is fitted at a narrow angle to the lower part without grooves or tongues, and a void form outside the carina (Figure 15a). In narrow-angled carinas, the lower fragment is curved, the upper part is shaped like a false rim, and the upper part is grooved. As the lower piece is rotated, the outer-facing part of the groove becomes thicker (Figure 15b). The carina of small vessels is usually made of a single piece of paste. It is shaped by supporting and pressing the paste from the inside with the thumb while simultaneously bending and twisting it from the outside with the other fingers. The inner surfaces of some sherds show marks where the thumb was pressed more forcefully (Figure 16). Some of the carinas were shaped with two slabs, and the gap created by the difference in the angles can easily be observed. After the two slabs were attached, they were shaped with fingers to create their final form. These sherds have a single, thicker fingerprint on the inner surface but thinner and multiple fingerprints on the outer surface (Figure 17).

Fingerprints are also detected on relatively large vessels with convex bodies. The convex bodies were formed by fitting two slabs together, and the vessel's body was bent by pressing it with a finger from the inside. The upper part of the vessel was tightened to place it. The same-sized vertical fingerprints extend through to the base on the inner surface, indicating that the compression probably took place on the inside of the vessel (Figure 18). The fingerprints on flat body fragments are similar to those on the inner and outer surfaces. While the fingerprints on the inner surface are mostly parallel, those on the outer surface are sometimes multi-directional. Other fingerprints are unevenly distributed on body fragments; sometimes, they occur only on upper parts and sometimes as asymmetrical marks spread all over the body. These traces suggest that the semi-fluid and plant-tempered paste were pressed and patted with fingers to obtain the desired shape and retain stability during drying (Figure 19-20).

Lugs, which are rare in plant-tempered pottery, were added to the body of the pots in two pieces. The first piece was attached to the slab outside the pot and joined to the groove formed to accommodate the slab on the part of the body extending towards the rim. This piece is the preform of the lug and extends outwards. The second piece was grooved to fit the outwardly extended lug form. After the second piece was added, it was plastered and the connection to the body was reinforced (Figure 21). The rims were shaped using a variety of techniques, depending on the size of the vessel and rim form. The rims of the small, thin-walled pots were shaped by attaching a piece of a grooved slab to the body to form the desired rim (Figure 22a). The rims of thick-walled, concave, or long-necked vessels were formed by attaching two long slabs vertically to the vessel body (Figure 22b). On jars with flaring or straight rims, the lower grooved coils were covered with a final coil formed into a rim (Figure 22c). On vessels with thick walls and steeply rising bodies, the last piece added to the body was covered with a thin coil-shaped rim (Figure 22d). On thick-walled slightly flaring vessels, a piece forming the rim was added to the body as a single coil and then shaped (Figure 22e).

Surface Treatments

The plant-tempered pottery yielded traces of smoothing, scraping, slipping, and burnishing. Burnishing was a rare practice (3.77% of the Plain and 12.14% of the Red Slipped ware) and applied only to outer surfaces (Figure 23). The low proportion of burnishing indicates that impermeability was not a preferred characteristic. Traces of scraping are also quite uncommon being found on only 4.75% of the Plant Tempered Plain and 2.60% of the Red Slipped group. The traces take the form of horizontal and parallel lines on the body sherds (Figure 24). The outer surfaces of the plant-tempered pottery were homogenously smoothened. It is likely that these vessels, which were used for daily activities, were carefully smoothened to remove traces of scraping and fingerprints left during manufacture from the surface. Because the porous and fragile structure of pottery causes the surfaces to abrade easily, it is impossible to observe surface smoothing traces.

Only 1.50% of the Plain Ware was slipped. The low proportion of slipped vessels may be a product of abrasion which could have removed a thin layer of slip from the exterior surfaces especially if it matched the surface colour. A distinctive feature of the Red Slipped pottery is it's red-coloured slip which was applied on both the interior and exterior surfaces (Figure 25). The red slip was usually applied in a relatively thick layer on the exterior surfaces. It is unclear whether the slip was applied with a tool or if the vessels were immersed in a solution (wash slip). The smooth and sharp lines on some surfaces indicate that they were carefully slipped. The slip is red (10R:3/8–10R:4/8) in 82.59% of cases, and darker for 17.41% (10R:3/6-10R:4/6-10R:5/6) of the Red Slipped Ware. This difference is likely related to the use of different pigments or firing conditions. It is possible that the slip served as a kind of decoration, given the differences in the pastes, surface treatments, size, and shapes of the Red Slipped Ware.

Surface Colours, Paste Conditions and Firing

Determining the colour of raw clay used in prehistoric pottery production is challenging because many factors influence how the colour of clay will change during firing. The size of the vessel, firing conditions, the amount of clay, and the amount of organic matter and iron in the clay are all important factors that affect the colour of the vessel.

Pure clay is white, but organic materials in the clay change its colour to grey or black. Iron constituents often produce a red tone and may occasionally cause the clay to acquire grey, brown, or yellow tones, depending on the type and quantity of FeO_2. If all other conditions remain constant, iron oxide will affect the colour of clay according to its concentration. Clay with around 1% iron oxide, will take on a yellowish colour, clays with1.5-3% iron oxide will turn light brown or orange, while 3% concentrations will create a red colour. The organic materials in the clay must be entirely burned for the iron components to change the colour of the fired clay. Thus, the iron must be heated at a high oxidation level (above 900°C). This transformation does not occur in pots fired at low temperatures or in open fires, and different combinations of conditions could cause clay to take on similar colours (Shepard 1956, 16-17). Similarly, iron components in the clay may cause it to turn brown or blackish under reducing atmospheric conditions or when oxidation is incomplete (Rice 1987, 336).

Although the plant temper in the paste significantly increased the carbon content, the paste of most of the pottery (approx. 75% of the assemblage) is buff in tone. This indicates a relatively firing time or a higher firing temperature. The colour of the paste is also related to the voids in the paste, which may have enabled better heat conduction. On the other hand, a considerable number of sherds (approx. 25% of the assemblage) have a brown or black paste that includes some organic components that were not entirely burned during firing, and iron components that were not completely oxidized. These sherds might have been fired in a slightly sooty environment. The differences in the colour of the paste from Sumaki indicates that the vessels were fired at low temperatures. Almost all plant-tempered sherds have black cores. The core appears quite thick in the cross-section of most sherds, covering almost the entire cross-section in some cases (Figure 26). Considering the paste surface colour and core characteristics, it can be suggested that the firing temperature rapidly reached its maximum, but did not remain there for long.

