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Pioneering potters

Early Neolithic ceramics from Mavropigi-Fillotsairi, Western Macedonia

Lily Bonga

lilybonga@gmail.com

ABSTRACT

The material discussed in this paper consists of c. 60,000 sherds from houses and their associated pits recovered from rescue excavations conducted at Mavropigi-Fillotsairi between 2005 and 2006. The preliminary pottery study was a sample of the extant pottery aimed at the documentation and establishment of vessel morphology, identifying technological aspects of ceramic production (construction techniques, fabrics, firing type, and surface treatment), and deducing vessel consumption and disposal. The contexts under study were chosen to check the stratigraphic observations made at the time of the excavation, particularly to establish the sequence of buildings in the northeastern part of the site. This paper thus presents a typological and technological overview of the ceramic assemblage and provides a case study for examining the relationship of pottery biographies, site depositional processes, and their interpretation in connection with the larger discussion of the Neolithisation of Europe.

INTRODUCTION AND OBJECTIVE

The Early Neolithic site of Mavropigi-Fillotsairi in Western Macedonia, Greece is the only fully excavated (4000 m^2) flat-extended Early Neolithic settlement in Greece.[1] In this type of settlement, buildings are not rebuilt on the same spot or to the same plan as in a canonical tell; instead the building areas shift horizontally around the settlement area in different phases.[2] The early radiometric and Accelerator Mass Spectrometry (AMS) dates show that occupation started in the middle of the seventh millennium BC, making Mavropigi-Fillotsairi one of the first Neolithic sites in Greece (and southeastern Europe) and at the center of the ongoing debate as to how the Neolithic was introduced into Europe from Anatolia and the Near East.[3]

Central to this discussion is the pottery,[4] because the early dates demand a reconsideration

1 This initial preliminary study of the pottery is one of several published and unpublished preliminary reports on the site: figurines (Starnini 2018), zooarchaeological remains (Michalopoulou 2017), lithics (Kaczanowska and Kozłowski 2016), archaeobotanical remains (Valamoti 2011), overviews of the site (Karamitrou-Mentessidi *et al.* 2013; 2016), absolute dates (Maniatis 2014), anthropological remains (Papathansiou and Richards 2011; Papageorgopoulou 2014), groundstone (Ninou forthcoming), and an unpublished report on micromammals (Katerina Papayiannis).

2 Kotsakis 2014, 54; Andreou *et al.* 1996, 578, n. 296; see Pappa and Besios 1999 for flat-extended sites in the Late Neolithic.

3 Reingruber *et al.* 2017; Bačvarov and Gleser 2016; Schier and Drasovean 2014; Ciobotaru *et al.* 2011; Lichter and R.Meriç 2005.

4 This preliminary study was conducted by the author at the Aiani Archaeological Museum over a period of five months between the falls of 2013–17, with the permission of the directors of the museum, Dr. Christina Ziota and Dr. Areti Chondrogianni-Metoki, and the director of the excavation, Dr. Georgia Karamitrou-Mentessidi.

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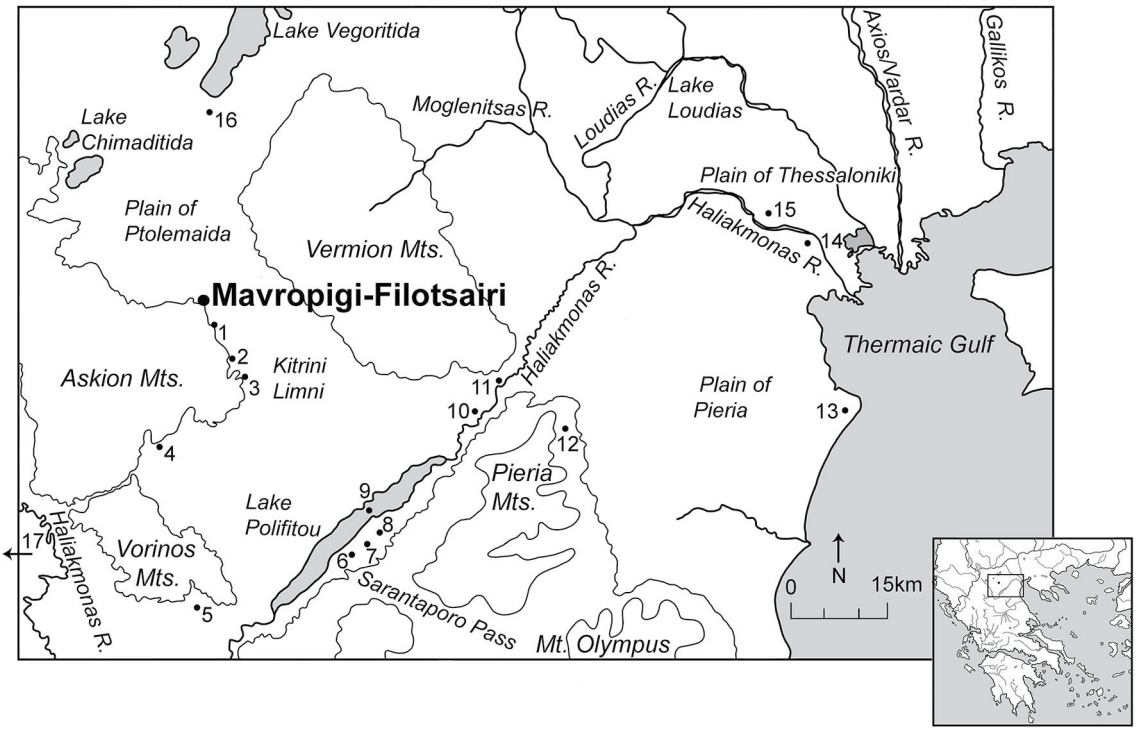

Fig. 1. Map showing detail of the location of Mavropigi-Fillotsairi and prominent geographical features. Early Neolithic sites in the vicinity of Mavropigi-Fillotsairi: 1. Pontokomi-Vrisi, 2. Pontokomi-Souloukia, 3. Xirolimni-Portes, 4. Gevena-Xiropotamos, 5. Knidi-Matsouka, 6. Tourla, 7. Varemenoi-Goules, 8. Krandion-Kryovrysi, 9. Servia-Varytimidis, 10. Roditis-Paliambela, 11. Lefkopetra, 12. Ritini, 13. Revenia-Korinos, 14. Paliambela-Kolindros, 15. Nea Nikomedeia, 16. Fiotas, 17. Kremastos, 18. Mavranei-Panagia. Scale 1:1,530,000. After Karamitrou-Mentessidi *et al.* 2016, 49, fig. 2.

of the traditional ceramic-defined chronologies not only in Greece, but also in the Adriatic (Impresso/Cardium culture) and the Balkans (Starčevo-Criş-Körös), where their development was based on the Greek model.[5] This paper also considers ceramic technology and use of early ceramics in southeastern Europe.

Mavropigi-Fillotsairi was located in an inconspicuous flat area at the natural geographical crossroads of the plain of Ptolemaïda, at an elevation of 670–750 m above sea level, between the Vermion and Askion Mountains (Fig. 1).[6] This area was probably chosen for settlement due to the existence of a natural spring (Mavropigi means "black spring") at the southeast edge of the eponymous modern village. The former marshland (drained in the mid-20th century) of Kitrini Limni (also known as Sarigioli/Sari Göl) was less than a dozen kilometers to the east and south and would have provided an attractive micro-environment for natural resources.

Mavropigi-Fillotsairi is one of over 40 Early Neolithic sites identified by surface material in the Grevena (21) and Kozani (23) prefectures in recent decades.[7] Only two of these sites, however, have been subject to extensive rescue excavation: Mavropigi-Fillotsairi and Xirolimni, although small trial trenches were made at Pontokomi-Vrisi, Knidi-Matsouka, Pontokomi-Souloukia, Roditis-Paliambela, Varemenoi-Goules, and Kremastos.[8] Early Neolithic sites in Central and Eastern Macedonia are similarly identified by surface material or excavation (Fig. 1).[9]

5 Bonga 2019.

6 Karamitrou-Mentessidi 2005, 511.

7 Karamitrou-Mentessidi 2014, 233; Wilkie and Savina 1997, 201–7.

8 Karamitrou-Mentessidi, Lokana, and Anagnostopoulou 2014. Recent fieldwork in the Amindeon basin will continue to fill in the picture (e.g., Chrysostomou *et al.* 2015).

