



**HAL**  
open science

## The Late Neolithic Pattern Burnished Pottery from Halai in East Locris, Central Greece

Effimia Angeli

### ► To cite this version:

Effimia Angeli. The Late Neolithic Pattern Burnished Pottery from Halai in East Locris, Central Greece. Société préhistorique française. Hiatus, lacunes et absences : identifier et interpréter les vides archéologiques, Actes du 29e Congrès préhistorique de France, 31 mai-4 juin 2021, Toulouse, Session La fabrication des poteries : quelles structures, quels outils, quels lieux de production ?, Société préhistorique française, pp.29-44, 2023. <hal-04260323v2>

**HAL Id: hal-04260323**

**<https://hal.science/hal-04260323v2>**

Submitted on 16 Dec 2025

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



ETALAB - Open licence

## The Late Neolithic Pattern Burnished Pottery from Halai in East Locris, Central Greece Preliminary Results of the Macroscopic Analysis

### *La « poterie à motifs brunis » (pattern burnished pottery) du Néolithique final de Halai, en Locride orientale (Grèce centrale) Résultats préliminaires de l'analyse macroscopique*

Effimia ANGELI

**Abstract:** This paper is concerned with the presentation of the main features of the Late Neolithic Pattern Burnished pottery from the Neolithic settlement of Halai in Central Greece. The site of Halai is a coastal settlement, situated southeast of the bay of Atalante and northwest of the Euboean Gulf. The Neolithic habitation in Halai seems to start around 6370 BC and lasts until ca. 5300 BC. The introduction of this type of ware dates to the very beginning of the Late Neolithic I period.

The analysis of the structural elements and the decorative grammar of the ceramic fragments leads to a preliminary reconstruction of the *chaîne opératoire*. Pattern Burnished ware from Halai has been associated with the supply and the consumption of food. The variety of small, medium-sized and large vessels may introduce both an individual and a non-individual character. The distribution of the Pattern Burnished pottery demonstrates its presence mainly in a place of “communal” use, where the habitats must have prepared and consumed, or at least offered food. However, it is also present in houses indicating its domestic use. This type of ware finds its closest parallels in Boeotia and the Peloponnese, displaying interrelationships between Halai and southern mainland Greece both by land and sea.

**Keywords:** Late Neolithic pottery, Pattern Burnished ware, Halai, Central Greece, *chaîne opératoire*, social organization, networking.

**Résumé :** Cet article porte sur « la poterie à motifs brunis » (*pattern burnished pottery*) du Néolithique final de Halai. Ce dernier site est une colonie côtière située au sud-est de la baie d'Atalante et au nord-ouest du golfe d'Eubée. L'occupation néolithique semble commencer vers 6000 avant J.-C. et s'achever vers 5300 avant J.-C. Au Néolithique moyen, les maisons qui montrent les indices les plus clairs d'une organisation domestique se trouvent à l'ouest et au nord-ouest du site ; la plupart sont pourvues de petits foyers intérieurs à usage domestique. À l'est, d'autres foyers ont été découverts dans un espace ouvert. Au Néolithique final I, la plupart de ces maisons ont été abandonnées, tandis que de nouvelles ont été construites plus au nord. Néanmoins, l'espace ouvert est toujours utilisé et présente des caractéristiques similaires à celles de la période précédente.

L'architecture et la taille des maisons suggèrent une inégalité minimale entre les familles ayant vécu dans la colonie, la répartition spatiale des poteries décorées apporte cependant des informations complémentaires sur l'organisation sociale. Ainsi, dans l'espace ouvert, la découverte d'un grand nombre de tessons de marmites et, plus généralement, d'une quantité importante de vaisselle, décorée et non décorée, laisse penser que ce lieu fonctionnait comme un lieu de préparation et de consommation communautaires de la nourriture. La poterie à motifs brunis, un type de vaisselle encore peu documenté dans les établissements néolithiques de la Grèce centrale, est représentée par un nombre important de fragments. Ce type de vaisselle apparaît au début du Néolithique final I et perdure jusqu'à la dernière phase de cette période.

Les résultats préliminaires de la reconstitution de la chaîne opératoire montrent que le montage est principalement réalisé au colombin. L'engobe est appliqué sur une argile à la consistance « cuir dur » ou déjà sèche. La brillance de l'engobe est obtenue après le séchage en frottant la surface avec un outil doux. La décoration de motifs brunis est ensuite réalisée, directement sur la surface lorsque cela est possible.

Le degré de séchage et la dureté de l'outil permettent d'obtenir deux types de décor à motifs brunis : soit des fines lignes parallèles, soit des motifs pleins et compacts. Dans quelques cas, le frottement exercé par les artisans lors du brunissage a retiré l'engobe, probablement parce que ce dernier n'était pas assez sec.

La présence de lissage et/ou de polissage de la poterie peut traduire la volonté du potier d'augmenter l'étanchéité des récipients ; on peut donc supposer que les motifs brunis relèvent essentiellement d'une volonté esthétique. Les motifs décoratifs linéaires sont comparables à ceux de la céramique peinte, même si aucune ligne ondulée n'a été observée. Ce dernier motif pourrait être plus difficile à réaliser avec cette technique.

La poterie à motifs brunis de Halai trouve des parallèles dans les colonies voisines (Béotie) mais aussi plus éloignées (Péloponnèse). Les similitudes ne portent pas seulement sur la grammaire décorative, mais aussi sur les formes des vases. Cela démontre le développement des relations et, peut-être, l'existence de réseaux d'échanges maritimes et terrestres. Bien que l'étude n'ait, pour l'heure, apporté aucune preuve de l'importation de céramiques, l'hypothèse d'un échange de savoir-faire ne peut être exclue. Les réseaux d'échanges et la nature des relations entre les populations ne peuvent pas être estimés à partir de l'étude d'un seul type de vaisselle, néanmoins, nous pouvons observer que ce type de vaisselle de Halai semble révéler une proximité avec le sud de la Grèce continentale.

**Mots-clés :** poterie à motifs brunis, Néolithique tardif, Halai, Locris oriental, Grèce centrale, chaîne opératoire, organisation sociale, réseaux d'échange.

## INTRODUCTION

This paper presents the main features of the Late Neolithic Pattern Burnished pottery from the Neolithic settlement of Halai in East Locris, as they have emerged through the macroscopic examination and analysis. The ultimate goal of this paper is to demonstrate the preliminary results of the reconstruction of the “*chaîne opératoire*” in the manufacture of this type of ware, for which little is known from the excavated Neolithic settlements in Central Greece so far<sup>(1)</sup>. Furthermore, a few remarks about the use-wear traces on this ceramic category and its distribution in the settlement will provide further information about its possible use, as it is mainly associated with specific parts of the settlement. In addition, a brief presentation of similarities and differences with neighboring and further-located sites in mainland Greece will give insight into the interrelationships and the networking between Halai and other settlements during the Late Neolithic I period. Therefore, through the presentation and analysis of the factors summarized above, this paper aims to ‘fill part of the gap’ of the archaeological knowledge for the Neolithic communities in Central Greece, their social relationships, and their exchange networks.

### The site of Halai

The site of Halai is a coastal settlement, situated southeast of the bay of Atalante and northwest of the Euboean Gulf, in the modern village of Ayios Ioannis Theologos (fig. 1). The extent of the excavated area is about 160 m in length and about 70 m in width. According to the excavation data, the Neolithic habitation in Halai seems to have started around 6370 BC and lasted until ca. 5300 BC. After 5300 BC, it was deserted for hundreds of years. However, in the late 7th century BC, it was reconstructed

as a citadel (acropolis). The new phase of habitation lasts until the Late Roman/Early Byzantine period (Coleman et al., 1992; O'Neill et al., 1999; Facorellis and Coleman, 2012; Coleman et al., 2017).

The town was named Halai (*Ἁλαίς* in Greek) in the historical period. Its name derives from the ancient Greek word *ἅλας*, which means sea, and it is associated with the term *αλυκέας* of the same root, which means salt marshes. Therefore, its name is supposed to demonstrate the significance of salt for the economy of the ancient town (e. g. Coleman et al., 2017; Malliri et al., 2019).

The significance of this site lies in the fact that it comprises one of the two Neolithic coastal settlements that have been thoroughly excavated so far in the mainland of Central Greece, with the other one being at Nea Makri in Attica (Pantelidou-Gofa, 1991 and 1995). It is worth mentioning that a coastal settlement can provide further information about the networking both by land and sea.