Despite the fact that the Fe_2O_3 ratio of the plant-tempered pottery is high, there are no red pastes or surfaces in the sherds from Sumaki. To understand whether this colour range is related to the firing temperature, thirty-five plant-tempered Proto-Hassuna potsherds were refired in a modern electric oven. The temperature was gradually increased over the course of 12 h and when the oven reached 1040°C, a 24 h cooling period was initiated. After the test, the surfaces and cross sections turned red, and the cores were no longer visible (Figure 27). The red paste and surfaces show that Fe_2O_3 comprises more than 3% of the raw material. This result is supported by the XRF analyses that show that the pottery was not oxidized in the original firing. Therefore, the Proto-Hassuna pottery of Sumaki Höyük must have been fired at a temperature below 850-900°C.

The exterior surfaces of 17.88% of the Plain Ware are brown/light brown, while 81.16 are buff and 0.96% are grey. The exterior colour of 13.08% of the Red Slipped Ware is dark, while 86.87% is buff, and 0.05% is cream. Buff tones are one of the defining characteristics of Proto-Hassuna pottery. The proportion of dark colours is higher on the interior surfaces exposed to lower firing temperatures. One percent of Plain Ware sherds have black exteriors but 9.12% have black interiors. Similarly, the proportion of sherds with black exterior surfaces is much lower (0.09%), than the proportion of black interior surfaces (6.93%) in the Red Slipped Ware. This observation indicates that the two surfaces reached significantly different temperatures during firing. The surfaces of the Proto-Hassuna pottery are mostly homogeneous and monochromatic. Some sherds have black traces on their surfaces, which may provide clues about the firing condition. These traces may have been caused by the contact of the fuel and the vessel's surface during firing. Incomplete oxidation leaves black traces (2.5-4 cm diameter) on the surface (Figure 28). It is likely that the fragments of fuel that touched the vessels were small twigs. The traces left by the fuel support the suggestion that the temperature increased and decreased rapidly during firing. There is no evidence that the vessels were placed on top of each other during firing.

The preliminary mineralogical analysis (XRD) of the plant-pottery (35 sherds) provides hints about the firing temperatures. The results were processed using HiScore Plus and Profex applications, which define the diffraction using the JCPDS ICDD (Joint Committee on Powder Diffraction Standards International Centre for Diffraction Data) database and classify samples with similar mineralogical structures into groups. The minerals shown in the diffractograms were chosen from the most abundant minerals in each group to inform on the clay structure and firing temperature. The mineralogical structure of the Neolithic pottery from Sumaki

Höyük includes some standard features. Most sherds contained significant amounts of calcite and quartz minerals. Quartz is the crystallized form of SiO_2 and commonly occurs in the structure of many rock types (plutonic, igneous, metamorphic) and sediments (Chesterman and Lowe 1993, 502-503). Hence, its presence in the pot paste is expected. However, when quartz is heated, some changes occur in its structure. Quartz minerals transform from α-quartz to β-quartz when the temperature reaches 573±5°C. β-Quartz begins to transform into tridymite when the temperature increases to 867°C. Cristobalite is formed at 1250°C and becomes stable at around 1470°C (Levien et al. 1980). Tridymite and cristobalite are usually absent in pot pastes since they are formed at temperatures that can't be reached by bonfires so it is not surprising that they are not present in the pottery. All groups of the Sumaki pottery contain high amounts of α-quartz, which is shown as quartz/quartz in the diffractograms. When β-quartz cools down, it reverts to the α-quartz phase. Only α-quartz is found in the results from Sumaki, indicating that the firing temperature of the pottery did not rise above 867°C. Preliminary results also show that the presence of minerals, such as albite, anorthite, and clinoclore, may be related to volcanic rocks. These minerals attest to the calcareous and volcanic origins of the exploited raw material.

The structure of the minerals begins to change and ultimately collapses when heated. Although they need to be analysed using different methods, the clay minerals identified in the Proto-Hassuna pottery (illite and montmorillonite) support the hypothesis that the vessels were fired at relatively low temperatures. Illite minerals have fine, regular crystal structures and high plasticity. Clay minerals in the illite group are abundant in marine sediments and calcareous terrain. The structure of illite minerals can be preserved up to 850°C. However, because its structure collapses very slowly, illite can be detected even in pots fired at approximately 1000°C (Rice 1987, 49). Montmorillonite is a clay mineral belonging to the smectite group. Smectite clays are formed from the weathering of calcium, magnesium, iron-rich basalt, calcite plagioclase rocks, and volcanic ashes. The ratio of silica to alkali metals in smectite mineral structure is quite high, but because the aluminium ratio is low, it melts at lower temperatures than other clays. Montmorillonite is a highly adhesive and plastic clay mineral owing to its crystal structure and small particle size. The montmorillonite structure collapses rapidly when the temperature reaches 678°C (Searle and Grimshaw 1959, Table XI-II). Therefore, the presence of montmorillonite in the paste of the vessel indicates that the firing temperature was below 700°C (Figure 29).

Conclusion

Plant-tempered pottery groups appeared in a broad region from the Zagros to Northern Levant in the second half of the 7th millennium BCE. Proto-Hassuna pottery has been found primarily in the Tigris Basin and represents similar features known from sites such as Tell Sotto, Kültepe, Umm Dabaghiyah and other sites in the Jezirah (Bader and Le Mière 2013). Sumaki Höyük is located in the Upper Tigris Basin and provides additional data on Proto-Hassuna pottery in the north.

The Proto-Hassuna pottery from Sumaki is probably locally produced. Although the clay resources around the site were not analysed, preliminary chemical and mineralogical analyses show that the pottery was made from calcareous clay containing volcanic minerals, which have similar features to the local lithology. The paste of the plant-tempered pottery is relatively porous. The Red Slipped group has a denser paste and harder body than Plain Ware. The paste of the Plain Ware is sandy and has more mineral inclusions than the Red Slipped Ware. This may have been a conscious raw material choice related to the functional differences of the pottery groups. The calcium carbonate components in the paste of the Plain Ware may indicate that they were used for storage and cooking. These likely precipitated when liquids evaporated from the Plain Ware during cooking or food storage. Although, the Red Slipped group was made of similar clays to those used to manufacture the Plain Ware, it contains much fewer mineral inclusions.

All of the Proto-Hassuna pottery from Sumaki was made with plant tempered, derived mostly from small fragments of chopped Poaceae plants. Two hypotheses can be proposed to explain the low proportion of seeds on the pottery surfaces and cross-sections. Initially, the chopped stems and seeds may have originated from plants other than Poaceae, suggesting that seeded plants were less preferred in pottery production. Alternatively, if the same plants were used, it can be assumed that pottery production took place t different times of the year regardless of seed availability, since the seeding of plants is seasonal. Even though more detailed studies are required to test these hypotheses, the size of the site and the number of potsherds support this statement. Furthermore, preliminary studies on carbonized seeds indicate intensive exploitation of wild plants, but no cultivated ones at Sumaki Höyük (Kutlu et al. 2018). Although this needs to be evaluated more extensively, these results are compatible with data obtained from the pottery. Plant tempered pottery appears with the Proto-Hassuna at Sumaki and is unrelated to the former mineral-tempered pottery used at the site. Unlike some other PN sites in the Khabur and Jezirah, there is no gradual transition from volcanic minerals to chopped plants at Sumaki.