9 Kotsakis 2014.

Many of these archaeological sites and the modern villages for which they are named are on land destined for lignite strip-mining or related industrial activities by the Public Power Company of Greece. Mavropigi-Fillotsairi was one such site. The Early Neolithic settlement no longer exists as it was removed by the mining operations and the modern village was also abandoned. Rescue excavations were carried out over a period of ten months in 2005 and 2006 by Georgia Karamitrou-Mentessidi, at the time the Ephor of the 30th Ephorate of Prehistoric and Classical Antiquities of the Greek Archaeological Service.[10]

SITE PHASES AND STRATIGRAPHY

The remains of 10 houses, 14 prehistoric inhumations,[11] and over a hundred pits of various shapes and sizes were uncovered across the site (Fig. 2; burials are indicated with the initial B followed by a number). The site's phases and stratigraphy were primarily based on the deep deposits (over 2 meters thick) found in and over a large, roughly oval sunken feature near the center of the site. This feature, the *central orygma* (large pit/trench), was interpreted as a pit-house due to the similarities of its small finds with those of the rectilinear houses, the presence of roofing materials, fragments of clay and plaster floors, and hearths within the feature itself, as well as on analogy with other partly contemporary Early Neolithic sites in the Balkans that have also been interpreted as pit-dwellings (e.g. Divostin in Serbia, Polyianitsa in Bulgaria, and Zadubravlje and Galavo-Slavonski Brod in Croatia).[12]

Three site phases were identified by the excavators in the *central orygma*,[13] numbered from the bottom up and these phases span the duration of the Early Neolithic period in Greece as defined by absolute dates.[14] Evidence for phase I is essentially confined to the middle of the *central orygma* in an area of 25 m^2; three small pits, one at the edge of the *central orygma* (pit 26), one immediately to the west (pit 2) of it, and another farther to the north (pit 62) were also assigned to this phase at the time of excavation, based on other small finds and soil similarities, but none of these pits contained pottery. Materials assigned to phase II cover an area of 50 m^2 in the *central orygma*, including also two large adjacent pits (pit 44 and pit 46) either in the southern part of the *central orygma* or alternatively just outside of it. Two additional large pits, the ellipsoidal house and *western orygma* appeared in this phase as well and were also interpreted as pit-dwellings, but both contained little diagnostic pottery. Phase II material was also found in pit 63 and pit 106, the latter being interpreted as a dump for the contents of the *western orygma*.

Phase III was divided at the time of excavation into two sub-phases on the basis of a sequence of closely-spaced floor remains in the *central orygma*.[15] Beginning in phase IIIa, the *central orygma* became an above-ground dwelling encompassing 100 m^2, and the ellipsoidal

10 Karamitrou-Mentessidi *et al.* 2016; 2013; Karamitrou-Mentessidi 2011; 2005.

11 Papathanasiou and Richards 2011. More specifically, 14 prehistoric inhumations, one historic burial (burial 13), plus human remains found in other contexts.

12 Karamitrou-Mentessidi *et al.* 2016, 51–3, figs 7–11; Karamitrou-Mentessidi 2005, 524–6. Pit house have also recently been interpreted at Revenia-Korinos, Paliambela-Kolindros, Apsalos-Komvos, and Giannitsa (Kotsakis 2018); however, the existence of pit-houses in Early Neolithic Greece is a debated topic (Perlès 2001, 184–5).

13 Bonga 2019; Karamitrou-Mentessidi *et al.* 2016, 58.

14 The Early Neolithic period in Thessaly dates from c. 6500–6000 BC (Reingruber *et al.* 2017, 41), although some sites may begin as early as c. 6600 BC. In northern Greece, the start of the period seems contemporaneous, (Tsirtsoni 2016; Maniatis 2014) but the period is less-well defined in terms of absolute dates, and some scholars suggest it may lie closer to 5900 BC or even 5800 BC (Urem-Kotsou *et al.* 2017, 324; Andreou *et al.* 1996, 538, tab. 1).

15 Maniatis, pers. comm, cited in Karamitrou-Mentessidi *et al.* 2016, 58.

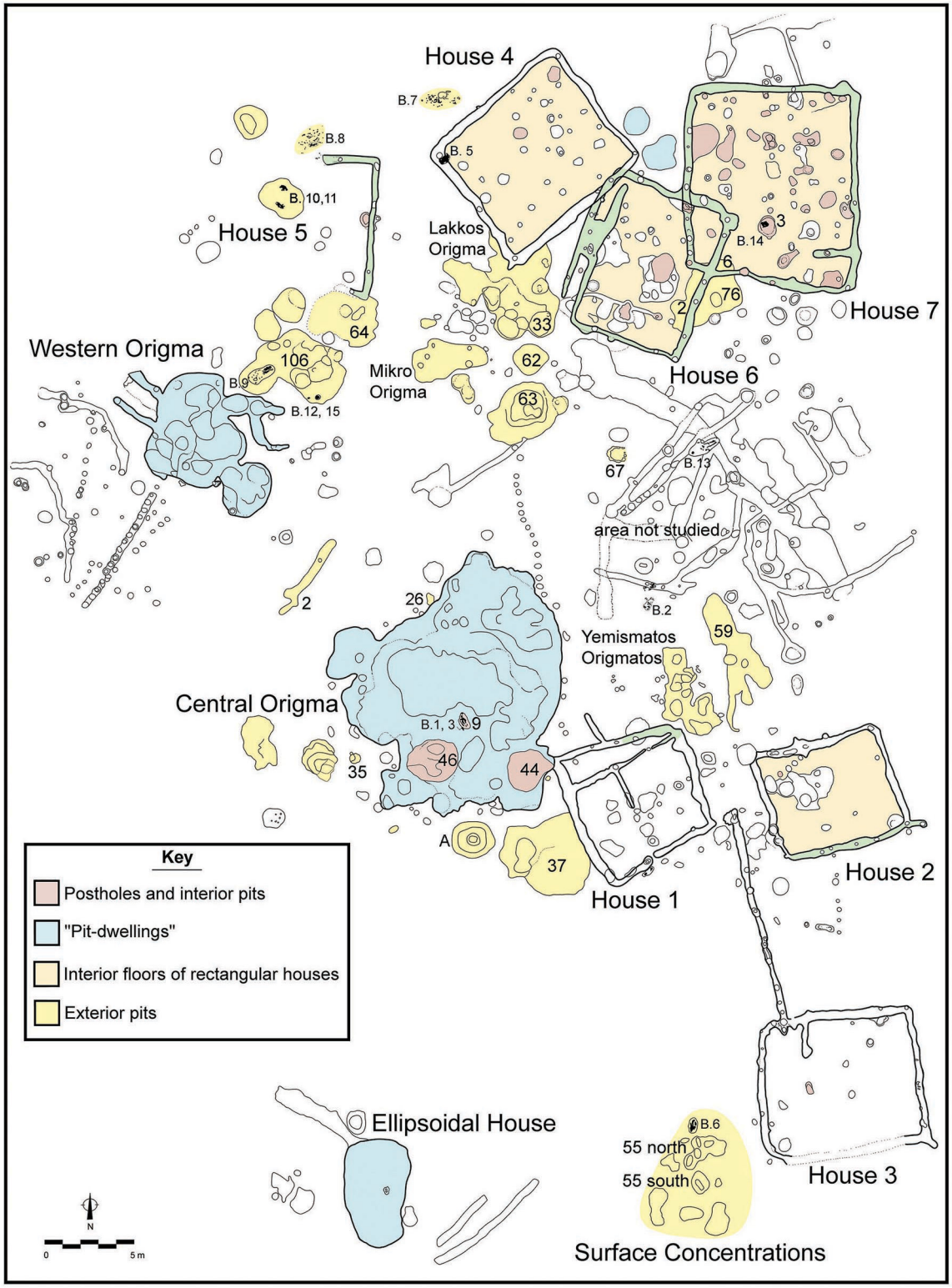

Fig. 2. Site plan of Mavropigi-Fillotsairi. Colored areas indicate deposits of ceramic material under study discussed in this paper. Pits mentioned in the text are numbered. Burials are labeled by the initial B followed by a number. Scale 1:350. After Karamitrou-Mentessidi *et al.* 2016, p. 51, fig. 5.

house and *western orygma* fell out of use.[16] At some point in phase III or sub-phase IIIb, all of the seven rectilinear houses (50–90 m^2 in size) were constructed,[17] but they were not contemporary with one another as some of their outlines overlap (see below). All of the burials were dated to this final phase and most of the numerous small and large pits, shallow elongated trenches, and post-holes throughout the site also belong to this phase.

ABSOLUTE DATING

The excavators proposed a model based on the entire set of 32 data covering the period between 6540–6000 calBC (Fig. 3).[18] This is the maximum possible time span for the occupation of the site. As the charcoal has not been determined in detail, it is possible that some long-lived species have been sampled and therefore the 'old wood' effect must be taken into account. Thus, the single date (DEM-1685, 7558±60 B.P.) on charcoal from pit 2 at 6540 calBC would be valid only as a terminus post quem.[19] On the other hand, if looking exclusively at the results obtained from seeds and specifically at their median values (Fig. 3a), then the duration of phases I and II can be limited to 6310 to 6200 (exclusive of the possible outlier DEM-2349 (7141±44 B.P.) at 6020 calBC). For phase III, human bones were also dated in addition to seeds (Fig. 3b); for these data, the influence of the 'reservoir' effect should be taken into account. Nevertheless, they suggest that phase III may have ended at the latest at 5940 calBC."[20] It seems then, that the primary duration of the site (phases I–III) could be limited to c. 6300 to 6000 calBC[21] rather than the maximum duration of 700 years based on all dates.[22]

Similarly, although recent data from other Early Neolithic sites in Greece and coastal sites in Western Anatolia suggests the earliest Neolithic sites appear c. 6600 BC (Fig. 4),[23]

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16 Phase III contains more than one sub-phase as indicated by three sequential lime-plaster floors, and round-fireplace (Karamitrou-Mentessidi *et al.* 2016, 51–2). It remains to be determined if a rectangular house once stood here, or if it was an irregular-shaped structure as suggested by the post-holes around the perimeter of the former pit.

17 Karamitrou-Mentessidi *et al.* 2016, 53; Michalopoulou 2017, 188. The dating of all of the rectilinear houses to the final phase of the settlement is based on the excavators' observations at the time of excavation based on the similarity of the soil and small finds.