### The Neolithic settlement

The Neolithic period in Halai corresponds to a stratigraphic sequence consisting of five strata by the earliest dating to the late Early Neolithic/earlier Middle Neolithic (6370-5810 BC; Stratum 1), and the latest to the later Late Neolithic I (5450-5300 BC; Stratum 5; see Facorellis and Coleman, 2012, p. 329). Strata 4 and 5 correspond to the Late Neolithic I period<sup>(2)</sup>. The excavated part of the Neolithic settlement is located in Area F (fig. 2). Nevertheless, the architectural remains of Neolithic walls below the ancient structures in Areas A, B, and H suggest that the Neolithic village must have extended to most of the expanse of the acropolis. The habitation was continual with every new phase built above the previous one during the Middle Neolithic period (Strata 1-3); a slight displacement to the north occurred at the very beginning of the Late Neolithic I (Stratum 4) due to the rise of

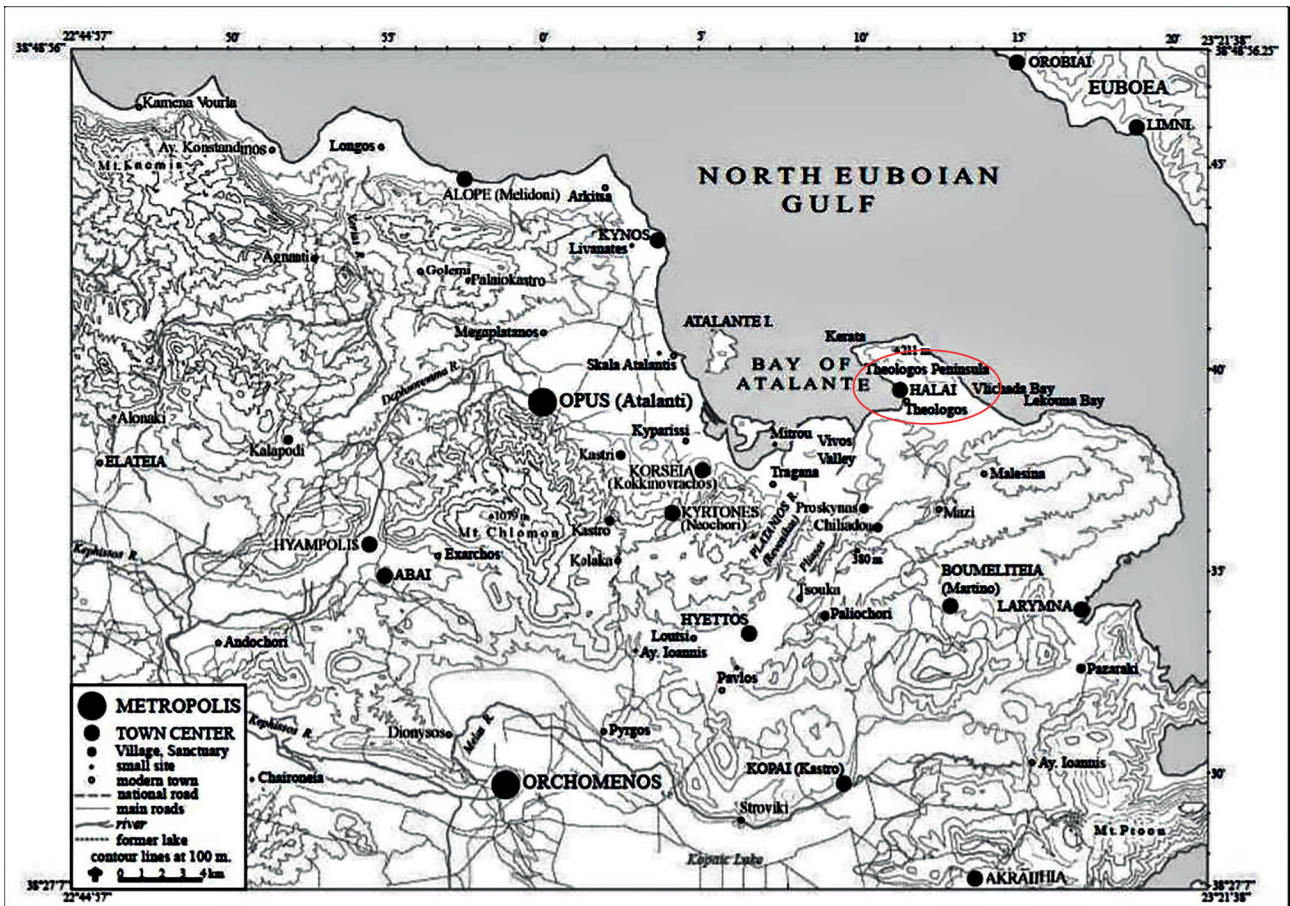


Fig. 1 – Map of Eastern Central Greece depicting Halai and the surrounding regions (Facorellis and Coleman, 2012, fig. 1).  
 Fig. 1 – Carte de la Grèce centrale orientale représentant Halai et les régions environnantes (Facorellis et Coleman, 2012, fig. 1).

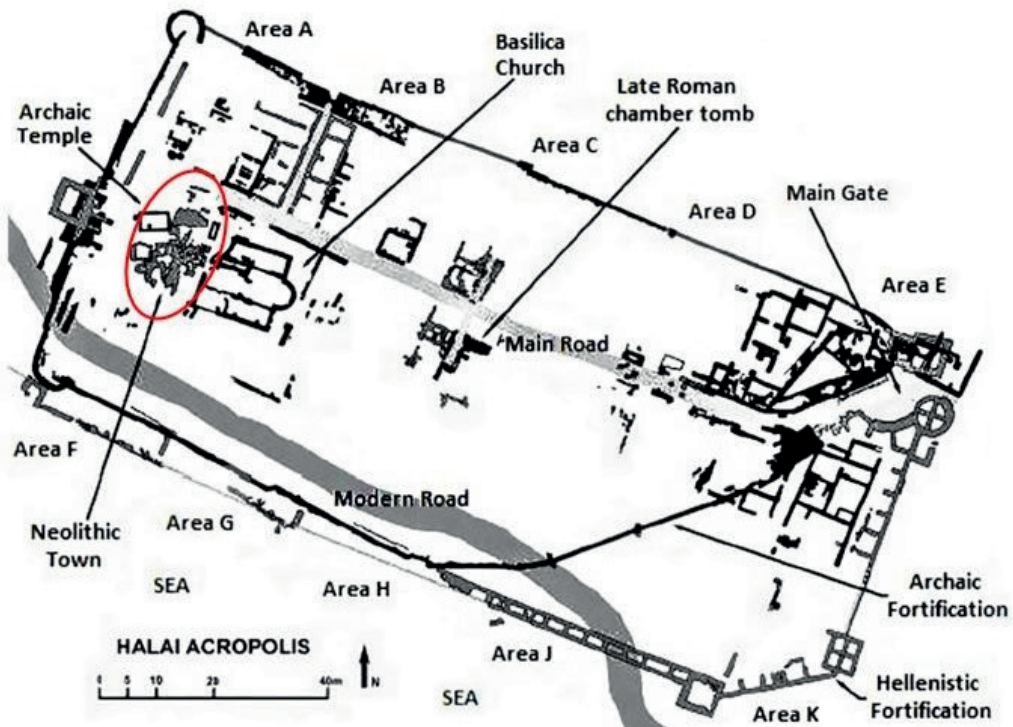
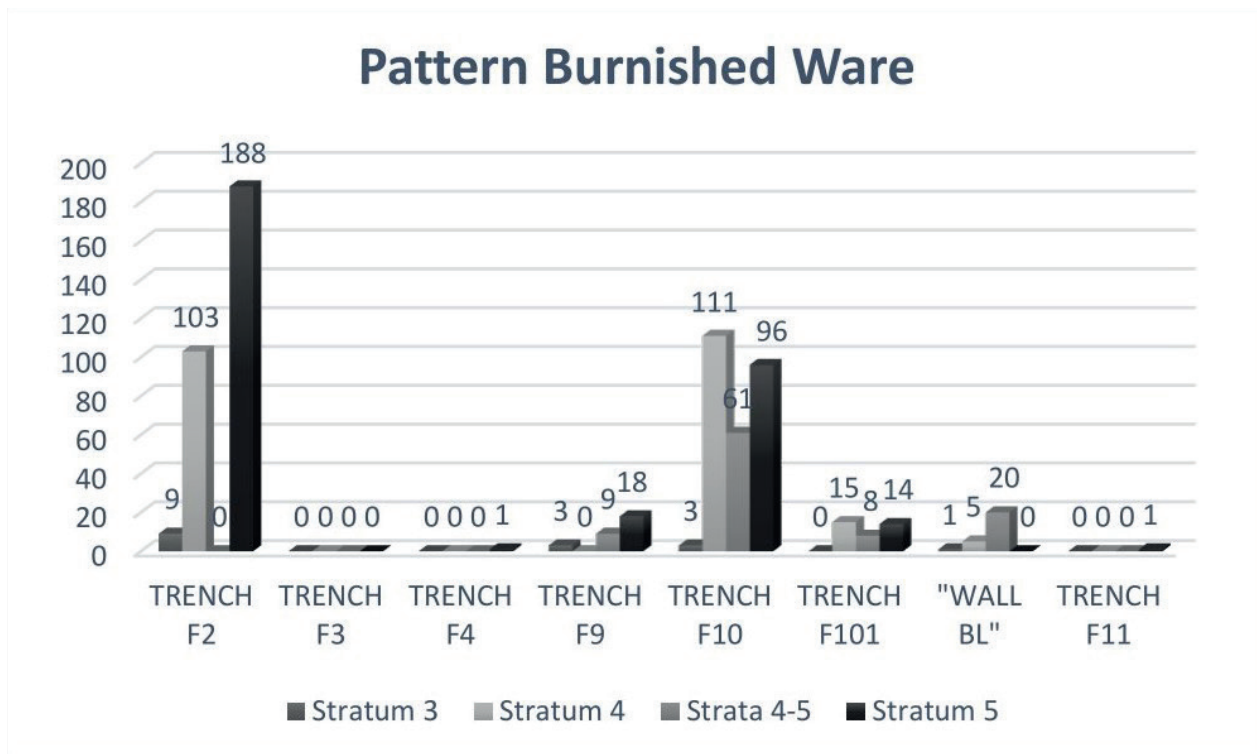


Fig. 2 – Plan drawing of the excavation Areas of Halai (Malliri et al., 2019, fig. 3).  
 Fig. 2 – Plan des zones de fouilles de Halai (Malliri et al., 2019, fig. 3).