The Proto-Hassuna pottery from Sumaki was shaped using multiple techniques. The bases and bodies of the vessels were shaped mainly by connecting slabs with similar dimensions. Coils were applied only to the upper part of the body. Moulds might have been used to support the bodies of vessels at wide angles. These results are consistent with those of previous studies on plant-tempered Neolithic pottery from Southwest Asia (Vandiver 1985; Petrova 2022). The plant-tempered pottery's surface colours, core thicknesses and the results from re-firing tests indicate that the vessels were fired at relatively low temperatures (approximately 700 °C or below). The clay minerals identified in the preliminary results of the mineralogical analyses also support this conclusion.

To sum up, in its primary characteristics the plant-tempered pottery from Sumaki is typical of the Proto-Hassuna culture, although there are some technological and typological differences. Future detailed analyses are essential to reveal the technological differences specific to the northern part of the Tigris Basin.

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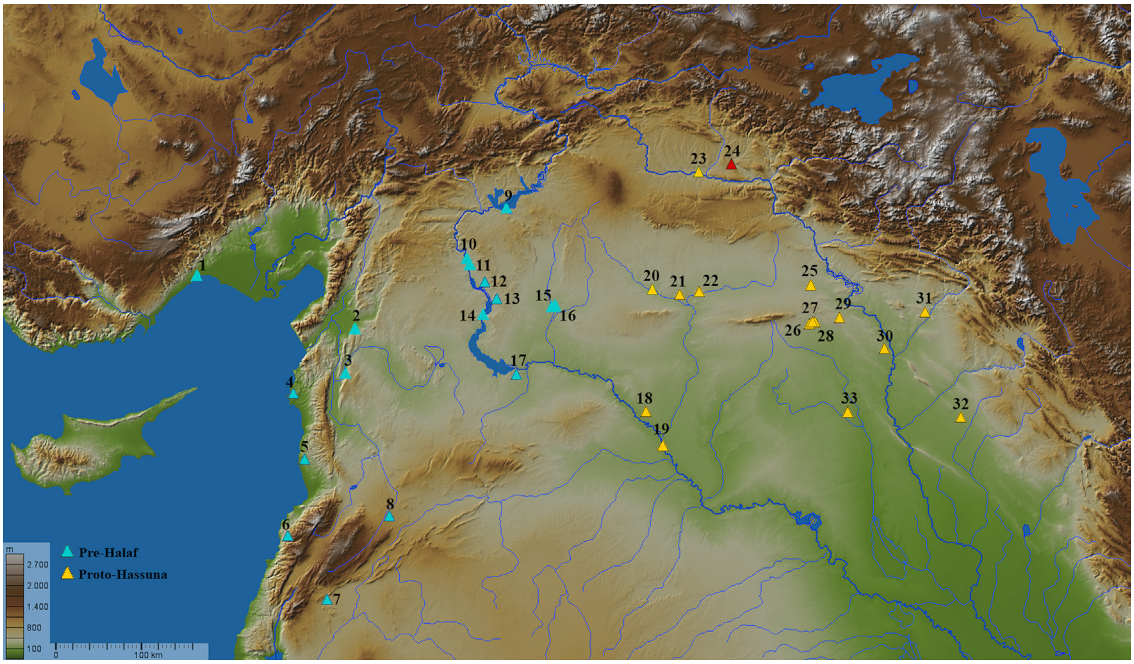

Figure 1.
Map showing the location of Pottery Neolithic Sites: 1. Yumuktepe, 2. Judaidah, 3. Tell el-Kerkh, 4. Ras Shamra, 5. Tabbat al Hammam, 6. Byblos, 7. Tell Ramad, 8. Labweh, 9. Kumartepe, 10. Mezraa-Teleilat, 11. Akarçay Tepe, 12. Dja'de, 13. Tell Kosak Shamali, 14. Tell Halula, 15. Tell Damishliyya, 16. Tell Sabi Abyad, 17. Abu Hureyra, 18. Tell es-Sinn, 19. Tell Bouqras, 20. Tell Seker al-Aheimar, 21. Tell Kashkashok, 22. Tell Hazna, 23. Salat Cami Yanı, 24. Sumaki Höyük, 25. Ginnig, 26. Kültepe, 27. Tell Sotto, 28. Yarım Tepe, 29. Telul eth-Thalathat, 30. Tell Hassuna, 31. Tell Nader, 32. Matarrah 33. Umm Dabaghiyah (Map: S. Gündüzalp).

Figure 2.
Sumaki Höyük, excavated areas (Sumaki Höyük Excavation Archive).

Figure 3. Sumaki Proto-Hassuna pottery shapes.