18 Compare with Karamitrou-Mentessi *et al.* 2016, 68, fig. 46. Broadly speaking, these dates appeared to correspond with the three site phases: (phase I) c. 6600–6400 BC, (phase II) c. 6400–6300 BC, and (phase III) just before c. 6200 until 5900 BC (Starnini 2018, 58, table 1 for contexts; Karamitrou-Mentessidi *et al.* 2016; 68, fig. 46; Maniatis 2014, 209 fig. 4), but shorter durations of each phase was also suggested: phase I, c. 52 ± 47 years, phase II c. 64 ± 45 years, and phase III c. 200 years (Maniatis, person, comm. in Karamitrou-Mentessidi *et al.* 2016, 68).

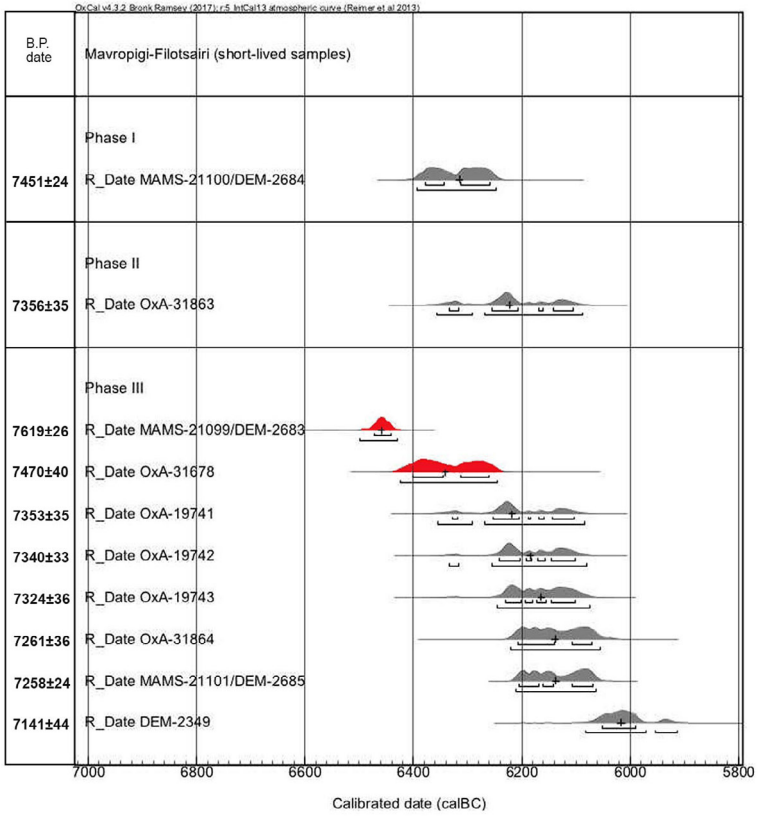
19 DEM-1685 7758 ± 60 B.P.

20 Reingruber personal comm. From the short-lived samples, the earliest date for the start of the site could be c. 6400 calBC or slightly earlier, if the seed (MAMS-21099) is identified as a domesticated type and if it is intrusive from phase I. If it is an outlier, as for example the result of a technical mistake in the laboratory or a contamination etc., then the start of occupation shortly before 6300 BC is safer. The same logic applies to seed sample (OxA-31678) from phase II in pit 106, which may be a bit older than the date from phase I, which situation reiterates that c. 6300 cal BC would be indeed the most minimal interpretation of the dates for a start of the occupation. (Reingruber personal comm.)

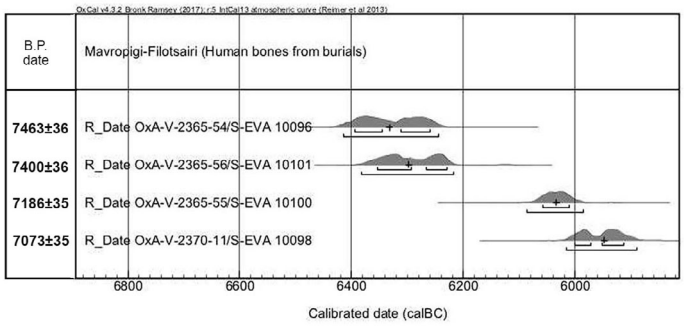
21 The early dates from charcoal in pits 62 (MAMS-21105/DEM-2667) and small pit/post-hole (?) 26 (MAMS-21106/DEM-2668) did not contain pottery. The earliest contexts with pottery and absolute dates from charcoal date to c. 6400/6300 calBC; see (Bonga 2019, 162) for a discussion.

22 Karamitrou-Mentessidi *et al.* 2016, 69; e.g. from OxA-V-2370-11/S-EVA-10098 at 7073±35 B.P. to DEM-1685, at 7758±60 B.P.

23 e.g. in Greece: Argissa, Achilleion, Sesklo, Larissa-Neraida (Reingruber *et al.* 2017), Knossos on Crete (Douka



a.



b.

Fig. 3. (a) Calibrated and modeled radiometric dates (seeds using Bayesian analysis OxCal v2.3, intcal13) from seeds. OxA-31678 and MAMS-21099/DEM-2683 are highlighted in red as they come from unknown species that were found in open areas of the site between houses, which should belong to Phase III but appear to be outliers. The pottery has not yet been studied. (b) Calibrated and modeled radiometric dates (using Bayesian analysis OxCal v2.3, intcal13) from human bones in Phase III burials. Courtesy of Agathe Reingruber, with the addition of the uncalibrated dates.

the weight of these dates is not the same, depending on the contexts from which they come and the nature of the samples themselves, which vary from more precise dates from short-

et al. 2017), Paliambela-Kolindros, Axos A-Pellas, Giannitsa B, Varemenoi-Goules, Lefkopetra, Orfeas Alistratis Cave (Maniatis 2014, 207), Dikili Tash (Lespez *et al.* 2013), the Franchthi Cave (Perlès, Quiles, and Valladas 2013) and in Turkey: Ulucak and Çukuriçi Höyük (Reingruber and Thissen 2016). Revenia-Korinos also dates to this period, as indicated by the date of a human burial (Hofmanová *et al.* 2015, 6687, table 1), but the full set of radiocarbon dates and their contexts is not yet published (but can be found in Adaktylou 2017).