**Fig. 4** – The distribution of the Pattern Burnished pottery in the Neolithic settlement of Halai.

**Fig. 4** – Répartition de la poterie à motifs brunis dans l'établissement néolithique de Halai.

The study of the decorated pottery of the Neolithic settlement of Halai has not been secluded from its general context. Therefore, it is combined with the stratigraphic data and the place it was found. To achieve this goal, the recording of the whole ceramic assemblage in stratigraphic order occurred first<sup>(4)</sup>. The main steps of the macroscopic analysis are described below, with the parameters needed to be faced.

The main parameter relates to the fragmentation of the ceramic assemblage, the absence of complete vessels, and the fact that, in most cases, the fragments that belong to the same vessel could not help its reconstruction. However, thanks to a significant number of preserved rim fragments, the discernment of shapes and sizes was feasible. Consequently, the first classification step comprises the division of rims, bottoms and bodies (including the handles and the lugs). Body fragments subsume the majority. Then, the fragments that belonged to the same vessel were organized into groups. In the second step, the ceramic assemblage was divided into categories based on the ceramic material and its composition (fabric). Afterwards, the determination of open and closed vessels took place by the information received by the rim fragments and the presence or absence of treatment on the interior surface of the body fragments. Due to the need to limit as much as possible the deviation parameters, the classification process of open and closed vessels included only the diagnostic fragments (rims, bottoms, bodies with carinated or angular shoulders, bodies with preserved handles or traces of handle presence, etc.).

The size and capacity estimations are approximated, based on the rim diameter with the maximum diameter of

the body and the relative height of the vessel (e.g. Kalogirou, 1994, p. 57). The calculations were conducted with the use of a template of concentric circles and the help of illustrations. In the next stage, one more categorization occurred following the surface treatment. This process sorted the ceramic assemblage into categories and sub-categories based on the presence of slip, polishing or burnishing, and decoration. The color of the surface was associated with the firing techniques and the use of the ceramics (e. g. Rice, 1987, p. 230-232; Skibo, 1997).

The same classification process was conducted for every decorated type of wares but in more detail. Besides all the stages mentioned above, the study of the decorated pottery requires more classification criteria, such as the type of decoration (painted, incised, plastic-added, pattern burnished, etc.), the decorative grammar, and the place of the decoration (exterior/interior surface, rim/body/base). All the information derived from the macroscopic study is included in a database, where every diagnostic fragment or group of joining/joined fragments have their own registration form. The database has allowed statistical data analysis.

## 2. THE PATTERN BURNISHED WARE

Although the Pattern Burnished decoration has already been described by several scholars (e.g. Rice, 1987, p. 138; Orton et al., 1993, p. 85-86; Phelps, 2004, p. 106-107; Roux, 2019, p. 96-98), a brief overview is presented below. The term “*Pattern Burnished*” refers to a type of

decoration in which the burnishing is executed on selected parts of the vessel producing a lustrous outcome in contradiction to the parts left unburnished/less burnished (Rice, 1987, p. 138). It is considered a *widely employed technique*, which is not regularly used to indicate chronological or cultural affinity (Phelps, 2004, p. 106). According to K. D. Vitelli (1993, p. 96), this technique “required little preparation of materials – no fine grinding, mixing of pigments, or preparation of brushes – and little practice or skill to execute”. The burnishing is generally used for a dual goal; the first is the aesthetic quality, while the second is more functional because it eliminates the pores of the surface, increasing the impermeability of the vessel (Kotsakis, 1983, p. 128; Vitelli 1999, p. 23).

The fabric of the vessels is generally brick or buff, while in some cases, it has reduced to gray or dark gray. The surface is usually coated with an orange, red or red-brown slip (Phelps, 2004, p. 106). The degree of drying, the re-humidification of the clay and the mineralogical composition of the paste seem to be the main factors that affect the degree of gloss (Roux, 2019, p. 97).

It is worth underlining the difference between burnishing and polishing, which are often considered synonymous. Although both techniques are executed on dry or leather-hard to dry paste, they define different variable degrees of shine and intensity on the surfaces of the vessels (Roux, 2019, p. 96-97). The burnishing is performed by the repeated rubbing of a hard tool, such as a pebble, a bone or a sherd, against a slipped or non-slipped paste aiming to compact the fine particles of the clay or the slip (Rice, 1987, p. 138; Bonga, 2013, p. 34, Roux, 2019, p. 96). A sharp tool with a curved surface can produce burnishing on the surface of a vessel, which is regularly identified by parallel strokes. Thus, sometimes it is called stroke burnishing (Rice, 1987, p. 138). However, some scholars differentiate the Pattern Burnished from the Stroke Burnished describing the second as a sparser technique that runs in different directions on different parts of the vessel. The more organized linear patterns are considered to depict basketry elements (Robinson and Weinberg, 1960; Phelps, 2004, p. 106-107). On the other hand, polishing is performed by a less sharp tool, and it provides a uniform outcome without parallel strokes (Rice, 1987, p. 138; Bonga, 2013, p. 34).

The earliest appearance of this type of decoration in mainland Greece occurs on Black Burnished pottery and dates to the Middle Neolithic period. Pattern Burnished Black Burnished ware is primarily typical at Franchthi and Corinth. It is considered a development from the Middle Neolithic Scribble and Pattern Burnished Urfirnis (Vitelli, 1993, p. 8 and 491-501; Phelps, 2004, p. 74). Although these first examples date to the Middle Neolithic period<sup>(5)</sup>, Pattern Burnished ware seems to characterize mainly the Late Neolithic period (Phelps, 2004, p. 74).

During the Late Neolithic period, Pattern Burnished Black Burnished is considered again predominant in mainland Greece in comparison to the appearance of this type of decoration on light/brown-slipped and red-slipped

(or red-burnished) surfaces (Phelps, 2004, p. 106-107). Wace and Thompson linked this type of ware to Middle Neolithic Scraped wares from Thessaly (Type A3δ) having claimed that the vessels were first coated with a black slip, part of which was then scrapped off creating a reserved pattern on the gray color of the biscuit (Ware Γ1α2; Wace and Thompson 1912, p. 17). This theory has been questioned whether it could refer to a general phenomenon or not (e.g. Bonga, 2013, p. 167). Some examples of this “scrapped technique” on Black Burnished ware were observed at Orchomenos (Kunze, 1931, p. 18-19) and at Servia (West Macedonia, Northern Greece; Heurtley, 1939, p. 68).

In general, Late Neolithic I Pattern Burnished Black Burnished seems to be more predominant in Central Greece (e.g. Sarakenos Cave at Akraiphnon, Elateia, Orchomenos) and Western Thessaly (e.g. Tsangli at Larisa) in comparison to the Peloponnese and Eastern Thessaly (Phelps, 2004, p. 74; Bonga, 2013, p. 136). This type of decoration is generally associated with the following shapes of vessels: carinated-shoulder bowls, conical bowls, and inward-leaning jars, handled bowls, biconical jars, and fruit-stands (Weinberg, 1937, fig. 29c; Jacobsen, 1973, pl. 50e; Phelps, 2004, p. 74; Bonga, 2013, p. 145-146). Three different decorative patterns appear on Pattern Burnished Black Burnished vessels of this period: a fishnet, which covers a large part of the vessel, groups of parallel lines (usually start from the rim of the vessel), and a rectangular reserved panel also decorated on its interior (e.g. Phelps, 2004, p. 74). The latter refers to the “scrapped technique” described by A. J. B. Wace and M. S. Thompson (Γ1α2; Wace and Thompson, 1912, p. 17).

It should be underlined that, although this decorative technique is considered characteristic on the Black Burnished ware (e.g. Demoule et al., 1988, p. 34-35; Bonga, 2013, p. 134, 136 and 145-146), several specimens have a reddish, grayish brown or greenish tone on them (Phelps 2004, p. 106; Bonga, 2013, p. 146). Thus, Pattern Burnished ware from Halai is divided into three groups for deeper analysis.

### 2.1. The Pattern Burnished ware at Halai

This type of ware appears in the Neolithic settlement of Halai at the very beginning of the Late Neolithic I period (5600-5480 BC; Stratum 4) except for very few fragments dating to the later Middle Neolithic period (5800-5600 BC; Stratum 3) and seem to have “fallen” from Stratum 4 due to partial layer disturbance in places<sup>(6)</sup>. The assemblage dating to the Late Neolithic I period (Strata 4 and 5) consists of 650 fragments, while only 16 fragments have been found in Stratum 3. Nevertheless, the diagnostic fragments of the Late Neolithic I period are only 230.