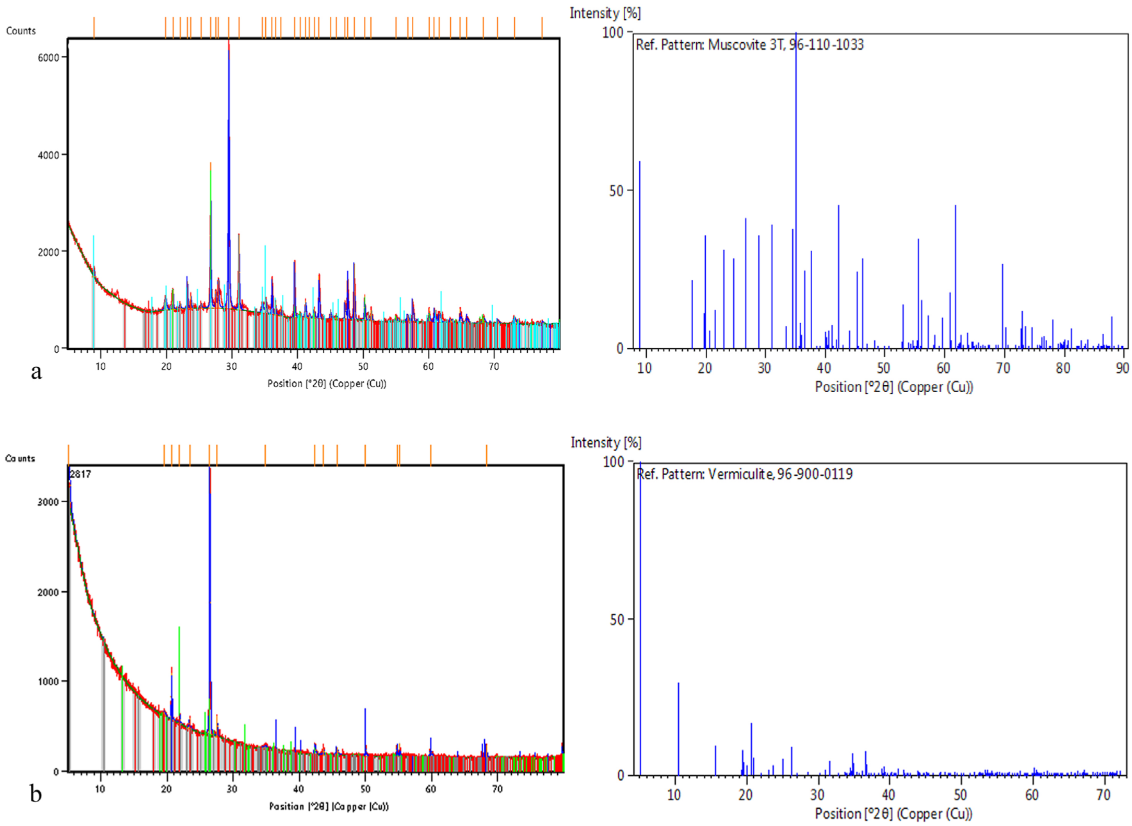

Figure 4. XRD diffractograms of mica minerals.

Figure 5. Calcified plant remains.

Figure 6. Negative seed traces.

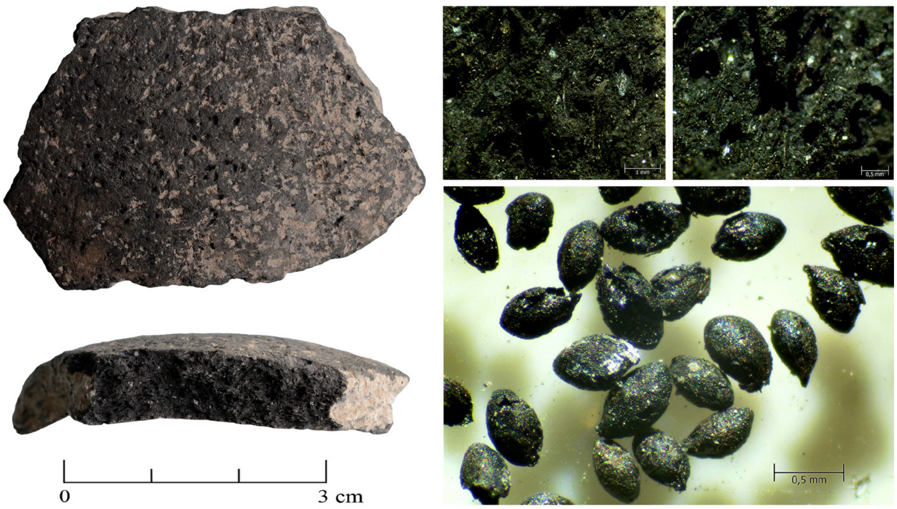

Figure 7. Carbonized Poaceae remains (identified and documented by Dr. Müge Ergun).

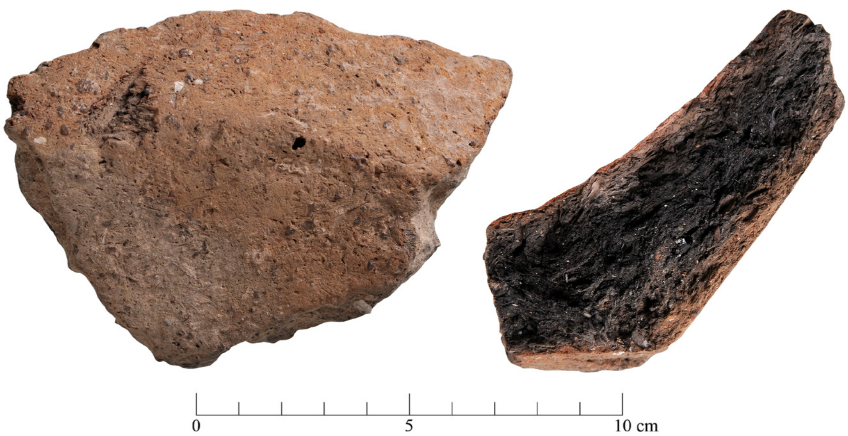

Figure 8. Basalt temper in a plant-tempered sherd.

Figure 9. Deformations of the base sherd.

Figure 10. Slabs and joints of a base.

Figure 12. Connections of the base and body sherds.

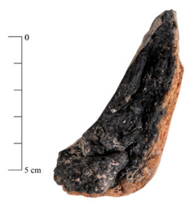

Figure 11. Slabs and joints of a wide-angled vessel.

Figure 13. Attached slabs.

Figure 14. Joint types.

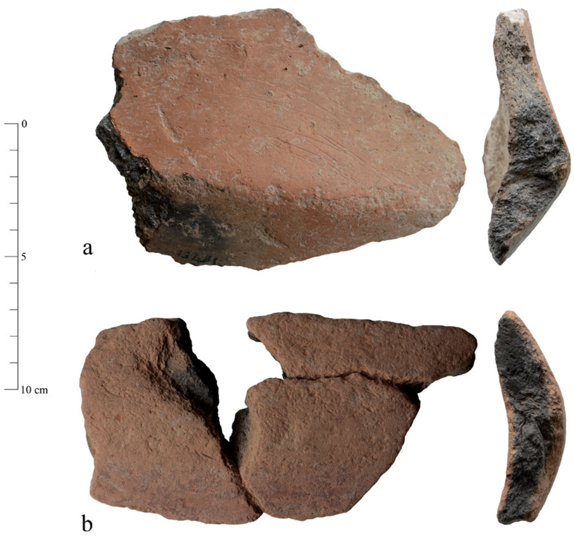

Figure 15. Joint types of carinated pots.

Figures 16 and 17. Fingerprints on carinated sherds.

Figure 18. Fingerprints on a convex body.

Figures 19 and 20. Fingerprints oriented in different directions.

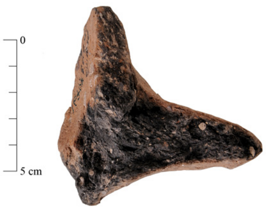

Figure 21. Cross-section of a plant-tempered lug.

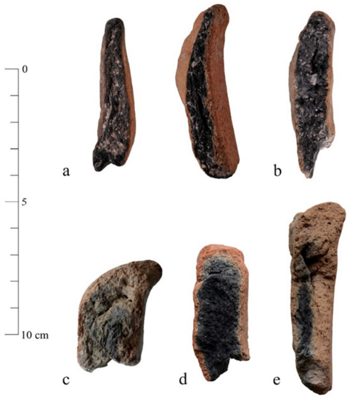

Figure 22. Joint types of the upper body.