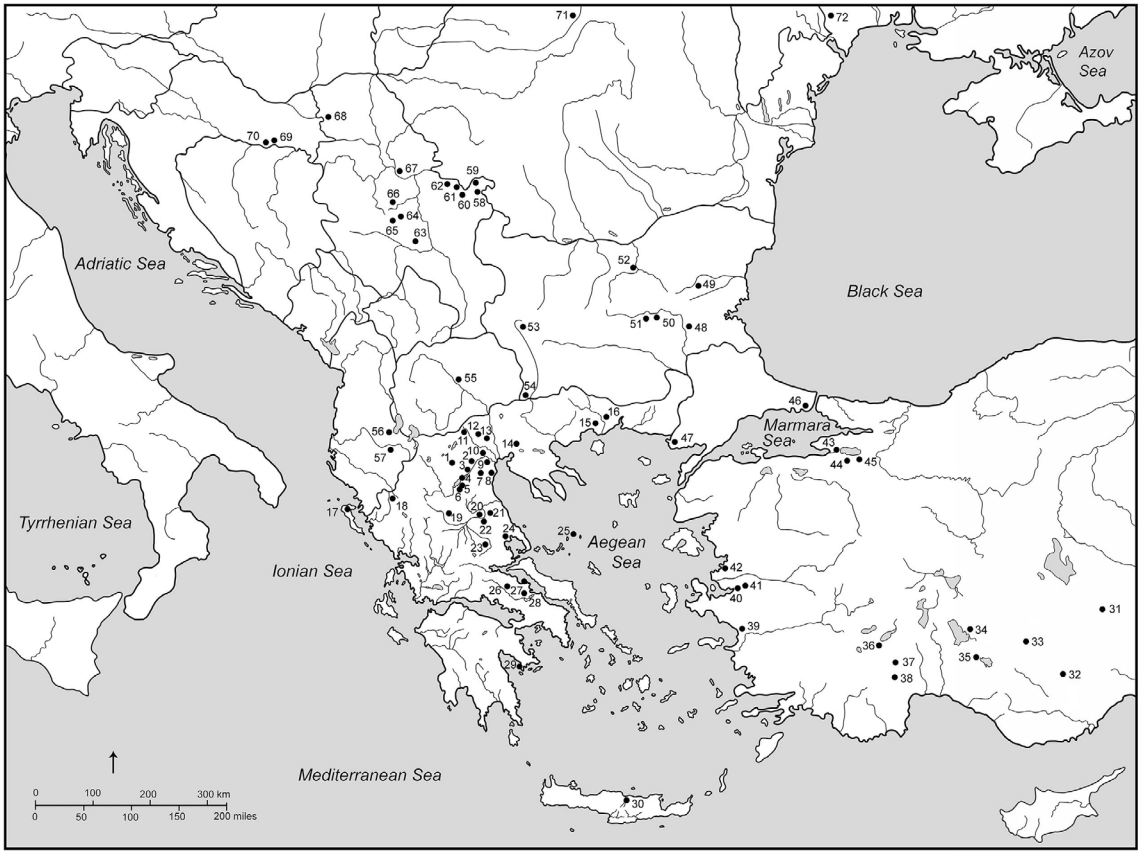


Fig. 4. Location of Mavropigi-Fillotsairi (triangle) in relation to other partially contemporary sites with absolute dates (represented by dots): 1. Mavropigi-Fillotsairi (represented by a triangle), 2. Lefkopetra, 3. Roditis-Paliambela, 4. Servia-Varytimidis, 5. Varemenoi-Goules, 6. Dimitra, 7. Ritini, 8. Revenia-Korinos, 9. Paliambela-Kolindros, 10. Nea Nikomedeia, 11. Sosandra, 12. Giannitsa B, 13. Axos A, 14. Lete 1, 15. Orfeas Alistratis Cave, 16. Dikili Tash, 17. Sidari, 18. Asfaka, 19. Theopetra Cave, 20. Otzaki Magoula, 21. Larissa-Neraida, 22. Argissa Magoula, 23. Achilleion, 24. Sesklo, 25. Cave of the Cyclops, 26. Elateia, 27. Halai, 28. Sarakenos Cave, 29. Franchthi Cave, 30. Knossos, 31. Tepecik-Çiftlik, 32. Canhasan I, 33. Çatalhöyük (West), 34. Erbaba, 35. Suberde, 36. Hacılar, 37. Bademağacı, 38. Höyücek, 39. Çukuriçi Höyük, 40. Yeşilova Höyük, 41. Ulucak Höyük, 42. Ege Gübre, 43. Ilıpınar, 44. Menteşe, 45. Barcın Höyük, 46. Yarımburgaz Cave, 47. Hoca Çeşme, 48. Poljanica-platoto, 49. Koprivets, 50. Tell Karanovo, 51. Tell Azmak, 52. Džuljunica-Smărdeš, 53. Gulbanik, 54. Kovačevo, 55. Amzabegovo, 56. Vashtëmi, 57. Podgori, 58. Velešnica, 59. Hajdučka Vodenica, 60. Vlasac, 61. Lepenski Vir, 62. Padina, 63. Blagotin-Poljna, 64. Divostin, 65. Grivac-Barice, 66. Banja-Aranđelovac, 67. Starčevo-Grad, 68. Donja Branjevina, 69. Zadubradlje, 70. Galavo-Slavonski Brod, 71. Gura Baciului, 72. Ghirzhove.

lived seed samples, to less precise ones from charcoal (subject to the old-wood effect) and human and animal bone (subject to reservoir effects).[24] These variables must be taken into account when assessing absolute dates rather than simply accepting them at face value and as fact.[25]

Given the overlapping of the rectangular houses with one another, with the *central orygma*, with other features, along with the interred burials within these features, the impression is given of a brief period of intense occupation, shifting around the site. The similarity of the ceramics and lack of drastic changes within the *central orygma* stratigraphy or across the site also suggests duration of only a few generations, through which fabric recipes, shapes, and decorations were transmitted.

24 Reingruber and Thissen 2017; 2016; Reingruber 2017.

25 Bonga 2019, especially 162–3 and n. 2 for Greek Macedonia.

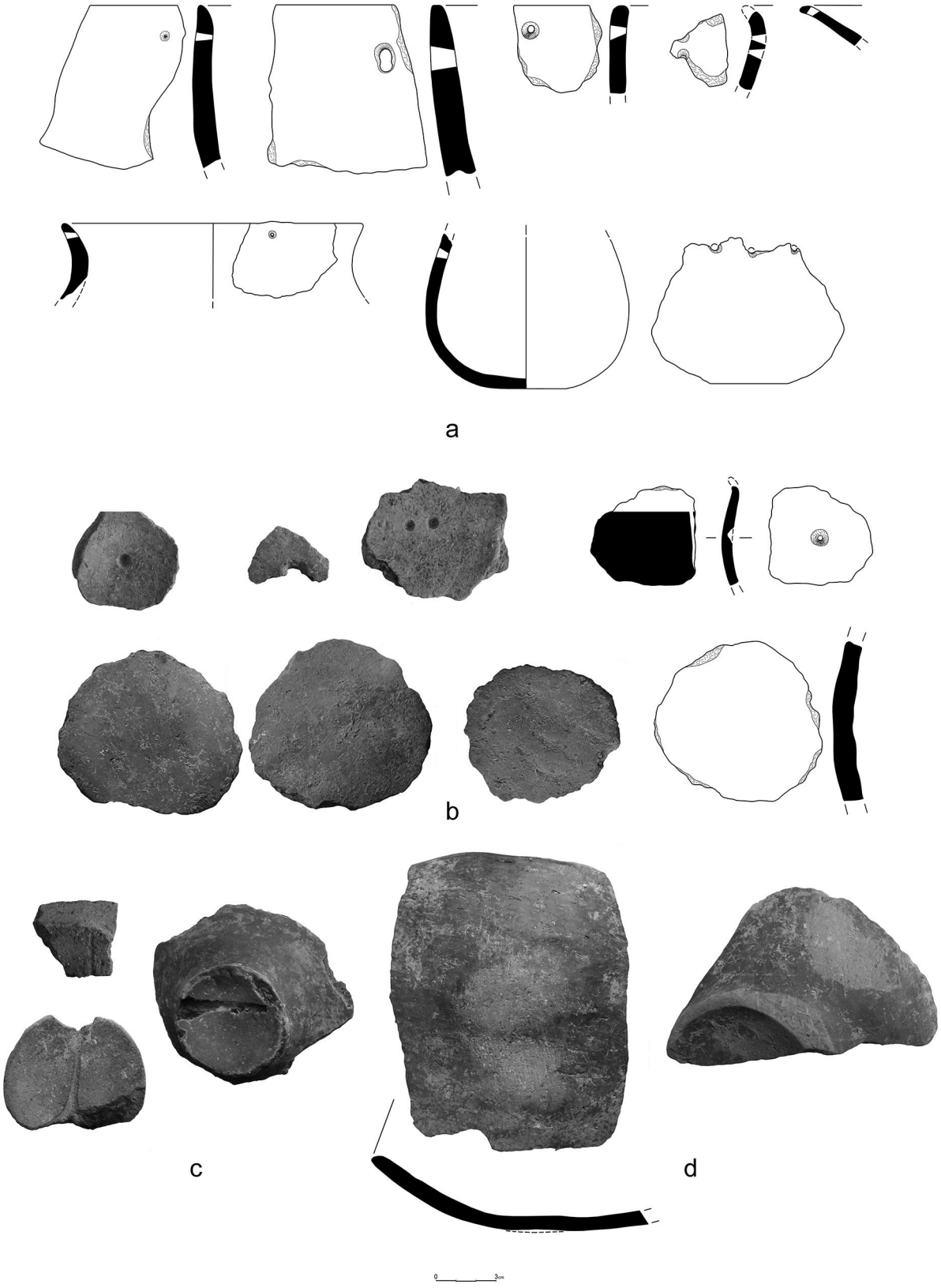


Fig. 5. (a) Sherds with bored repair holes. (b) Incompletely perforated sherds and reworked ceramic discs. (c) Bases with use-wear abrasion from a string. (d) Sherds with abrasion use-wear, re-used as shallow plates.

POTTERY CONTEXTS

The pottery contexts under study for this paper are highlighted in Fig. 2. The material is primarily from the 2006 season, except for a limited sample of the 2005 material, necessary for stratigraphical appraisals of the *central orygma*.[26] Due to depositional practices of the Early Neolithic inhabitants, pottery was rarely found in primary contexts. The majority of the ceramics were recovered in a highly fragmented state in secondary contexts including within pits, ditches, post-holes, and foundation trenches. Numerous repair holes (e.g. Fig. 5a) in vessels and reworked ceramic discs (some with bored holes)[27] attest to the conservation and recycling of material until the point of exhaustion (e.g. Fig. 5b–c). Providing yet another example, broken pieces of vessel walls with surface abrasion on their exterior may have been reused as plates (Fig. 5d).[28] These secondary pit contexts were found throughout the site, and regardless of their shape, size, or location, contained secondary refuse deposits of all types of material (including architectural debris in *lakkos orygma*, pit 59, and *mikro orygma*).

The dearth of pottery from the interiors of most houses, including the ellipsoidal house and the *western orygma* pit-houses, suggests that ceramics were removed upon the abandonment of these structures.[29] Of the rectilinear houses, only houses 6 and 7 produced ceramic material from their interiors, either from what was interpreted by the excavators as being on their "floors," or from some (but not all) of the numerous small pits and shallow ditches inside the houses.

Conversely, the *central orygma* contained a large quantity of pottery given its size and deep deposits.[30] In the first two phases, however, the small number of sherds and their mismatched and non-joining condition is suggestive of secondary deposition.[31] It is also possible, that at the start of phase IIIa, discarded material was purposely dumped into the *central orygma* in order to raise it to ground level in this area before constructing the floors of the dwelling. Yet at some point during phase III, these floors were dug through for the interment of burials 1 and 3, disturbing the stratigraphy down to the level of phase II as indicated both by the depth of pit 9 as well as the ceramic mixing. After these interments, the *central orygma* was probably abandoned.

The only documented instance of undisturbed primary deposition, pit 37, did not yield pottery but instead contained a cache of chipped-stone tool debitage from preliminary and advanced stages of the reduction of four radiolarite cores and evidence for horn-core processing.[32] The rest of the pits were used and reused for different functions and modified over time, through the addition and removal of material, the digging of smaller pits within pre-existing pits (including graves), and the expansion of pits.