The fabric colors range from yellowish red to dark brown, and from pinkish gray to dark gray. The majority of the fragments are fine-grained and medium-grained. Very few examples are large-grained (coarse). Based on

the macroscopic analysis, the inclusions consist of dark elements and very small gravels. At the moment, it is difficult to define the origins of the raw materials due to the lack of studies in the broader area. T. S. Kendall (1998) used NAA to examine 24 ceramic samples (mainly from Trench F2) from Halai covering all five strata, and clay samples from 18 spots around the settlement. According to his results and conclusions, the Neolithic pottery from Halai can be divided into two main groups. Group A seems to demonstrate the use of local raw materials. Group B is sub-divided into Subgroup B1 and Subgroup B2. Subgroup B1 seems to include local raw materials, possibly from Pilasas Stream which is located close to Proskynas. Subgroup B2 may either be the result of alterations or mixes of local clays or be imported. Further research in the broader area may provide more explicit information.

The Pattern Burnished decoration is observed mostly on open vessels (90%; hemispherical bowls, carinated and conical bowls, a few fruit-stand vessels), but there are also a few examples of closed vessels (10%; collared-neck jars and biconical jars; fig. 5 to 9). Stratum 5 shows a greater variety of open shapes than Stratum 4. The topography of the wall profiles depicts a general symmetric formation, and thickened carinations. The width of the wall profiles ranges from 4 mm to 9 mm, without any visible pattern depending on the size and the fabric of the vessels. The carinations may suggest an additional coil on the coil building technique, a detail that will be

further examined through the petrographic analysis with thin sections.

The identified rim fragments are 87. From these, 84 belong to open vessels and only 3 to closed vessels. They have generally a rounded lip throughout the Late Neolithic I period. In very few examples of open vessels, the lip is tapered or projected (fig. 5 and 6). Most of the open vessels are medium-sized (69%); the predominant rim diameters are between 20 cm (27%) and 22 cm (21%). Nevertheless, a notable variety of smaller vessels with rim diameter ranging from 12 cm to 15 cm (5%), and larger vessels with rim diameter ranging from 30 cm to 42 cm (0.14%) also exists. The latter are shallow vessels with highly everted rim. The preserved bottoms are only 13, with 10 of them being flat bases, and 3 pedestals (fig. 7). The diameter of the flat bases ranges from 6 cm to 10 cm. Very few are also the preserved handles, which are short strap handles, small mastoid pierced lugs, or small mastoid unpierced lugs, all regularly placed below the rim.

The exterior surface of the vessels is generally slipped or polished (fig. 8 and 9). The slip is thin and usually glossy, while in some cases, it is loose and weathered, almost undefined. As mentioned above, the Pattern Burnished ware from Halai is sub-divided into three subcategories (groups) leading the study to a deeper analysis. This sub-division is based on the color of the exterior surface of the vessels.

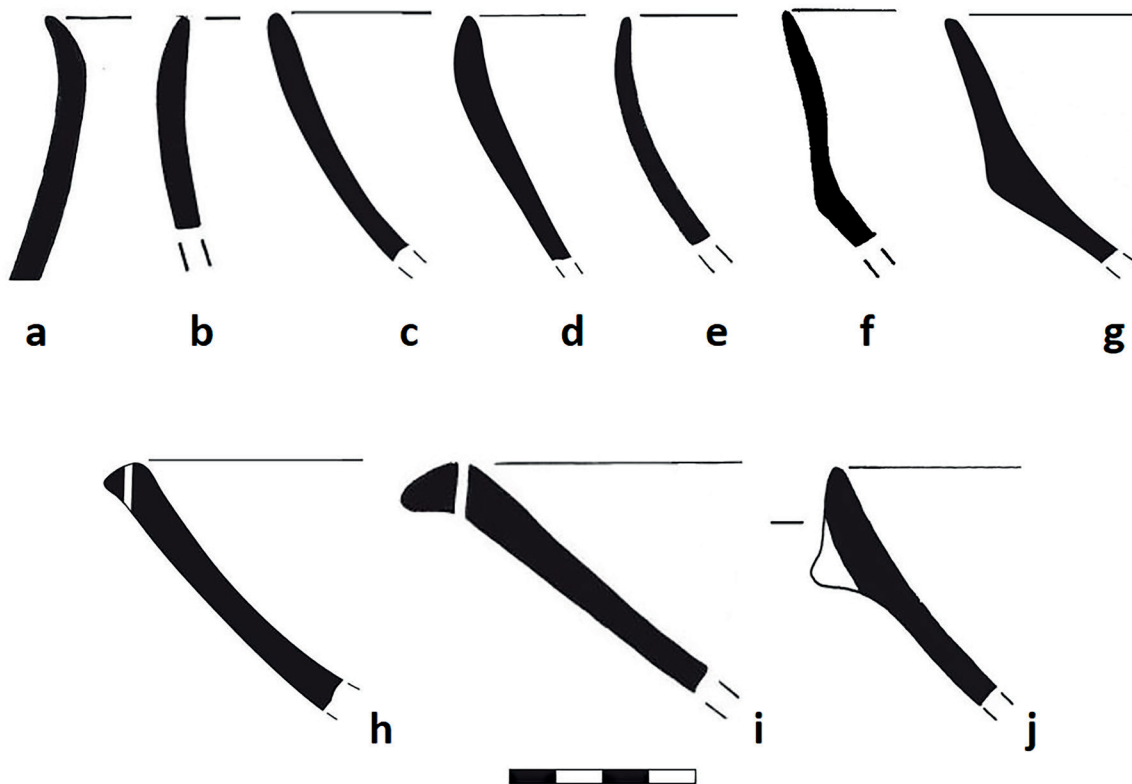
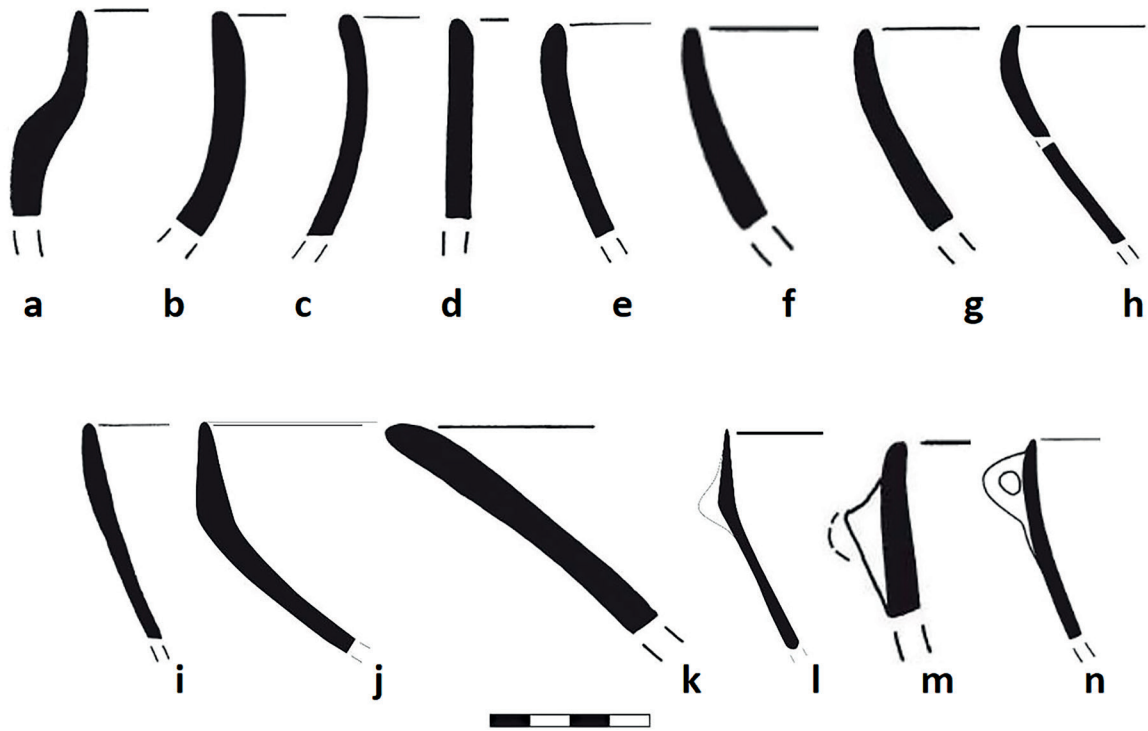
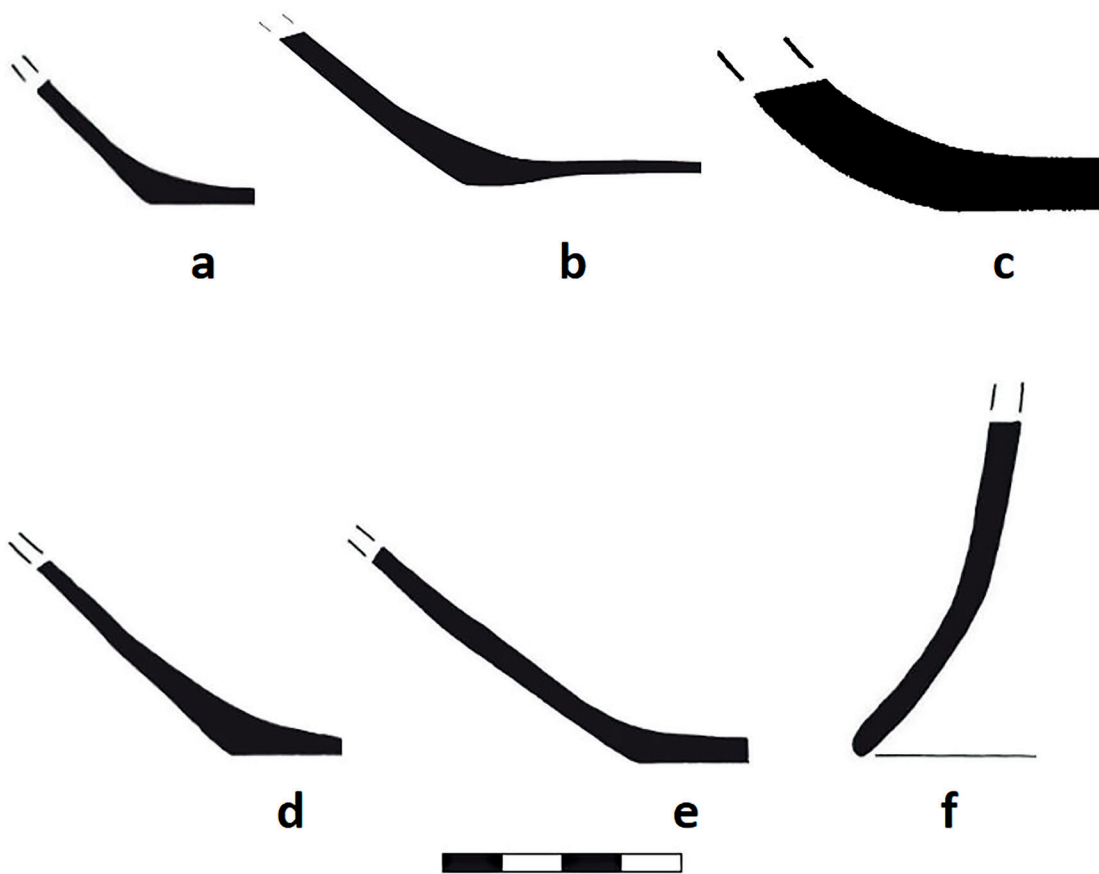