Figure 23. Burnished plant-tempered sherds.

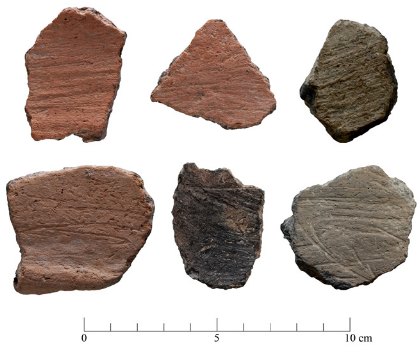

Figure 24. Scraping traces of exterior surfaces.

Figure 25. Red slipped sherds.

Figure 26. Core forms.

Figure 27. Refired sherds.

Figure 28. Incomplete oxidation traces.

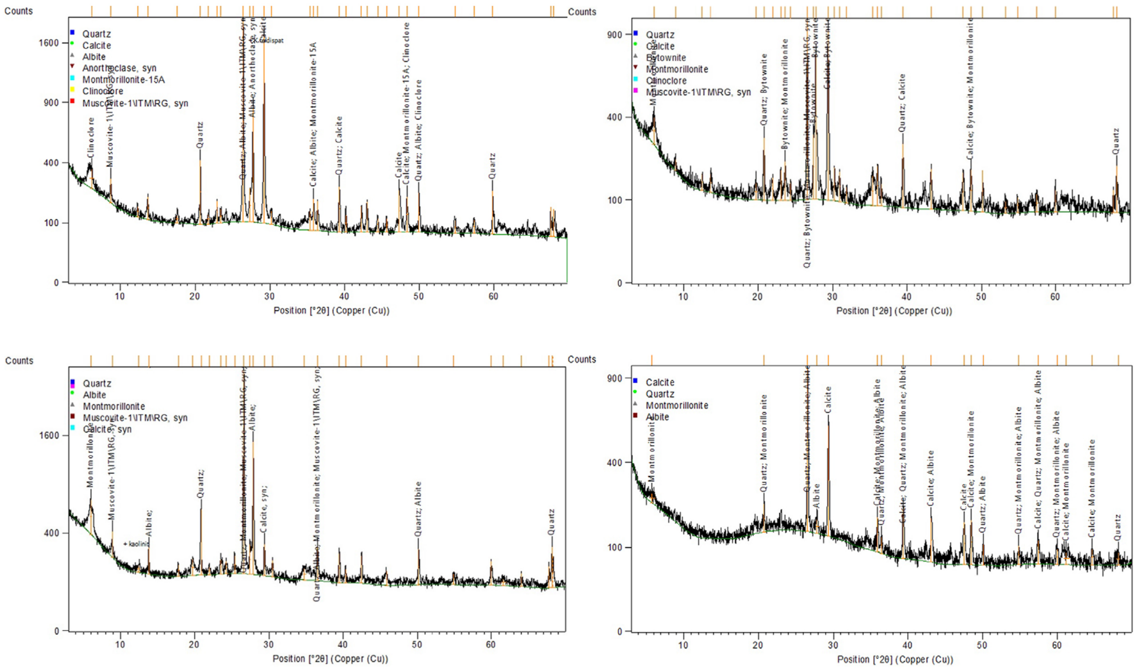

Figure 29. XRD diffractograms of selected minerals.

ARKEOLOJİ BİLİMLERİ DERGİSİ
TURKISH JOURNAL OF ARCHAEOLOGICAL SCIENCES

Amaç ve Kapsam

Arkeoloji bir süredir geçmişin yorumlanmasında teknoloji ve doğa bilimleri, mühendislik ve bilgisayar teknolojileri ile yoğun iş birliği içinde yeni bir anlayışa evrilmektedir. Üniversiteler, ilgili kurum ya da enstitülerde yeni açılmakta olan "Arkeoloji Bilimleri" bölümleri ve programları, geleneksel anlayışı terk ederek değişen yeni bilim iklimine adapte olmaya çalışmaktadır. Bilimsel analizlerden elde edilen sonuçların arkeolojik bağlam ile birlikte ele alınması, arkeolojik materyallerin, yerleşmelerin ve çevrenin yorumlanmasında yeni bakış açıları doğurmaktadır.

Türkiye'de de doğa bilimleriyle iş birliği içindeki çalışmaların olduğu kazı ve araştırma projelerinin sayısı her geçen gün artmakta, yeni uzmanlar yetişmektedir. Bu nedenle Arkeoloji Bilimleri Dergisi, Türkiye'de arkeolojinin bu yeni ivmenin bir parçası olmasına ve arkeoloji içindeki arkeobotanik, arkeozooloji, alet teknolojileri, tarihlendirme, mikromorfoloji, biyoarkeoloji, jeokimyasal ve spektroskopik analizler, Coğrafi Bilgi Sistemleri, iklim ve çevre modellemeleri gibi uzmanlık alanlarının çeşitlenerek yaygınlaşmasına katkı sağlamayı amaçlamaktadır. Derginin ana çizgisi arkeolojik yorumlamaya katkı sağlayan yeni anlayışlara, disiplinlerarası yaklaşımlara, yeni metot ve kuram önerilerine, analiz sonuçlarına öncelik vermek olarak planlanmıştır.

Arkeoloji Bilimleri Dergisi uluslararası hakemli bir dergidir. Dergi, Ege Yayınları tarafından çevrimiçi olarak yayınlanmaktadır. Kazı raporlarına, tasnif ve tanıma dayalı çalışmalara, buluntu katalogları ve özgün olmayan derleme yazılarına öncelik verilmeyecektir.

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Aims and Scope

Archaeology is being transformed by the integration of innovative methodologies and scientific analyses into archaeological research. With the establishment of new departments, institutes, and programs focusing on "Archaeological Sciences", archaeology has moved beyond the traditional approaches of the discipline. When placed within their archaeological context, studies can provide novel insights and new interpretive perspectives to the study of archaeological materials, settlements and landscapes.

In Turkey, the number of interdisciplinary excavation and research projects incorporating scientific techniques is on the rise. A growing number of researchers are being trained in a broad range of scientific fields including but not limited to archaeobotany, archaeozoology, tool technologies, dating methods, micromorphology, bioarchaeology, geochemical and spectroscopic analysis, Geographical Information Systems, and climate and environmental modeling. The Turkish Journal of Archaeological Sciences aims to situate Turkish archaeology within this new paradigm and to diversify and disseminate scientific research in archaeology. New methods, analytical techniques and interdisciplinary initiatives that contribute to archaeological interpretations and theoretical perspectives fall within the scope of the journal. The Turkish Journal of Archaeological Sciences is an international peer-reviewed journal. The journal is published online by Ege Yayınları in Turkey. Excavation reports and manuscripts focusing on the description, classification, and cataloging of finds do not fall within the scope of the journal.