Storage in pits at Mavropigi-Fillotsairi has been ruled out, as the capacities of the pits were minimal, being of shallow depth and because of the irregularities in their construction (e.g. shape, size, depth, and the inclination of their walls). Only three pits (35, 62, and 67) may have

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26 All of the 2006 material recovered from the contexts presented here was studied, along with the 2005 material from excavation squares VII,VIII, X in the *central orygma* to give a full stratigraphic profile of the feature.

27 Karamitrou-Mentessidi *et al.* 2016, 63, fig. 37.

28 Compare with Vuković 2017a, 125, fig. 2.

29 Kaczanowska and Kozłowski (2016, 92) also noted the lack of lithics from within the houses and suggested that they were removed when the houses were abandoned.

30 Bonga 2017.

31 Bonga 2019, 160–3.

32 Michalopolou 2017, 184; Kaczanowska and Kozłowski 2016, 87, 91. Aside from this pit, there does not seem to be preferential deposition and separation of materials into pits as at Revenia-Korinos (Urem-Kotsou *et al.* 2015; Papaioannou 2011, 33–4).

Fig. 6. (a) Finger-pinched impresso from lakkos orygma and pit 33. Scale just under 1:3. (b) Finger-pinched and tool-made pottery from pit 2 inside house 7 and exterior pit 76. Scale just under 1:3. (c) Red-painted pottery with (Red-on-white) and without (Red-on-red) the addition of a white slip. Scale 1:3. (d1) Non-joining sherds of a Polychrome bowl with string hole lug from Pit 106 and (d2) other Polychrome sherds from Pit 106. Scale 1:3. (e) White-on-red painted pottery. Scale 1:3. (f) Red-slipped bowl from house 7, small S-profiled jar from area 172, square VII, tan monochrome bowl from phase 2 in the central orygma; red-slipped hemispherical bowl from pit 79, house 7.

been designed for special purposes, based on the presence of lime-plaster lining on their sides, bottoms, or rims, but none of them contained pottery.[33]

In addition, the large pits (e.g. pits 37, 64, 76, *lakkos orygma*) along the exterior walls of most of houses either pre-date or post-date the construction of the adjacent structures.[34] The ceramic study was not able to determine the sequence between pits and houses in the phase III sub-phases, such as the overlap of house 2 with a pit at its northwest corner, house 1 with both pit 37 and the *central orygma*, or house 5 with pit 64. It was possible, however, to establish the relationship and chronology between the overlapping houses 4, 6, and 7, the *lakkos orygma* with house 4, and finally of houses 6 and 7 with pit 76 (to which belong pits 2 and 6) in the northeastern part of the site.

Exterior pit 76 runs along the eastern side of house 6 and the southern side of house 7 and was determined to predate both houses as the foundation trenches of both houses were cut into it and so ultimately split the large pit into three smaller ones: the remaining part of pit 76, pit 2 inside house 6, and pit 6 inside house 7. After house 4's demolition, house 6 was constructed through pit 76. This pit contained a number of joining and non-joining sherds from the same vessels as those in pit 2 in house 6 (e.g. a black, brittle disc base, a gray disc base, a tan "ring" base, and a number of monochrome body sherds). House 7 was then built on top of the eastern part of house 6, again cutting through pit 76, as evidenced by pieces of the same finger-pinched decorated vessel recovered from house 7's western foundation trench, pit 2 inside house 6, and exterior pit 76 (Fig. 6a).

This sequence seems to confirm the stratigraphic observations made during excavation, in which house 7 was interpreted as the last structure in use before the site's abandonment, based on differences in soil color and the richer quantity of finds within the house. The radiocarbon dates from post-holes inside houses 6 (DEM-1715, 7216±25 B.P., 6072±29 calBC at 1σ) and 7 (DEM-1751, 7135±25 B.P., 6021±19 calBC at 1σ) also seem to support this proposal; however, burial 14 in pit 3 inside house 7 is problematic in this scenario as it would be the only burial not interred after abandonment (as in houses 4, 5, and the *central orygma*).[35]

Burials elsewhere at the site sometimes (but not exclusively) were dug into or utilized pre-existing pits or abandoned areas (e.g. house 4's western corner). Three separate burials (9, 12 and 15) were interred in different southerly areas of pit 106, disturbing the material within the pit, as evidenced by non-joining pieces of the same vessels found in the larger area of the pit as well as in both burials 9 and 15 (but not burial 12).

No complete vessels were found with any burials and pottery was only found in eight of the 15 burials. In all cases the pottery associated with burials originated from the surrounding soil into which the grave was dug and was not deposited as grave goods (e.g. burials 6, 8). The only evidence for grave goods consists of polished and chipped stone tools, bone tools, and a stone frog amulet from burial 7; although the concentration of charred seeds of emmer or new glume wheat in burials 1 and 3 may have been part of a burial ritual or offering.[36]

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33 Michalopolou 2017, 183–4.

34 These large pits cannot be explained as burrow pits for extracting clay or mud with which to build the houses, even if they predated the structures. A burrow pit, by definition, is an excavated area where material has been dug for use as fill at another location. It would be structurally problematic for a Neolithic house to have a mud wall without stone foundations abutting an exterior pit, which would collect rainwater and reduce the stability of the wall. These pits are also rather shallow and small for extracting enough material for house construction.

35 Starnini 2018, 58–9 table 1.

36 Karamitrou-Mentessidi *et al.* 2016, 57, fig. 30; Valamoti 2011, 246, 250.

Nor did all of the pits necessarily have the entirety of their contents sealed below ground. A pit may have been gradually filled in beyond its capacity so that some of the material was spread out on the ground surface in a small pile: this phenomenon is documented in the small pits (e.g. pit 55 north, pit 55 south) underneath the surface concentrations of pottery southwest of house 3; burial 6 was later interred into this area. Pits, like open areas, were used for a wide range of activities over time as evidenced by the accumulation and removal of all types of remains.[37]

This depositional pattern also seems to be the case for the *lakkos orygma*, at the southern corner of house 4. Pieces of the same vessel with finger-pinched decoration were found within the *lakkos orygma*, its smaller interior pit 33, as well as in the ground-level material overlying the *lakkos orygma* (Fig. 6b).

The *lakkos orygma* appears to post-date house 4, based on the ceramic comparisons between the *lakkos orygma* and house 4 (although only 30 sherds come from within the house; as opposed to possibly 119 from the southeastern corner of the house in the southern baulk). The presence of construction materials in the pit (possibly from the demolition of the house), the overlap with house 6 on the eastern side, and the fact that the northern limit of the *lakkos orygma* also seems to follow the southern corner of house 4's southern corner support this suggestion. The sequence of construction in the larger northern area of the site seems to indicate that house 4 was constructed first, then the *lakkos orygma* and house 6, to be followed lastly by house 7.

POTTERY MANUFACTURE/TECHNOLOGY

Based on macroscopic identification of the non-plastic inclusions, fabric pastes, and pigment colors, it is possible to identify potential clay sources in the immediate vicinity of the settlement using the Greek Institute of Geology and Mineral Exploration (IGME) geological maps for the surrounding areas (Kozani and Siatista sheets).[38] This macroscopic method remains conjectural and was used in advance of planned petrographic[39] and chemical studies; geological prospection for clay sources in the immediate vicinity of the site is not an option now as the relevant layers have been removed by strip-mining. This present approach may not be enough for unequivocally demonstrating the possible use of local, non-local, or exotic sources of non-plastic materials,[40] but it gives a general idea of ceramic manufacture at the site.

The Early Neolithic potters of Mavropigi-Fillotsairi seem to have exploited local clay beds of different ages related to the Mesohellenic Trough and the Pelagonian Zone that extends from southern Albania through northern Greece by way of the Kozani basin. (Fig. 7). These clay beds contained many naturally occurring non-plastic materials. The same clays used for vessels were also used to produce terracotta figurines[41] as well as ceramic stamp-seals (*pintadera*), beads, buttons, amulets, and bracelets.

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37 For a micromorphological approach to open areas at Early Neolithic Paliambela-Kolindros, see Koromila (2016).

38 IGME 1982a, b.

39 A request for an initial thin-section analysis of 30 sherds was submitted in May 2020 as part of the PLANTCULT (European Research Council funded project, Consolidator Grant, Horizon 2020 Research and Innovation Program, Grant Agreement No 682529) under the direction of Dr. Soultana Maria Valamoti, and these samples will be analyzed by postgraduate Dr. Anastasia Mavromati, under the supervision of Dr. Anastasia Dimoula. A larger study will follow.