Fig. 5 – Rim profiles from Stratum 4 (a: closed vessel, b-j: open vessels).

Fig. 5 – Profils des bords, strate 4 (a : récipient fermé, b-j : récipients ouverts).



**Fig. 6** – Rim profiles from Stratum 5 (a-c: closed vessels, d-n: open vessels).  
**Fig. 6** – Profils des bords, strate 5 (a-c : récipients fermés, d-n : récipients ouverts).



**Fig. 7** – Bottom profiles (a-c: Stratum 4, d-f: Stratum 5).  
**Fig. 7** – Profils des fonds (a-c : strate 4, d-f : strate 5).

Group 1 includes the fragments with a buff, brownish or grayish brown surface (main color variations based on Munsell Soil Color Charts 1994: 2.5 YR 4/4, 5 YR 6/3, 7.5 YR 5/8, 10 YR 3/3, 10 YR 4/6, 10 YR 5/3, 10 YR 5/4, 10 YR 6/4, 10 YR 6/6, 2.5 Y 5/3; fig. 8 and 9a-g). The surface is regularly slipped, while in some cases, it seems to have been left unslipped (fig. 9a). The decoration is usually one or two hues darker than the surface including both linear and solid motifs. The most popular linear motif, which is observed in every subcategory, includes two horizontal parallel bands (usually consist of thin strokes), one placed along the rim and the second along the shoulder, and diagonal lines (fig. 8b) or parallel chevrons (fig. 9a-b) or nested Vs (fig. 8e) within them. In some cases, a second group of diagonal lines may occur below the second band (fig. 8b). Other motifs that appear in the first sub-category are the nested Vs that may decorate the whole surface of the vessel (fig. 9g), and the “fishbone” (fig. 9d; only one example). The solid motifs are generally very few, with the joint triangles (fig. 9e) and the coverage of a large area with merged bands being predominant (fig. 9f). Some fragments show decoration on the interior, which is usually a horizontal band (consisting of thin strokes) along the rim.

Although this subcategory seems to be predominant in Halai, it is not clear whether all the examples were meant to have this surface color or they are the result of uncontrolled firing. This observation is associated with the fact that some specimens with linear decoration demonstrate kiln mottling and/or soot in places (fig. 8a) or they have a grayish brown surface (fig. 8d and 9f)<sup>[7]</sup>. For the moment, they have been classified into this group for two main reasons: 1. as fragments, they cannot provide a complete overview of their actual image, 2. since they have been examined only macroscopically, it is not certain whether the soot is associated with uncontrolled firing in all cases or with their use as cooking pots. However, there are no other distinctive traces for their use as cooking pots.

Group 2 includes fragments with a reddish slipped surface (main color variations based on Munsell Soil Color Charts 1994: 5 YR 4/4, 5 YR 4/6, 5 YR 5/6, 5 YR 6/8, 7.5 YR 6/8; fig. 9h-i). This group comprises a very small assemblage (18 fragments). The surface of the vessel has a reddish yellow or a yellowish red slip. In some cases, the surface shows the craftsman’s attempt to produce a red-burnished outcome, but the result seems to be unsuccessful. The decoration is either one or two hues darker or it has a brownish hue. The decorative themes are mainly linear.

Group 3 includes 38 fragments. The surface of the vessel is gray/dark gray or black (main color variations based on Munsell Soil Color Charts 1994: 2.5 YR 2.5/1, 5 YR 2.5/1, 5 YR 5/1, 7.5 YR 3/1, 7.5 YR 6/2, 10 YR 4/1; fig. 9j-l). The surface is either slipped or unslipped having the same color as the fabric. In some examples, the vessel is Black Burnished and the decoration is applied on a gray panel (fig. 9l). This decorative pattern seems to correspond to the “scrapped technique” (Γ1α2) proposed by Wace and Thompson (1912, p. 17). Around 5 examples

have the same pattern, and they need further examination. In the case of the unslipped fragments, the decoration is visible only by its gloss. The linear motifs are generally similar to the previous groups (fig. 9j), but here one more motif appears, the fishnet (fig. 9k; only one example).

The firing techniques seem to vary in accordance with the sub-division of this type of ware. On the first and the second groups, the fragments demonstrate the use of oxidization, often uneven, with fire clouds appearing either on the exterior surface or on both surfaces. Some examples indicate re-firing with the interior surface being black. As for Group 3, it is difficult to define the firing techniques with the naked eye; the core margins are diffused or the gray/black color extends completely through the wall eliminating the core (based on Orton et al., 1993, fig. 11.1). According to the research so far concerning the ceramic technology of the black ware, there are at least two main production techniques: 1. use of iron clays, slipped or unslipped surfaces and reduction while firing, 2. use of the smoking or smudging firing technique for slipped/unslipped vessels. These two techniques lead to different results; the first technique results in chemical changes of the clay, while in the second, carbon deposits are observed on the walls and the pores of the vessels (e.g. Tsirtsoni, 2000, p. 14). Fissures and voids on several examples demonstrate weak resistance to thermal shocks (e.g. fig. 9a). Limepops are sometimes visible on the surfaces of the vessels (fig. 9a-b) indicating firing at ca. 870 °C or above this temperature (e.g. Maniatis and Tite, 1981; Rice, 1987, p. 97-98; Schneider et al., 1991).

## 2.2. Capacity<sup>(8)</sup> and possible functions

Due to the limited number of fragments that belong to closed vessels and their very fragmentary preservation, the calculation of the capacity took place on fragments belonging to open vessels. Twenty-five samples have been calculated, 10 of which come from Stratum 4 and 15 from Stratum 5 (fig. 10). From these, 18 samples are medium-sized vessels and 7 are large vessels. The major capacity ranges between 2.2 to 5.5 L indicating deep medium-sized vessels (5 examples), and quite deep large vessels (4 examples); the latter possibly for non-individual use. The smallest defined capacity ranges from < 100 mL to 250-500 mL (16 examples; 2 large shallow vessels and 14 medium-sized vessels). The vessels with capacity up to 500 mL may be considered for individual use.

The fragmentary preservation of the pottery cannot provide a clear outline of the possible functions of the Pattern Burnished ware. However, the few traces of use detected with the naked eye indicate that the main utilitarian function of these vessels must have been connected with the supply and the consumption of the food. Specifically, the detected traces include thin scratches or small pits on the mid-interior of the body and on the interior of the base, small chips on the lips, abrasion on the lips and on the exterior of the bases (e. g. Skibo, 1992, p. 106-143, and 2013, p. 116-143).