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ARKEOLOJİ BİLİMLERİ DERGİSİ
TURKISH JOURNAL OF ARCHAEOLOGICAL SCIENCES

Makale Gönderimi ve Yazım Kılavuzu

* *Please see below for English*

Makale Kabul Kriterleri

Makalelerin konu aldığı çalışmalar, Arkeoloji Bilimleri Dergisi'nin amaçları ve kapsamı ile uyumlu olmalıdır (bkz.: Amaç ve Kapsam).

Makaleler Türkçe veya İngilizce olarak yazılmalıdır. Makalelerin yayın diline çevirisi yazar(lar)ın sorumluluğundadır. Eğer yazar(lar) makale dilinde akıcı değilse, metin gönderilmeden önce anadili Türkçe ya da İngilizce olan kişilerce kontrol edilmelidir.

Her makaleye 200 kelimeyi aşmayacak uzunlukta Türkçe ve İngilizce yazılmış özet ve beş anahtar kelime eklenmelidir. Özete referans eklenmemelidir.

Yazarın Türkçesi veya İngilizcesi akıcı değilse, özet ve anahtar kelimelerin Türkçe veya İngilizce çevirisi editör kurulu tarafından üstlenilebilir.

Metin, figürler ve diğer dosyalar wetransfer veya e-posta yoluyla **archaeologicalsciences@gmail.com** adresine gönderilmelidir.

Makale Kontrol Listesi

Lütfen makalenizin aşağıdaki bilgileri içerdiğinden emin olun:

- Yazarlar (yazarların adı-soyadı ve iletişim bilgileri buradaki sırayla makale başlığının hemen altında paylaşılmalıdır)
- Çalışılan kurum (varsa)
- E.mail adresi
- ORCID ID

Makalenin içermesi gerekenler:

- Başlık
- Özet (Türkçe ve İngilizce)
- Anahtar kelimeler
- Metin
- Kaynakça
- Figürler
- Tablolar

Bilimsel Standartlar ve Etik

- Gönderilen yazılar başka bir yerde yayınlanmamış veya yayınlanmak üzere farklı bir yere gönderilmemiş olmalıdır.
- Makaleler özgün ve bilimsel standartlara uygun olmalıdır.

- Makalelerde cinsiyetçi, ırkçı veya kültürel ayrım yapmayan, kapsayıcı bir dil kullanmalıdır ("insanoğlu" yerine "insan"; "bilim adamı" yerine "bilim insanı" gibi).

Yazım Kuralları

Metin ve Başlıkların Yazımı

- Times New Roman karakterinde yazılan metin 12 punto büyüklüğünde, iki yana yaslı ve tek satır aralıklı yazılmalıdır. Makale word formatında gönderilmelidir.
- Yabancı ve eski dillerdeki kelimeler *italik* olmalıdır.
- Başlık ve alt başlıklar **bold** yazılmalıdır.
- Başlıklar numaralandırılmamalı, italik yapılmamalı, altları çizilmemelidir.
- Başlık ve alt başlıklarda yalnızca her kelimenin ilk harfi büyük olmalıdır.

Referans Yazımı

Ayrıca bkz.: Metin içi Atıflar ve Kaynakça Yazımı

- Referanslar metin içinde (Yazar yıl, sayfa numarası) şeklinde verilmelidir.
- Referanslar için dipnot ve son not kullanımından kaçınılmalıdır. Bir konuda not düşme amacıyla gerektiği taktirde dipnot tercih edilmelidir.
- Dipnotlar Times New Roman karakterinde, 10 punto büyüklüğünde, iki yana yaslı, tek satır aralıklı yazılmalı ve her sayfa sonuna süreklilik izleyecek şekilde eklenmelidir.

Şekiller ve Tablolar

- Makalenin altına şekiller ve tablolar için bir başlık listesi eklenmelidir. Görsellerde gerektiği takdirde kaynak belirtilmelidir. Her şekil ve tabloya metin içerisinde gönderme yapılmalıdır (Şekil 1 veya Tablo 1).
- Görseller Word dokümanının içerisine yerleştirilmemeli, jpg veya tiff formatında, ayrı olarak gönderilmelidir.
- Görüntü çözünürlüğü basılması istenen boyutta ve 300 dpi'nin üzerinde olmalıdır.
- Görseller Photoshop ve benzeri programlar ile müdahale edilmeden olabildiğince ham haliyle gönderilmelidir.
- Excel'de hazırlanmış tablolar ve grafikler var ise mutlaka bunların PDF ve Excel dokümanları gönderilmelidir.

Tarihlerin ve Sayıların Yazımı

- MÖ ve MS kısaltmalarını harflerin arasına nokta koymadan kullanınız (örn.: M.Ö. yerine MÖ).
- "Bin yıl" ya da "bin yıl" yerine "... binyıl" kullanınız (örn.: MÖ 9. binyıl).
- "Yüzyıl", "yüz yıl" ya da "yy" yerine "yüzyıl" kullanınız (örn.: MÖ 7. yüzyıl).
- Beş veya daha fazla basamaklı tarihler için sondan sayarak üçlü gruplara ayırmak suretiyle sayı gruplarının arasına nokta koyunuz (örn.: MÖ 10.500)
- Dört veya daha az basamaklı tarihlerde nokta kullanmayınız (örn.: MÖ 8700).
- 0-10 arasındaki sayıları rakamla değil yazıyla yazınız (örn.: "8 kez yenilenmiş taban" yerine "sekiz kez yenilenmiş taban").

Noktalama ve İşaret Kullanımı

- Ara cümleleri lütfen iki çizgi ile ayırınız (—). Çizgi öncesi ve sonrasında boşluk bırakmayınız.
- Sayfa numaraları, tarih ve yer aralıklarını lütfen tek çizgi (-) ile ayırınız: 1989-2006; İstanbul-Kütahya.

Kısaltmaların Yazımı

- Sık kullanılan bazı kısaltmalar için bkz.:

Yaklaşık:	yak.	Circa:	ca.
Bakınız:	bkz.	Kalibre:	kal.
Örneğin:	örn.	ve diğerleri:	vd.

Özel Fontlar

- Makalede özel bir font kullanıldıysa (Yunanca, Arapça, hiyeroglif vb.) bu font ve orijinal metnin PDF versiyonu da gönderilen dosyalar içerisine eklenmelidir.