40 Kaczanowska and Kozłowski 2016.

41 Starnini 2018, 61.

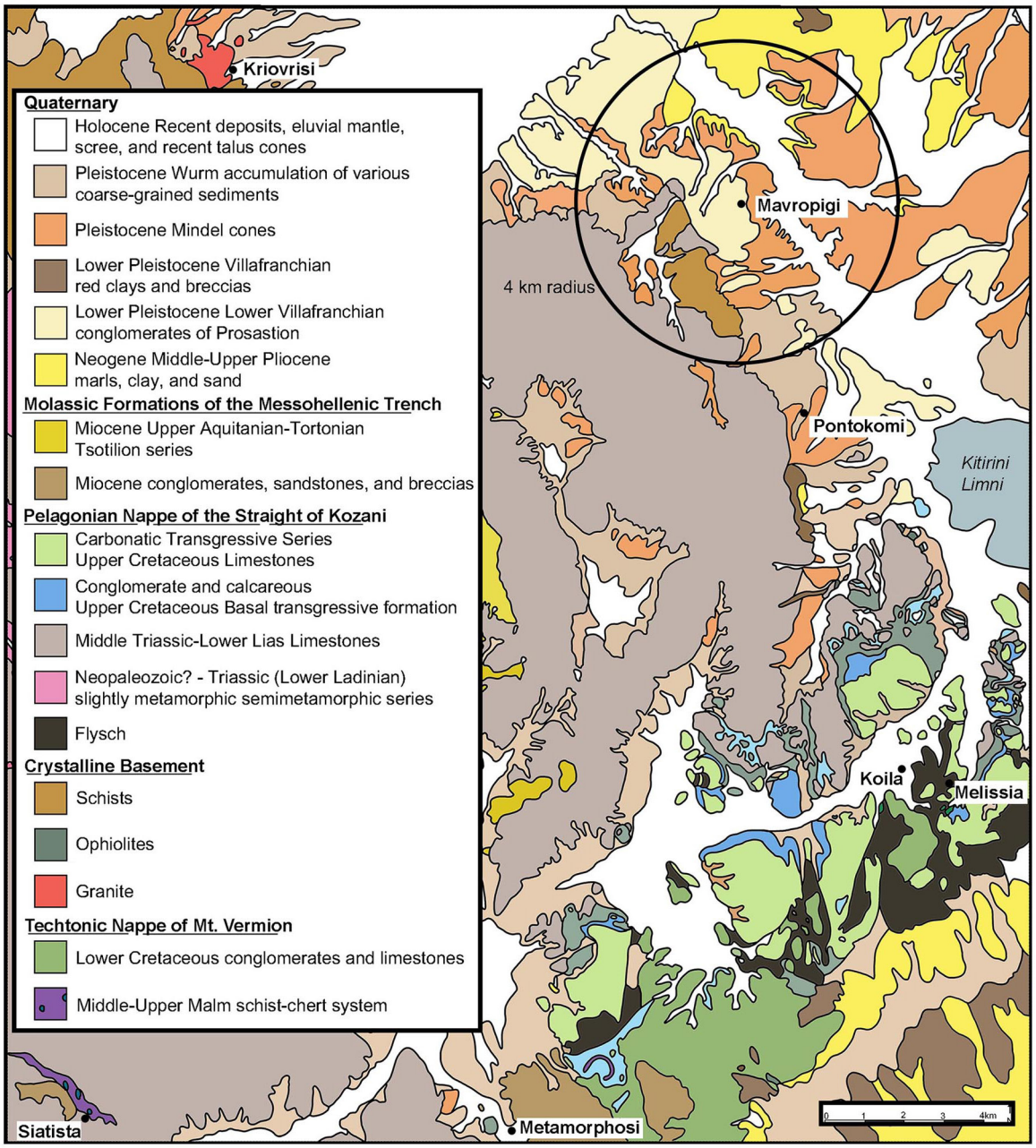

Fig. 7. Simplified geological map of areas around Mavropigi-Fillotsairi with 4 km radius around the site indicated, along with the modern villages near possible sources for clay with shell inclusions. Scale1:50,000

The use of these clay sources in close proximity to the site seems probable, but more distance sources could also have been exploited. Recent research[42] on Early Neolithic raw material sourcing agrees with the findings of ethnographic studies.[43] The exploitation of resources at a distance of 1 to 5 km in the immediate vicinity of sites is the norm, with occasional use of

42 Saridaki 2019; Dimoula 2017.

43 Arnold 2017, 17; 1985, 32–60. Ethnographic studies demonstrate that the landscape-based resource area for both clay and temper is typically 1 km and seldom larger than a radius of 7 km from the production center. Of the 110 examples studied by Arnold, 85% traveled less than 1 km from the settlement and 31 cases traveled no more than 50 km for temper (Rice 1987, 116).

Fig. 8. (a) Sherd breaks showing range in coarse fabrics, temper, and firing variations. Not to scale. (b) Glistening surfaces of fine micaceous fabrics fired under different kiln conditions. (c) Large inclusions of chert, calcium carbonate, and quartz. Scale 1:3. (d) Shell-tempered pottery. Scale 1:3. (e) Impressions on the surface of pottery from burnt-out organic temper. Not to scale.

more distant sources. For instance, in Western Macedonia only local material (1 to 5 km) was collected.[44] In Central Macedonia, local resources were preferred, although there are examples of clays drawn from 10 to 25 km away.[45] Similarly, in Thessaly, clay sources 5 km from Achilleion were exploited,[46] and at Sesklo the majority of the fabrics were also found the immediate geological environment, with but a few from further off.[47] Only at sites in the plain of Larisa did the primary sources exploited by sites tend to be located at 10 to 20 km off, but raw materials in the closer vicinity were also used.[48]

One of the likely primary clay sources was immediately to the north and east of the site in the Quaternary Pleistocene Mindel Cones, which contained both the red clays used for the ceramic body and pigment (iron-oxide) for red slips and motifs, and also the calcareous rubble inclusions in the clay paste. In the same area are Neogene Middle-Upper Pliocene marls, clays, and sand with loose conglomerates that also bear fossil shells.[49] These deposits could have been the sources for the white-slip used for Red-on-white, the paint for White-on-red and Polychrome, as well as the fabric for some of the sandier reddish-brown fabrics and fabrics with fossil-shell inclusions.

Fluvial deposits of the Lower Pleistocene Villafranchian Conglomerates of the Proastion Formation (sometimes overlaying the Neogene sediments) are found all around the site as well as toward the hills to the east. These deposits contain the well-rounded types of limestone, schist, and radiolarite inclusions noted in the ceramic body. Similarly, fluvial deposition from the hills to the east of site can account for the presence of inclusions of micaceous schist and quartz (from the Crystalline Basement) and schist and chert (from the Pelagonian Nappe Middle Triassic-Lower Lias Limestones). The few and rarely occurring igneous rock inclusions possibly originated from the northwest, near the modern village of Kriovrisi in the Crystalline Basement, Granite, where it intersects with the metamorphic formations of the Triassic-Neopaleozoic formation.[50]

The occasional use of fossil-shell-bearing clays is documented sporadically in different areas of the site and found beginning with the lowest levels in the *central orygma*. It remains to be determined if the source for these vessels was the Neogene Middle-Upper Pliocene clay deposits adjacent to the site or if the clay (or the pots themselves) actually originated 20-30 km to the southwest, where two other fossil-shell bearing deposits occur. Of these two extra-local sources, the first and closest is located in the Vermion Nappe, Lower Cretaceous Conglomerates and Calcareous deposits found in the Madzi Rachi hill, just south of the villages of Koila and Melissia. The second possible source is probably the deposits from the Molassic Formations of the Mesohellenic Trench, Miocene Upper Acquitanian-Tortonian, Tsotilion series further to the southwest near the villages of Siatista and Metamorphosi. The origin of the shell-tempered pottery will be scientifically investigated in the future; the possibilities are merely presented here.

The potters may have refined the clay to various degrees through ageing and levigation, but it is also possible that they simply selected naturally-occurring fine clays; in any case,

44 Saridaki 2019, 540–1.

45 Saridaki 2019, 540.

46 Björk, 1995, 15–42.

47 Only three non-local fabrics were identified at Sesklo, but it remains to be determined if raw material sources were exploited or whether we are looking at the consumption of vessels imported from another site as yet to be discovered (Dimoula 2017, 211).

48 Dimoula 2017, 213.

49 IGME 1982a, b.

50 IGME 1982b.

there appear some very fine fabrics devoid of inclusions larger than 1 millimeter (Fig. 8a). A particularly fine micaceous tan-colored fabric was used throughout the duration of the site for small and medium-sized monochrome bowls, which were perhaps admired for their glittering, shiny surfaces (Fig. 8b). In the last phase, other refined reddish fabrics were also used for both bowls and jars with fine sand and micaceous inclusions.

The majority of the pottery, however, contained varying amounts and sizes of organic and inorganic non-plastic inclusions, but proportional to the size and type of the vessel: smaller vessels have finer temper; the larger pots have larger-sized inclusions and greater amounts of temper.[51] This distinction may indicate the potter's behavior and choices, as well as good control over both the material and the manufacturing process.[52] These inclusions consist of rocks, minerals, and fossil shells that were naturally-occurring within the selected clay and are not considered added temper in the technical sense (since they were already present). Possibly, non-plastic inclusions were sorted (either through sieving or settling) according to size and added back into the clay as temper,[53] but deliberately crushed rock or mineral inclusions do not macroscopically seem to have been systematically employed.[54]

The edges of the non-plastic mineral and rock inclusions tended to be rounded and sub-rounded. In terms of size, fine (<.25 mm) and medium (<.5mm) rounded, subrounded, and subangular inclusions are the most common, but larger, even coarse (1 cm) pieces of rounded or subrounded quartz, radiolarite chert, and calcareous rubbles were particularly common in the fabric and protrude from the surfaces of medium- and large-sized vessels (Fig. 8c). Both of these locally-occurring materials were also used for chipped stone tools at the site (as was flint to a lesser extent), which thus demonstrates familiarity with these materials for other uses.[55]

The fossil-shell fabric seems to have been used almost exclusively for red-slipped bowls, particularly deep bowls and S-profiled jars with lugs.[56] As with the mineral and rock inclusions, it does not seem to have been ground up or pulverized, because the pieces are large and preserve the ridges of the small bivalves (Fig. 8d), although the separate addition of more shell to clay already with natural shell inclusions cannot be excluded at this stage of analysis. Fine mineral inclusions are sometimes present in a variation of this recipe. Clay mixing may have been practiced,[57] but it was not macroscopically visible.