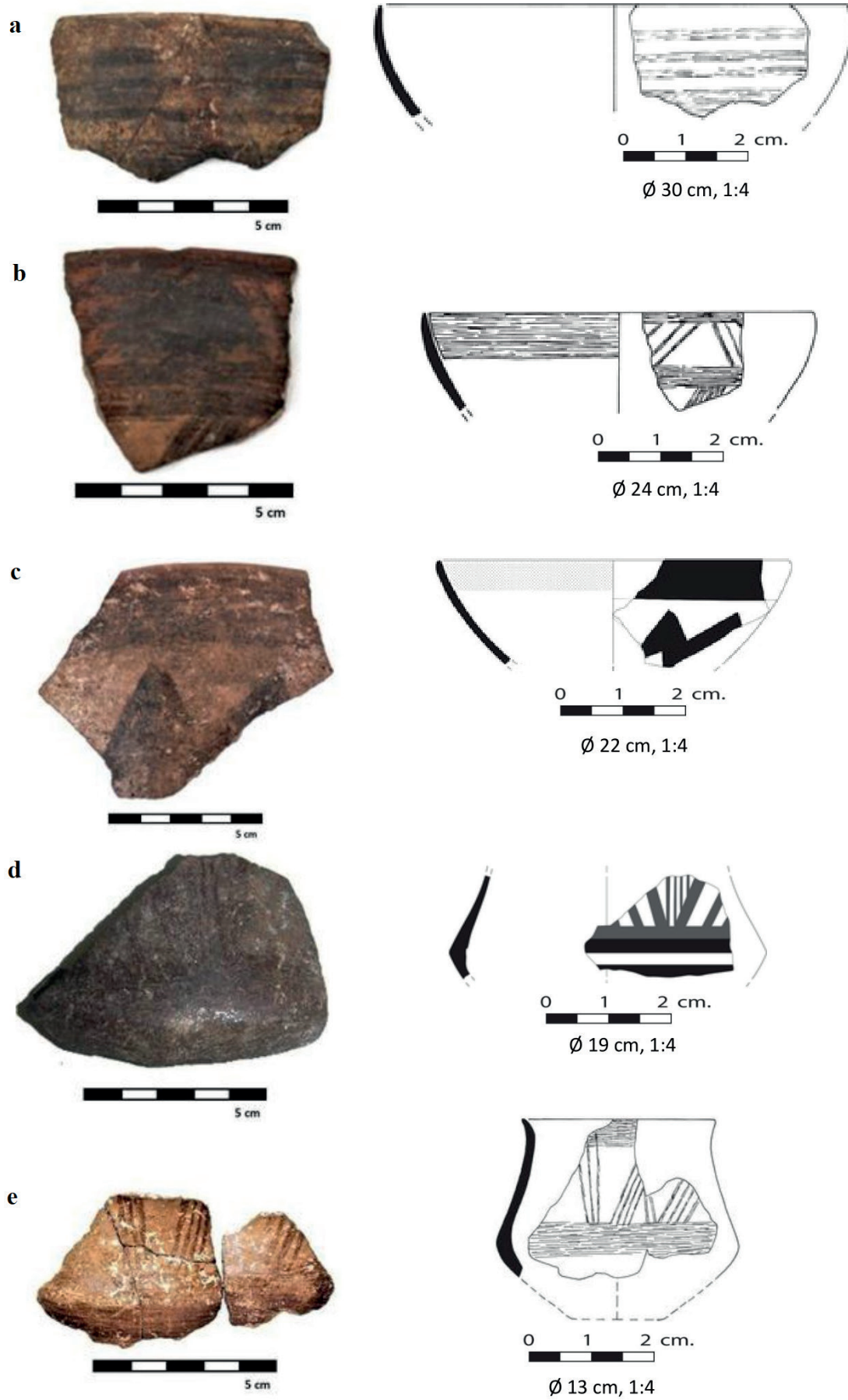
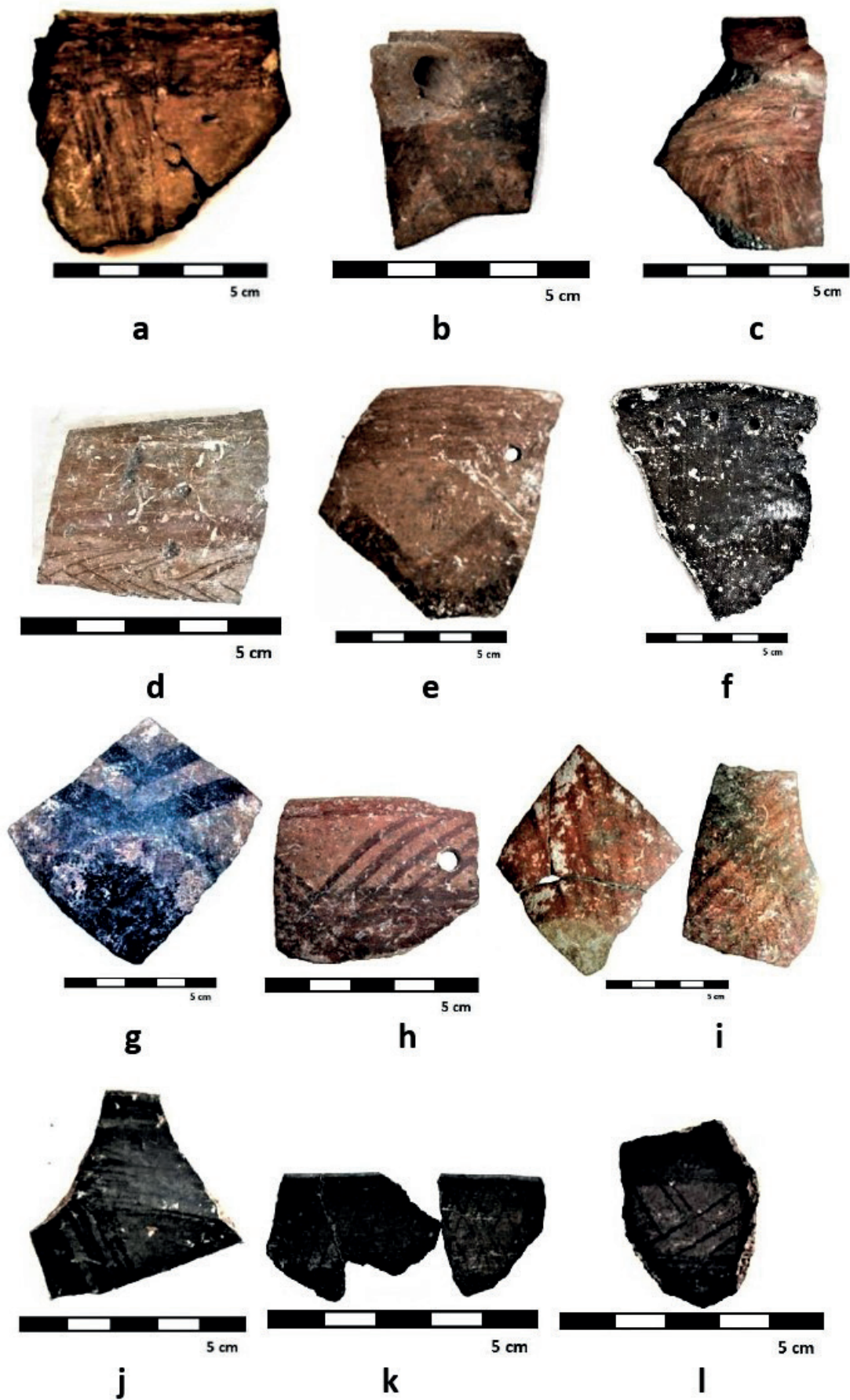
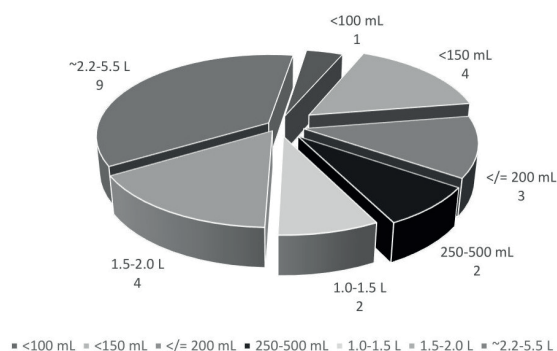


Fig. 8 – Representative shapes and main decorative motifs of Late Neolithic I Pattern Burnished pottery from Halai.  
 Fig. 8 – Formes principales et motifs décoratifs de poterie à motifs brunis du Néolithique tardif I de Halai.



**Fig. 9** – Characteristic examples of Late Neolithic I Pattern Burnished pottery from Halai.  
**Fig. 9** – Exemples caractéristiques de poterie à motifs brunis du Néolithique tardif I de Halai.



**Fig. 10** – Capacity rates of the open vessels.

**Fig. 10** – Contenance des récipients ouverts.

The fire clouds mentioned above (see 2.1.1), as well as soot deposits at the bottom of two base fragments could suggest cooking activities (e.g. Rice, 1987, p. 235; Skibo, 1992, p. 39), but in any case, the interior does not demonstrate any distinct traces of cooking. Further studies may give more profound results about the utilitarian function of this type of ware.

It is also worth mentioning the presence of post-firing bored holes in a small number of fragments. The preserved examples with post-firing bored holes demonstrate one hole below the rim of open vessels (fig. 9e, h). Post-firing bored holes have been suggested to attest the great value of pots, which may have been passed from generation to generation as heirlooms (e.g. Sampson 2008, p. 112 and 115). Nevertheless, the safest explanation could be that these holes were opened to refit broken vessels for reuse or other unknown reasons.

In two examples, the presence of ante-firing bored holes along the rim might indicate the distinctive use of these two vessels (fig. 9f). The vessels with holes along the rim have received several different terms in bibliography, all of which are supposed to connect them with their possible use. The main term which characterizes them is “cheese pots”, a term that connects them with dairy production (e.g. Phelps, 2004, p. 115 and 117; Urem-Kotsou and Kotsakis, 2007, p. 237, Sampson, 2008, p.188-189). Other terms used to describe this type of vessels are “pierced bowls” or “pierced cups” (Vitelli, 1999, p. 89-90), “cooking pans”, “baking pans” or “baking plates” (e.g. Coleman, 1977, p. 17). They have also been associated with the beekeeping (Regert et al., 2001), and the lightening (Woods, 2004, p. 520).