Metin içi Atıflar ve Kaynakça Yazımı

- Her makale, metin içerisinde atıf yapılmış çalışmalardan oluşan ve "Kaynakça" olarak başlıklandırılan bir referans listesi içermelidir. Lütfen metin içerisinde bulunan her referansın kaynakçaya da eklendiğinden emin olun.
- Metin içerisindeki alıntılar doğrudan yapılabilir: '…Esin (1995)'in belirtmiş olduğu gibi' ya da parantez içerisinde verilebilir: 'analiz sonuçları gösteriyor ki … (Esin 1995).'
- Aynı parantez içerisindeki referanslar yayın yılına göre sıralanmalı ve ";" ile ayrılmalıdır: '… (Dinçol ve Kantman 1969; Esin 1995; Özbal vd. 2004).'
- Aynı yazarın farklı yıllara ait eserlerine yapılan atıflarda yazarın soyadı bir kere kullanılmalı ve eser yılları "," ile ayrılmalıdır: '... (Peterson 2002, 2010).'
- Aynı yazar(lar)ın aynı yıl içerisindeki birden fazla yayınına referans verileceği durumlarda yayın yılının yanına harfler 'a', 'b', 'c' gibi alfabetik olarak koyulmalıdır.
- Tek yazarlı kaynakları, aynı yazar adıyla başlayan çok yazarlı kaynaklardan önce yazınız.
- Aynı yazar adıyla başlayan fakat farklı eş yazarlara sahip kaynakları ikinci yazarın soyadına göre alfabetik sıralayınız.
- Aynı yazara ait birden fazla tek yazarlı kaynak olması durumunda kaynakları yıllara göre sıralayınız.
- Dergi makaleleri için doi bilgisi varsa kaynakçada mutlaka belirtiniz.

Aşağıda, farklı kaynakların metin içerisinde ve kaynakçada nasıl yazılacağına dair örnekler bulabilirsiniz.

Tek yazarlı dergi makaleleri, kitap içi bölümler ve kitaplar

Metin içerisinde:

Yazarın soyadı ve yayın yılı (Esin 1995).

Sayfa sayısı bilgisi verilecekse:

Yazarın soyadı ve yayın yılı, sayfa sayısı (Esin 1995, 140).

Dergi makalesi:

Bickle, P. 2020. Thinking Gender Differently: New Approaches to Identity Difference in the Central European Neolithic. *Cambridge Archaeological Journal* 30(2), 201-218. https://doi.org/10.1017/S0959774319000453

Kitap içi bölüm:

Esin, U. 1995. Aşıklı Höyük ve Radyo-Aktif Karbon Ölçümleri. A. Erkanal, H. Erkanal, H. Hüryılmaz, A. T. Ökse (Eds.), *İ. Metin Akyurt - Bahattin Devam Anı Kitabı. Eski Yakın Doğu Kültürleri Üzerine İncelemeler*, İstanbul: Arkeoloji ve Sanat Yayınları, 135-146.

Kitap:

Peterson, J. 2002. *Sexual Revolutions: Gender and Labor at the Dawn of Agriculture*. Walnut Creek, CA: AltaMira Press.

İki yazarlı dergi makaleleri, kitap içi bölümler ve kitaplar

Metin içerisinde:

Her iki yazarın soyadı ve yayın yılı (Dinçol ve Kantman 1969, 56).

Dergi makalesi:

Pearson, J., Meskell, L. 2015. Isotopes and Images: Fleshing out Bodies at Çatalhöyük. *Journal of Archaeological Method and Theory* 22, 461-482. https://doi.org/10.1007/s10816-013-9184-5

Kitap içi bölüm:

Özkaya, V., San, O. 2007. Körtik Tepe: Bulgular Işığında Kültürel Doku Üzerine İlk Gözlemler. M. Özdoğan, N. Başgelen (Eds.), *Türkiye'de Neolitik Dönem. Yeni Kazılar, Yeni Bulgular*, İstanbul: Arkeoloji ve Sanat Yayınları, 21-36.

Kitap:

Dinçol, A. M., Kantman, S. 1969. *Analitik Arkeoloji, Denemeler*. Anadolu Araştırmaları III, Özel sayı, İstanbul: Edebiyat Fakültesi Basımevi.

Üç ve daha çok yazarlı dergi makaleleri ve kitap içi bölümler

Metin içerisinde:

İlk yazarın soyadı, "vd." ve yayın yılı (Özbal vd. 2004).

Dergi makalesi:

Özbal, R., Gerritsen, F., Diebold, B., Healey, E., Aydın, N., Loyet, M., Nardulli, F., Reese, D., Ekstrom, H., Sholts, S., Mekel-Bobrov, N., Lahn, B. 2004. Tell Kurdu Excavations 2001. *Anatolica* 30, 37-107.

Kitap içi bölüm:

Pearson, J., Meskell, L., Nakamura, C., Larsen, C. S. 2015. Reconciling the Body: Signifying Flesh, Maturity, and Age at Çatalhöyük. I. Hodder, A. Marciniak (Eds.), *Assembling Çatalhöyük*, Leeds: Maney Publishing, 75-86.

Editörlü kitaplar

Metin içerisinde:

Yazar(lar)ın soyadı ve yayın yılı (Akkermans ve Schwartz 2003).

Akkermans, P. M. M. G., Schwartz, G. M. 2003. (Eds.) *The Archaeology of Syria. From Complex Hunter-Gatherers to Early Urban Societies (c. 16.000-300 BC)*. Cambridge: Cambridge University Press.

Web kaynağı:

Soyad, Ad. Web Sayfasının Başlığı. Web Sitesinin Adı. Yayınlayan kurum (varsa), yayın tarihi. Erişim tarihi. URL.

ARKEOLOJİ BİLİMLERİ DERGİSİ
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Submission and Style Guideline

Submission Criteria for Articles

The content of the manuscripts should meet the aims and scope of the Turkish Journal of Archaeological Sciences (cf. Aims and Scope).

Manuscripts may be written in Turkish or English. The translation of articles into English is the responsibility of the author(s). If the author(s) are not fluent in the language in which the article is written, they must ensure that the text is reviewed, ideally by a native speaker, prior to submission.

Each manuscript should include a Turkish and an English abstract of up to 200 words and five keywords in both Turkish and English. Citations should not be included in the abstract.

If the author(s) are not fluent in the language of the manuscript, a translation of the abstract and the keywords may be provided by the editorial board.

Manuscripts, figures, and other files should be sent via wetransfer or e-mail to **archaeologicalsciences@gmail.com**

Submission Checklist

Each article must contain the following:

- Authors (please provide the name-last name and contact details of each author under the main title of the manuscript)
- Affiliation (where applicable)
- E-mail address
- ORCID ID

The manuscript should contain:

- Title
- Abstract (in English and Turkish)
- Keywords
- Text
- References
- Figures (when applicable)
- Tables (when applicable)

Scientific Standards and Ethics

- Submitted manuscripts should include original research that has not been previously published or submitted for publication elsewhere.
- The manuscripts should meet scientific standards.
- Manuscripts should use inclusive language that is free from bias based on sex, race or ethnicity, etc. (e.g., "he or she" or "his/her/their" instead of "he" or "his") and avoid terms that imply stereotypes (e.g., "humankind" instead of "mankind").