Vegetal material was also deliberately added as temper and sometimes in clays already

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51 This contrasts with the use of temper at other Early Neolithic sites like Franchthi, Lerna, Sesklo, Achilleion, and Nea Nikomedeia, where the nature of the temper varied independent from the size and shape of the vessel (Yiouni 1996; Björk 1995; Vitelli 1993a, 1993b).

52 Dimoula (2017, 215) came to a similar conclusion for Early Neolithic sites on the plain of Larisa.

53 Manual sieving or levigation is documented in the Early Neolithic period in both Northern Greece and Thessaly (Saridaki *et al.* 2019, 134; Dimoula 2017, 213) as the main fabrics are found in both coarse and finer versions, along with consistency of the size of inclusions.

54 Toward the end of the Early Neolithic in the Franchthi Cave (Franchthi Ceramic phase 1, FCP 1), crushed calcite temper was added to Lime Ware (Vitelli 1984, 117, citing the observations of Charles Vitaliano, Professor of Petrology at Indiana University; 1989, 18, 1993b, 96) and a very limited use of crushed pottery (grog) temper in Fabric A (the most common fabric) at Nea Nikomedeia (Yiouni 1996, 73, 78). Naturally occurring inclusions were retained at Sesklo (Wijnen 1981).

55 Kaczanowska and Kozłowski 2016.

56 Pottery made from fossil-shell-bearing clay was until recently not a well-documented in the Early Neolithic period, with only occasionally occurring pieces as in Fabric A at Nea Nikomedeia (Yiouni 1996, 72).
Recent research now demonstrates the presence of shell inclusions in Western Macedonia at both Paliambela-Kolindros and Revenia-Korinos (Saridaki *et al.* 2019, 132; Urem-Kotsou *et al.* 2017; Papadakou *et al.* 2015; Papadakou 2011) as well as in Thessaly at sites in the plain of Larisa (e.g., Argissa, Otzaki, Soufli, and Melissochori Magoula (Dimoula 2017, 213).

57 Clay mixing was petrographically noted in Pieria (Saridaki *et al.* 2019).

containing mineral inclusions.[58] Macroscopically, the use of cut straw, chaff, and small pieces of thinner grass is clearly evident in both cross-sections of the vessel fabric (as carbonized pieces or rectilinear-shaped voids) and on the vessel surfaces (in the presence of small impressions; Fig. 8e). Very small, short pieces of a medium breadth are most common. Vegetal temper in the Early Neolithic has not been thoroughly explored in technical studies, and there is no established system to describe or quantify it.[59] It appears to have been abundantly used at Mavropigi-Fillotsairi.

Both the types of clays selected by the potters and their choice of adding or re-adding certain non-plastic inclusions demonstrates practical and technical solutions to making and firing pots (probably without a kiln) and demonstrates advanced potting knowledge. The potters made deliberate choices to first select certain clays with naturally beneficial inclusions (like quartz and calcitic materials) or to add others so as to aid in the formation and firing of their pots through reducing the plasticity of the clay (e.g. radiolarite chert, quartz, or chaff), by making it easier to work, preventing excessive shrinking and cracking during the drying and firing processes (e.g. chaff and quartz, sand), and reducing the temperature necessary to fire the pottery (e.g. calcareous materials like shell, limestone, mica schist).[60]

"Flattened coil-slabs,"[61] also called "fillets of clay,"[62] were primarily used for building the vessel body,[63] using the segmental or composite coiling technique, in which each course is composed of several segments, rather than a single rope as in the rope-coiling method (Fig. 9a).[64] Clay flattened coil-slabs could also be layered on top of one another (Fig. 9a.1) to create thicker walls or slathered with more clay at joins (Fig. 9a.2) to assure adherence.[65] Both bevel

58 Vandiver (1987) found that in the Zagros regions of the Near East chaff was added by early potters to montmorillonite clays in order to make them workable. The clays, which were gathered dry, were not sufficiently aged and, in turn, the heavy use of chaff temper required the construction of pots using small palm-sized flattened pieces or slabs of clay rather than cylindrical coils. This type of construction was not used in Greece or the Balkans (e.g. Kozatsasa *et al.* 2018, 111; Kozatsasa 2017 for the Middle Neolithic; Thissen 2017, 82; Dimoula, *et al.* 2014, 499; Wijnen 1993; Fidanoski 2009, 66).

59 E.g. vegetal inclusions were mentioned at Achilleion (Winn and Shimabuku 1989) but were not found in the samples later analyzed by Björk 1995 (Perlès 2001, 28) and Dimoula (2017); it was also noted at Prodromos (Chourmouziadis 1972, 176–9), and at Nea Nikomedeia (Yiouni 1996, 78) where charred plant remains were present in all fabrics except for the painted pottery, and most recently at Otzaki, Soufli, and Melissochori (Dimoula 2017, 213). In no publication is the nature or extent of use commented upon, but this methodological lacuna will be addressed for northern Greece by Papadakou (forthcoming).

60 Rice 1987, 96–8; Shepard 1980, 19–31, 51–4, 72–4.

61 Dimoula, Pentedeka, and Filis (2014, 499, fig. 7) refer to flattened coil-slabs in Eastern Macedonia.

62 Rice (1987, 127) also describes flattened coil-slabs as "fillets of clay." Along with "flattened coil-slabs," these terms connotate that the slabs were not rectangular pieces cut from a large rolled piece of clay or produced using a clay extruder.

63 Vandiver (1987, 15, fig. 6) distinguished between coils, strips, slabs and lumps, while Kozatsasa *et al.* (2018, 111) identified coils, flattened coils, elongated slabs, flattened patches at Middle Neolithic Sesklo. Flattened coil-slabs/fillets of clay seem to be most common in Northern Greece and Thessaly during the Early Neolithic. These different methods and slightly different terminologies may have artificially created different potting traditions in the literature for Early Neolithic Greece (Perlès 2001, 211). For instance, Vitelli's publications on Franchthi (Vitelli 1984; 1996, 96) and Lerna (Vitelli 2007, 92) mention only coils, but Wijnen (1993, 324, via pers. comm. with Vitelli) reported the use of slabs. Conversely, Wijnen (1982) did not initially identify the use of slabs at Early Neolithic Sesklo or elsewhere in Thessaly, but after the publication of Vandiver's article, she recognized the use of slab-building throughout Neolithic Greece (e.g. Sesklo, Achilleion, Otzaki, Argissa Servia, Nea Nikomedia, Elateia, and Corinth (Wijnen 1993, 324).

64 Rice 1987, 127. This process differs from the sequential slab construction technique defined by Vandiver (1988; 1987), in which multiple palm-sized slabs were overlapped like patchwork with one another to build a vessel (Vandiver, 13, pl. II.19, III.21, V).

65 There is no evidence for what has recently been called the "layer-building technique" (Todaro 2016, 274) in which slabs and layers of clay are added to the interior of vessels, and which was first identified at Kommos on