### 2.3. Parallels

The first group (Group 1) of Pattern Burnished pottery finds its closest parallels at Orchomenos in Boeotia, with similar shapes of vessels and similar decorative patterns (Kunze, 1931, pl. 11 and 12). Parallels for the second group (Group 2) can be detected in the Peloponnese, at Klenia (Blegen, 1937, fig. 635) and Corinth (Robinson and Weinberg, 1960, fig. 29c and 29e). The third group (Group 3) shares similar characteristics throughout mainland Greece during the Late Neolithic I period

(e.g. Demoule et al., 1988, p. 34-35). In some cases, this type of decoration is combined with white paint and added plastics, white paint and black-top and/or appliqué ornaments (Phelps, 2004, p. 74-75; Bonga, 2013, p. 144). However, there is no distinctive example of these combinations in Halai. The closest parallels for the settlement under study come from neighboring sites, such as the Sarakenos Cave at Akraiphnion (Sampson, 2008, p. 101, fig. 55: 994, 1007, p. 102, fig. 56: 982, 1032, 1124), Elateia (Weinberg, 1962, pl. 62b: 4), and Orchomenos (Kunze, 1931, pl. X, c-g). On the contrary, the Thessalian Pattern Burnished Black Burnished pottery seems to have more organized and more solid motifs, which cover most of the surface of the vessel (e.g. Bonga, 2013, fig. 47).

## 3 DISCUSSION

All the details mentioned above can provide the preliminary outline for the reconstruction of the ceramic technology of the Late Neolithic I Pattern Burnished pottery from Halai, which is summarized below. Coiling is the principal building technique. The slip – if exists – is applied on leather-hard or dry clay, but it is not easy to define the degree of dehydration with the naked eye. The gloss on the slipped surface is executed after the slip is dry by rubbing the surface with a soft tool (leather) or a harder tool (pebble). If the pot is left unslipped (very few examples from Groups 1 and 3), the polishing is applied immediately on the surface of the vessel. Afterwards, the pattern burnished decoration is performed.

The tools used for the linear decoration seem to be generally sharp, creating several parallel thin lines (strokes). In the cases of solid decorative motifs, a non-sharp tool must have been used, creating a more compact decoration without any strokes visible to the naked eye. In general, the decoration on the exterior surface seems to be careful and successful. The fragments decorated on the interior surface with a horizontal band along the rim indicate that the process was less careful than on the exterior surface. On the former, the lines demonstrate a quicker movement, and the gaps in between show a smaller-scale symmetry. In a few examples, the potter’s attempt to execute the burnishing destroyed the slip in places by removing it through the rubbing process. This failure should be related to the fact that the slip was not dry to the desired level.

The presence of slip and/or polishing on the Pattern Burnished ware, which displays the manufacturer’s attempt to increase the water-tightness of the vessels, leads to the assumption that pattern burnishing is connected mainly with the aesthetic quality. The linear decorative patterns are similar to those on the painted wares, but no wavy lines have been observed. It could be reasonable to suggest that it is hard to execute this type of motif by the use of a sharp tool (Bonga, 2013, p. 145).

The presence of both deep and shallow vessels proposes the use of this type of pottery not only for liquids

but also for solid food. The very few visible traces of use, seem to denote that this type of ware was generally used for the supply and the consumption of the food. The few closed vessels with non-abrasive attrition must have been used for storing goods. The Pattern Burnished Black Burnished fragments indicate the least possible traces of use. Could these vessels be used as the “fine tableware”? In addition, the post-firing bored holes observed on fragments of open shapes denote the need for their reuse, possibly not any longer for liquids, but only for solid food. The variety of small, medium-sized and large vessels may introduce both an individual and a non-individual character. The evidence that the majority of the Pattern Burnished pottery fragments comes from Trench F2, where the open space with the stone platforms and the fireplaces has been revealed, could indicate that this type of ware is considered for communal use, without implying any sort of social inequality in the settlement. However, a significant number of fragments were also found in Building IV, an element that suggests both communal and domestic use.

Finally, the Pattern Burnished pottery from Halai finds its closest parallels in both neighboring (Boeotia) and distant (Peloponnese) settlements. The similarities do not relate only to the decorative grammar but also to the shapes of the vessels. This evidence seems to indicate the development of interrelationships and perhaps networking both by land and sea (Coleman et al., 1992; O’Neill et al., 1999; Coleman et al., 2017). The proximity to the sea, especially the open sea, could allow the inhabitants to travel long distances with less difficulty than land routes. Although the study so far has shown very little evidence of imported ceramics, the assumption of knowledge exchange cannot be precluded. Certainly, the degree of interrelationships and networking cannot be estimated only by one type of ware. Nonetheless, we can observe that this type of ware from Halai denotes communication mostly with southern mainland Greece. Further research combined with microscopic analysis will provide a more definite outline upon the reconstruction of the “*chaîne opératoire*” of the ceramic manufacture, as well as about the daily life in the settlement, and the networks in which Halai participated.

**Acknowledgements:** I wish to thank the excavator of the site of Halai, Emeritus Professor J. E. Coleman for our long-term and fruitful collaboration in CHELP (Cornell Halai and East Lokris Project), and for the knowledge he has generously offered me. I would also like to thank my PhD supervisor, Professor D.-C. Urem-Kotsou for her enlightening advice on the pottery study. Last but not least, I would like to thank the reviewers of this paper for their fruitful feedback. The study of the Neolithic ceramic material from Halai is under permission of the excavator and the Ephorate of Antiquities of Phthiotis and Euboea.

## NOTES

- (1) The region south of the Spercheios River (e. g. Alram-Stern, 2005, p. 183; Angeli and Borowka, 2020). Although Euboea is considered to have participated in the socio-cultural traditions of Central Greece (Mastrogiannopoulou and Sampson, 2017), the Pattern Burnished pottery seems to appear on the island in the Late Neolithic IIA period (see note 5). Thus, parallels from Euboea are not mentioned in this paper.
- (2) Although Stratum 4 has been described as earlier Late Neolithic I and Stratum 5 as later Late Neolithic I (e.g. Facorellis and Coleman, 2012, p. 329; Coleman et al., 2017, p. 97), they both date to the very beginning of the Late Neolithic period (i. e. Late Neolithic Ia; Andreou et al., 2001). This division occurred for a better understanding of the two short phases of habitation.
- (3) The excavation data and the geomorphology of the broader area of the Atalante basin imply that, besides the rise in sea level possibly occurred after the end of the last ice age due to global warming, the sea level near the Halai settlement must have also been affected by the local seismic activity. The rise in sea level has also been proposed as a possible factor for the abandonment of the settlement around 5300 BC (e.g. Ganas and Buck, 1998, p. 181; Coleman et al., 2017, p. 97-98 and fig. 2).
- (4) For a complete presentation of the recording methods, see K. Kotsakis (1983, p. 276-281), P. M. Rice (1987, p. 276-304), C. Orton et al. (1993, p. 58-70), K. D. Vitelli (1999, p. 2-3).
- (5) The term “Pattern Burnished” has also been used to describe the introduction of the burnished decoration, as a new technique, in the Aegean islands and the southern mainland in the Late Neolithic IIA period (e.g. Mastrogiannopoulou and Sampson, 2017), which seems to indicate close connections between the Middle Chalcolithic western Anatolia and the Aegean Late Neolithic pattern burnished ware (e.g. Takaoğlu, 2006). However, A. Sampson (2008, p. 99) clarified that the Late Neolithic I burnished decoration is the same decorative method that was re-introduced in the Late Neolithic II period.
- (6) Layer disturbance at the Halai Neolithic settlement has been associated with the continuous habitation of the settlement as well as with environmental factors (see note 3).
- (7) According to A. Sampson (2008, p. 99-100), the examples with a grayish surface and a darker tone of grayish burnished decoration belong to the “gray-on-gray” ware, which was widely diffused in Northern Greece, but less common in Thessaly and Central Greece. However, the fragment in figure 9f has not been included in the small group of “gray-on-gray” found in Halai due to the fact that its shape and burnished decoration are completely different from the rest of the specimens found not only in Halai but also at Elateia and in the Sarakenos Cave.
- (8) The capacity has been calculated in an automated way in <https://capacity.ulb.be/> (CReA Patrimoine, Calcul de capacité d’un récipient à partir de son profil). The results have been multiplied by 3 since the scale used for the illustrations was 1:3.