Style Guide

Manuscript Formatting

- Manuscripts should be written in Times New Roman 12-point font, justified and single-spaced. Please submit the manuscript as a word document.
- Words in foreign and ancient languages should be *italicized*.
- Titles and subtitles should appear in **bold**.
- Titles and subtitles should not be numbered, italicized, or underlined.
- Only the first letter of each word in titles and subtitles should be capitalized.

References

Cf.: In-Text Citations and References

- In-text citations should appear inside parenthesis (Author year, page number).
- Footnotes and endnotes should not be used for references. Comments should be included in footnotes rather than endnotes.
- The footnotes should be written in Times New Roman 10-point font, justified and single-spaced, and should be continuous at the bottom of each page.

Figures and Tables

- Please provide a caption list for figures and tables following the references. Provide credits where applicable. Each figure and table should be referenced in the text (Figure 1, or Table 1), but please do not include figures in the text document.
- Each figure should be submitted separately as a jpg or tiff file.
- Images should be submitted in the dimensions in which they should appear in the published text and their resolution must be over 300 dpi.
- Please avoid editing the figures in Photoshop or similar programs but send the raw version of the figures if possible.
- Tables and graphs prepared in Excel should be sent as both PDF and Excel documents.

Dates and Numbers

- Please use BCE/CE and please avoid using dots without dots (i.e., BCE instead of BC or B.C.).
- Please use a dot for numbers and dates with 5 or more digits (i.e., 10.500 BCE).
- Please avoid using dots for numbers and dates with 4 or less digits (i.e., 8700 BCE).
- Please spell out whole numbers from 0 to 10 (e.g., "the floor was renewed eight times" instead of "the floor was renewed 8 times").

Punctuation

- Please prefer em dashes (—) for parenthetical sentences: "Children were buried with various items, the adolescents—individuals between the ages of 12-19—had the most variety in terms of grave goods."
- Please prefer an en dash (-) between page numbers, years, and places: 1989-2006; İstanbul-Kütahya.

Abbreviations

- Commonly used abbreviations:

Approximately:	approx.	Figure:	Fig.
Confer:	cf.	*Id est:*	i.e.,
Circa:	ca.	*Exempli gratia:*	e.g.,
Calibrated:	cal.		

Special Fonts

- If a special font must be used in the text (e.g., Greek or Arabic alphabet or hieroglyphs), the text in the special font and the original manuscript should be sent in separate PDF files.

In-Text Citations and References

- Each article should contain a list of references in a section titled "References" at the end of the text. Please ensure that all papers cited in the text are listed in the bibliography.
- Citations in the text may be made directly, e.g., 'as shown by Esin (1995) ...' or in parenthesis, e.g., 'research suggests ... (Esin 1995)'.
- References within the same parenthesis should be arranged chronologically and separated with a ";", e.g., '... (Dinçol and Kantman 1969; Esin 1995; Özbal et al. 2004).'
- In references to the studies by the same author from different years, please use the last name of the author once, followed by the years of the cited studies, each separated by a ",", e.g., '... (Peterson 2002, 2010).
- More than one reference from the same author(s) in the same year must be identified by the letters 'a', 'b', 'c' placed after the year of publication.
- When dealing with multiple papers from the same author, single authored ones should be written before the studies with multiple authors.
- When dealing with papers where the first author is the same, followed by different second (or third, and so on) authors, the papers should be listed alphabetically based on the last name of the second author.
- When dealing with multiple single-authored papers of the same author, the papers should be listed chronologically.
- Please provide the doi numbers of journal articles.

Below, you may find examples for in-text citations and references.

Single-authored journal articles, book chapters, and books

In-text:

Last name and publication year (Esin 1995).

If the page number is indicated:

Last name and publication year, page number (Esin 1995, 140).

Journal article:

Bickle, P. 2020. Thinking Gender Differently: New Approaches to Identity Difference in the Central European Neolithic. *Cambridge Archaeological Journal* 30(2), 201-218. https://doi.org/10.1017/S0959774319000453

Book chapter:

Esin, U. 1995. Aşıklı Höyük ve Radyo-Aktif Karbon Ölçümleri. A. Erkanal, H. Erkanal, H. Hüryılmaz, A. T. Ökse (Eds.), *İ. Metin Akyurt - Bahattin Devam Anı Kitabı. Eski Yakın Doğu Kültürleri Üzerine İncelemeler*, İstanbul: Arkeoloji ve Sanat Yayınları, 135-146.

Book:

Peterson, J. 2002. Sexual Revolutions: *Gender and Labor at the Dawn of Agriculture*. Walnut Creek, CA: AltaMira Press.

Journal articles, book chapters, and books with two authors

In-text:

Last names of both authors and publication year (Dinçol and Kantman 1969, 56).

Journal article:

Pearson, J., Meskell, L. 2015. Isotopes and Images: Fleshing out Bodies at Çatalhöyük. *Journal of Archaeological Method and Theory* 22, 461-482.
https://doi.org/10.1007/s10816-013-9184-5

Book chapter:

Özkaya, V., San, O. 2007. Körtik Tepe: Bulgular Işığında Kültürel Doku Üzerine İlk Gözlemler. M. Özdoğan, N. Başgelen (Ed.), *Türkiye'de Neolitik Dönem. Yeni Kazılar, Yeni Bulgular*, İstanbul: Arkeoloji ve Sanat Yayınları, 21-36.

Book:

Dinçol, A. M., Kantman, S. 1969. *Analitik Arkeoloji, Denemeler*. Anadolu Araştırmaları III, Özel sayı, İstanbul: Edebiyat Fakültesi Basımevi.

Journal articles and book chapters with three or more authors

In-text:

Last name of the first author followed by "et al." and the publication year (Özbal et al. 2004).

Journal article:

Özbal, R., Gerritsen, F., Diebold, B., Healey, E., Aydın, N., Loyet, M., Nardulli, F., Reese, D., Ekstrom, H., Sholts, S., Mekel-Bobrov, N., Lahn, B. 2004. Tell Kurdu Excavations 2001. *Anatolica* 30, 37-107.

Book chapter:

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Edited books

In-text:

Last name(s) of the author(s) and publication year (Akkermans and Schwartz 2003).

Akkermans, P. M. M. G., Schwartz, G. M. 2003. (Eds.) *The Archaeology of Syria. From Complex Hunter-Gatherers to Early Urban Societies (c. 16.000-300 BC)*. Cambridge: Cambridge University Press.

Web source:

Last name, Initial of the first name. Title of the web page. Title of the website. Institution (where applicable), publication date. Access date. URL.