**Effimia ANGELI**

Department of History and Ethnology,  
Democritus University of Thrace, Greece  
effieangeli7@gmail.com; eangel@he.duth.gr

## REFERENCES

- ALRAM-STERN E. (2005) – The Early Neolithic Settlement in Central and Southern Greece. The Actual State of Research, in C. Lichter (ed.), *How Did Farming Reach Europe? Anatolian-European Relations from the Second Half of the 7th through the First Half of the 6th Millennium cal BC*, Istanbul, Ege Yayinlari, p. 183-194.
- ANDREOU S., FOTIADIS M., KOTSAKIS K. (2001) – Review of Aegean Prehistory V: The Neolithic and Bronze Age of Northern Greece, in T. Cullen (ed.) *Aegean Prehistory: A Review*, Boston, Archaeological Institute of America (American Journal of Archaeology, Supplement 1), p. 259-327.
- ANGELI E., BOROWKA D. (2020) – Painting the Pots in the Middle Neolithic Period. Red-on-White Pottery from Central Greece, *Gdanskie Studia Archeologiczne*, 8, p. 219-238.
- BLEGEN C. W. (1937) – *Prosymna: The Helladic Settlement Preceding the Argive Heraeum*, Cambridge, Cambridge University Press, 486 p.
- BONGA L. A. (2013) – *Late Neolithic Pottery from Mainland Greece, ca. 5,300-4,300 B.C.*, PhD Dissertation, Temple University, Philadelphia, 536 p.
- COLEMAN J. E. (1977) – *Kephala: A Late Neolithic Settlement and Cemetery (Keos)*, Princeton, American School of Classical Studies, 166 p.
- COLEMAN J. E., O'NEILL K., POMEROY M., KAREN E. CARR K. E., HEAFITZ A. (1992) – Excavations at Halai, 1990-1991, *Hesperia*, 61, 3, p. 265-289.
- COLEMAN J. E., KARIMALI E., KARALI L., FILLIOS M., DIFFEY C., VAIGLOVA P., BOGAARD A., JOOS J., ANGELI E. (2017) – The Environment and Interactions of Neolithic Halai, in A. Sarris, E. Kalogiropoulou, T. Kalayci and L. Karimali (eds.), *Communities, Landscapes, and Interaction in Neolithic Greece*, Proceedings of the International Conference (Rethymno, Greece, 2015), Ann Arbor, International Monographs in Prehistory (Archaeological Series, 20), p. 97-125.
- DEMOULE J.-P., GALLIS K., MANOLAKAKIS L. (1988) – Transition entre les cultures néolithiques de Sesklo et de Dimini : les catégories céramiques, *Bulletin de correspondance hellénique*, 112, p. 1-58.
- FACORELLIS Y., COLEMAN J. E. (2012) – Interpreting Radiocarbon Dates from Neolithic Halai, Greece, *Radiocarbon*, 54, 3-4, p. 319-330.
- GANAS A., BUCK V. (1998) – A model for tectonic subsidence of the Allai archaeological site, Lokris, Central Greece, *Bulletin of Geological Society of Greece, Proceedings of the 8th Conference*, 32, 1, p. 181-187.
- HEURTLEY W. A. (1939) – *Prehistoric Macedonia. An Archaeological Reconnaissance of Greek Macedonia (West of the Struma) in the Neolithic, Bronze, and Early Iron Ages*, Cambridge, University Press, p. 275.
- JACOBSEN T. W. (1973) – Excavations in the Franchthi Cave, 1969-1971. Part II, *Hesperia*, 42, 3, p. 253-283.
- KALOGIROU A. (1994) – *Production and Consumption of Pottery in Kitrini Limni, West Macedonia, Greece, 4500 B.C.-3500 B.C.*, PhD Dissertation, Indiana University, Bloomington, 434 p.
- KENDALL T. S. (1998) – *The Neolithic Pottery and Ceramic Resources from Halai, Greece: A Study by Neutron Activation Analysis*, Senior Honors Thesis, Cornell University, Ithaca, 80 p.
- KOTSAKIS K. (1983) – *Κεραμεική τεχνολογία και κεραμεική διαφοροποίηση: προβλήματα γραπτής κεραμεικής της Μέσης Νεολιθικής του Σέσκλου*, PhD Dissertation, Aristotle University of Thessaloniki, Thessaloniki, 472 p.
- KUNZE E. (1931) – *Orchomenos II: Die neolithische Keramik*, Munich, Verlag der Bayerischen Akademie der Wissenschaften (Abhandlungen. Bayerische Akademie der Wissenschaften. Philosophisch-Historische Klasse, 5), 108 p.
- MALLIRI A. N., SKONDRAS E., SIOUNTRI K. (2019) – The Enhancement of Underwater Cultural Heritage Assets using Augmented Reality (AR), in D. Skarlatos, P. Agraftiotis, E. Nocerino, F. Menna, F. Bruno and M. Vlachos (eds.), *Underwater 3D Recording and Modelling "A Tool for Modern Applications and CH Recording"*, vol. 42-2/W10, Göttingen, Copernicus Publications, p. 119-125.
- MANIATIS Y., TITE M. S. (1981) – Technological Examination of Neolithic-Bronze Age Pottery from Central and Southeast Europe and from the Near East, *Journal of Archaeological Science*, 8, 1, p. 59-76.
- MASTROGIANNOPOULOU V., SAMPSON A. (2017) – Euboea during the Neolithic Period: A Review of the Evidence, in Ž. Tankosić, F. Mavridis and M. Kosma (eds.), *An Island between Two Worlds. The Archaeology of Euboea from Prehistoric to Byzantine Times*, Athens, Norwegian Institute at Athens (Papers and monographs, 6), p. 33-49.
- MUNSELL COLOR CHARTS COMPANY (1994) – *Munsell Soil Color Charts*, Baltimore, Md, 29 p.
- O'NEILL K., YIELDING W., NEAR J., COLEMAN J. E., WREN P. S., QUIN K. M. (1999) – Halai: The 1992-1994 Field Seasons, *Hesperia*, 68, p. 285-341.
- ORTON C., TYERS P., VINCE A. (1993) – *Pottery in Archaeology*, Cambridge, Cambridge University Press, 269 p.
- PANTELIDOU-GOFA M. (1991) – *Η Νεολιθική Νέα Μάκρη. Τα οικοδομικά*, Athens, Library of the Archaeological Society at Athens (B.A.E.), no. 119, 432 p.
- PANTELIDOU-GOFA M. (1995) – *Η Νεολιθική Νέα Μάκρη. Η Κεραμεική*, Athens, Library of the Archaeological Society at Athens (B.A.E.), no. 153, 426 p.
- PHELPS B. (2004) – *The Neolithic Pottery Sequence in Southern Greece*, Oxford, Archaeopress (BAR International Series, 1259), 277 p.
- REGERT M., COLINART S., DEGRAND L., DECAVALLAS O. (2001) – Chemical Alteration and Use of Beeswax through Time: Accelerated Ageing Tests and Analysis of Archaeological Samples from Various Environmental Contexts, *Archaeometry*, 43, 3, p. 549-569.
- RICE P. M. (1987) – *Pottery Analysis: A Sourcebook*, Chicago, The University Chicago Press, 559 p.
- ROBINSON H. S., WEINBERG S. S. (1960) – Excavations at Corinth, 1959, *Hesperia*, 29, 3, p. 225-253.

- ROUX V. (2019) – *Ceramics and Society: A Technological Approach to Archaeological*, Berlin, Springer (Études spécifiques), 360 p.
- SAMPSON A. (2008) – *The Sarakenos Cave at Akraephnion, Boeotia, Greece*, vol. 1 *The Neolithic and Bronze Age*, Athens, University of the Aegean-Polish Academy of Arts and Sciences, 550 p.
- SKIBO J. M. (1992) – *Pottery Function: A Use-Alteration Perspective*, New York, Springer, 222 p.
- SKIBO J. M. (1997) – Ceramic Surface Treatment and Abrasion Resistance: An Experimental Study, *Journal of Archaeological Science*, 24, p. 311-317.
- SKIBO J. M. (2013) – *Understanding Pottery Function*, New York, Springer, 201 p.
- SCHNEIDER G., KNOLL H., GALLIS C., DEMOULE J.-P. (1991) – Production and Distribution of Coarse and Fine Pottery in Neolithic Thessaly, Greece, in E. Pernicka and G. A. Wagner (eds.), *Archaeometry '90*, Proceedings of the 27th Symposium on Archaeometry (Heidelberg, April 2-6, 1990), Basel, Birkhäuser Verlag, p. 513-522.
- TAKAOĞLU T. (2006) – The Late Neolithic in the Eastern Aegean. Excavations at Gulpınar in the Troad, *Hesperia*, 75, p. 289-315.
- TSIRTSONI Z. (2000) – Les poteries du début du Néolithique récent en Macédoine. I. Les types de récipients, *Bulletin de correspondance hellénique*, 124, 1, p. 1-55.
- UREM-KOTSOU D.-C., KOTSAKIS K. (2007) – Pottery, Cuisine, and Community in the Neolithic of North Greece, in C. Mee and J. Renard (eds.), *Cooking up the Past: Food and Culinary Activities in the Neolithic and Bronze Age Aegean*, Oxford, Oxbow, p. 225-246.
- VITELLI K. D. (1993) – *Franchthi Neolithic Pottery*, vol. 1 *Classification and Ceramic Phases 1 and 2*, Bloomington, Indiana University Press (Excavations at Franchthi Cave, Greece, fasc. 8), 542 p.
- VITELLI K. D. (1999) – *Franchthi Neolithic Pottery*, vol. 2 *The Later Neolithic Ceramic Phases 3 to 5*, Bloomington, Indiana University Press (Excavations at Franchthi Cave, Greece, fasc. 10), 542 p.
- WACE A. J. B., THOMPSON M. S. (1912) – *Prehistoric Thessaly*, Cambridge, University Press, 304 p.
- WEINBERG S. S. (1937) – Prehistoric Remains from Corinth, *Hesperia*, 6, p. 487-542.
- WEINBERG S. S. (1962) – Excavations at Prehistoric Elateia, 1959, *Hesperia*, 31, p. 158-209.
- WOODS J. (2004) – Bunsen Burners.... or Cheese Moulds?, *Current Archaeology*, 191, p. 517-521.