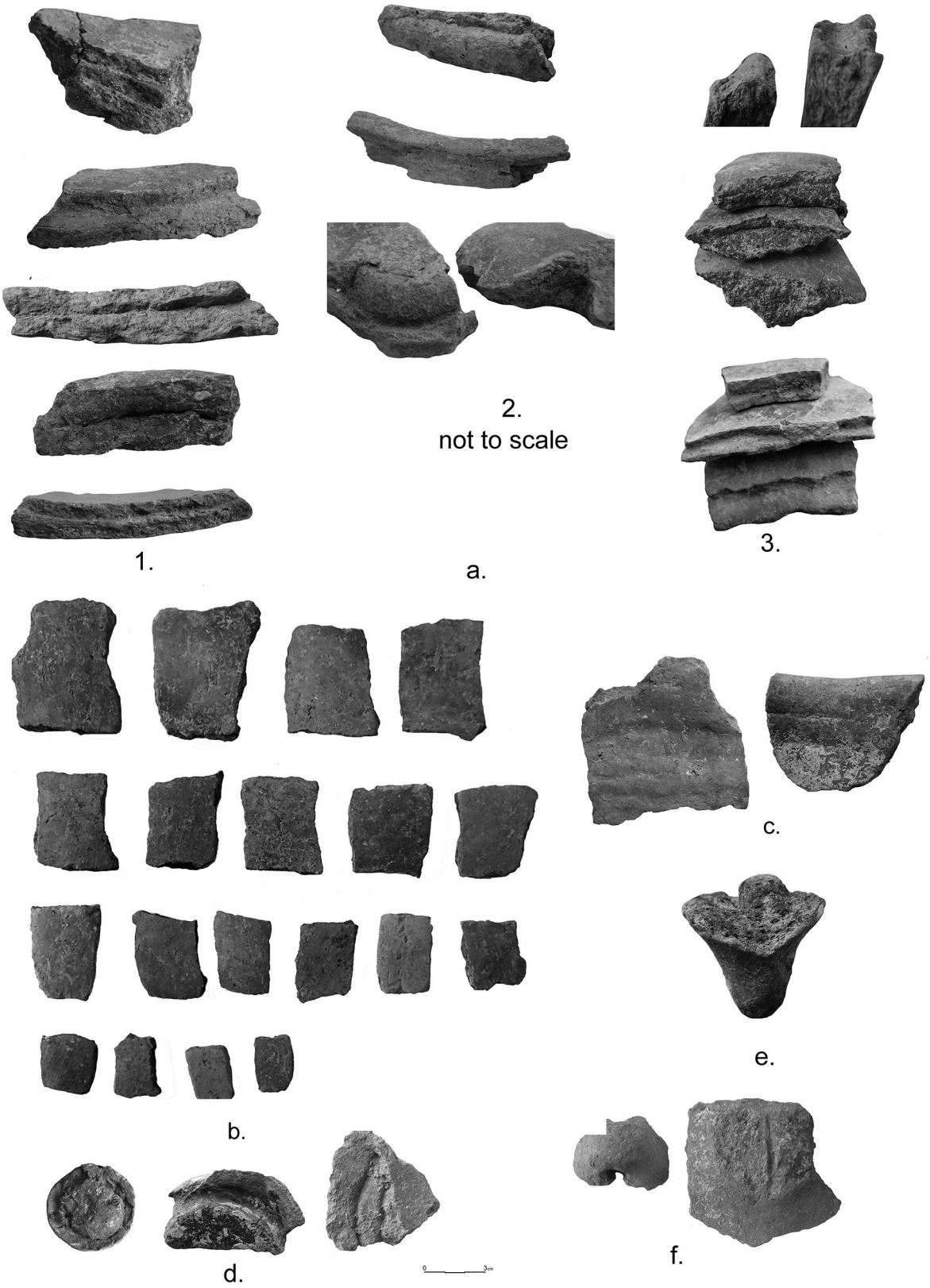

Fig. 9. (a1) Layered slabs of various thicknesses; (a2) clay slathered on joins; (a3) slab fracture at join, butt and bevel joins. (b) Breakage pattern of vessels constructed using flattened coil-slabs from the same spit in pit 106. (c) Cylindrical coils at rim. (d) Cylindrical coils in base construction. (e) Thrust leg. (f) Detached, vertically perforated lug.

(flat, angular oblique junctures that enable a stronger bond) and butt joins (in which successive courses were stacked directly one on top of the other; and sometimes treated to a tongue-and-groove arrangement) were used (Fig. 9a.3). There is not much macroscopic evidence for the use of molds[66] or for support when building,[67] but external supports could have occasionally been used. Quantification of the dimensions of the flattened coil-slabs from Mavropigi-Fillotsairi is for future research, but they were probably in proportion to the size and shape of the vessels while maintaining an easily-workable size.[68]

The use of flattened coil-slabs is also documented by the distinctive breakage patterns of vessels into rectangular pieces, which may indicate balls flattened into circular, oval, or roughly square slabs.[69] It also indicates that the successive slabs were added when the previous layer was technically too dry to allow for proper bonding (Fig. 9b). Cylindrical coils were sometimes used in the upper courses and rim, but other rim sherds indicate that some vessels were entirely slab-built (Fig. 9c). Cylindrical coils were also added to bases to create concave and ring bases (Fig. 9d).

When the vessel body was plastic and malleable, some vessels had their exterior surfaces decorated by displacing parts of the clay making up the vessel surface. The moist clay was manipulated by finger-pinching, impressing fingernails, fingertips, or using various tools (see below, impressed, incised, and finger-pinched decorated pottery) that created a rough-textured exterior surface. Pots not receiving these types of decoration were simply left to dry. When this process began, they were scraped down inside and out to thin and even out their walls, which could be made really rather thin for fine ware (ca. 3 mm). A totally flat, smooth surface or consistent thickness, however, was not always the potter's aim: some vessels retain irregular surfaces from their construction.[70] The vessels were then typically thinly slipped with the same clay as the vessel body by simply dampening the vessel surface (self-slipping).

Crete (Van de Moortel 2006); this method involves joining subsequent slabs by overlapping them and smearing the joins with extra layers of clay on the interior of vessels which are built inside molds (Todaro 2016; 2017; 2018). In the Greek Early Neolithic, additional slabs tended to be added to the exterior of bases, rather than the interior; some of the bases from Mavropigi-Fillotsairi may have also been formed over the exterior of an inverted pot for a form (Shepard 1985, 57).

66 Mold-made pottery "as a primary forming technique is concept foreign to Greece, the Marmara region and the Aegean alike, as far as this time period concerned," – though large mold-made dishes occur in Central Anatolia and the Balkans, these shapes are not part of the repertoire of Early Neolithic Greece (Thissen 2017, 84). None of Vandiver's (1987, 30 Appendix III) mold-made criteria are met in Greece. Even hand-made Early Minoan II Vasiliki Ware on Crete was built using precut-slabs and without a mold, but with the aid of turn table (Betancourt *et al.* 1979, 13).

67 As in the Balkans, a secondary use of paddle-and-anvil is possible but not common (Thissen 2017, 82; also for Middle Neolithic Sesklo (Kozatsasa *et al.* 2018, 109). Even recent micro-computed tomography scanning of Middle Neolithic Sesklo pottery identified only a single example in which the use of an inverted base was used as a mold for a basin (Kozatsasa *et al.* 2018, 112). This is a completely different technique than the Early Neolithic Balkan basins which were shaped inside of baskets (Thissen 2017, 82).

68 At Sesklo, the coil-slabs were typically larger than 20 cm by 10 cm high (Wijnen 1993, 151). Pieces of 4 cm high and the length of the diameter of the vessel were used for Early Minoan II Vasiliki ware (Betancourt *et al.* 1979, 13).

69 Thissen 2017, 82.

70 These basic vessel-forming procedures are stated in detail because outlining the *chaîne opératoire* highlights the choices of the potters (Roux 2016) in all phases of vessel production selection from the procurement of raw materials, the preparation of clay paste, forming, surface treatment and firing (Saridaki *et al.* 2019, 130). This approach emphasizes the fluidity of ceramic technology that results in the physical manifestation (via a pot) of ideas, perceptions, and symbols important to a society, through which it can define and reproduce itself. That is, through choice within the flexible set of technological possibilities, pottery traditions are defined, including organization of production (level of standardization), proportions of fabrics, decorative choices, which all in turn suggest social roles (Pentedeka 2017, 340; Urem-Kotsou *et al.* 2014, 505).

Red-painted decoration was applied when the vessels were leather-hard and before burnishing, as is sometimes indicated by the slightly displaced, blurry paint at the edges of bands, while the white paint seems to be applied after burnishing, particularly on White-on-red and Polychrome (Fig. 6c-e). A white (calcareous) slip was used for the background of Red-painted vessels, for outlining red-painted motifs on Polychrome-painted pottery, and for the main motifs of White-on-red painted pottery. An iron-based red pigment was used for monochrome bowls and jars, the background slip for White-on-red, and for the main motifs of Red-painted, Red-on-white and Polychrome-painted. The red ranges in color from a deep maroon to bright crimson. The adherence of the paint (a colored slip in essence) to the vessel surface varies, determined by the mineral sources used for the pigment, the fabric of the vessel body, the degree of burnishing, if any, and the firing conditions (Fig. 6c, d.1-2, e).

Monochrome pottery surface colors range in hue, tint, and tone from tan-brown and beige with reddish, yellow, grayish or gray-black being noted (Fig. 6f).[71] Mottled areas are documented on some sherds but uniformly colored surfaces are the rule. A trend toward producing redder-colored vessels is noted in the later phases of the site, both by the selection of red-firing clays and through the application of a red-slip on a wider range of shapes. Post-depositional conditions have also affected the level of surface preservation and color of vessel surfaces, which varied between deposits at the site. Some pits, like pit 106 in the northwest part of the site and the *lakkos orygma*, contained examples with well-preserved surfaces, but the pottery from inside house 7 and the surface concentrations, for instance, was heavily worn and eroded. In the case of house 7, it is likely that the majority of the pits and pottery found in them predate the constructions of the house. It should be noted that decorated pottery (both painted and impressed, incised, and finger-pinched) began with the occupation of the site.[72]

After slipping and decorating, the vessels were burnished to varying degrees with a hard tool or at least polished with a soft cloth/piece of leather, and allowed to dry.[73] Even rough-textured impresso pots often had reserved, carefully burnished bands around the rim and base, but the raised areas of impresso decoration were sometimes lightly polished and in some instances subsequently flattened from burnishing.

Firing of the pots probably took place in a simple bonfire or pit as it is possible to so produce oxidized surfaces and polychrome-painted pottery,[74] but firing in a clamp kiln (or possibly even in a basic kiln such as a bank kiln/two-chamber oblique kiln) would have provided better control over firing atmosphere.[75] The light-colored surfaces also indicate that very smoky fuel

71 The Munsell color ranges for pottery surfaces are: red-slipped (10 YR 4/4 weak red, 2.5 YR 3/6 dark red, 2.5 YR 4/4 reddish brown); tan-brown and brown-red (7.5YR 6/4 light brown, 10YR 4/2 brown, 7.5YR 5/4 brown, 5 YR 5/6 yellowish red); brownish-grey or black (10YR 6/3 pale-brown, 10YR 3/1 very dark gray, 10YR 4/1 dark gray); white (10YR 9.5/1 white, 2.5YR 9.5/1 white, 2.5Y 8.5/1 off-white).

72 The use of a red-slip on the pottery occurred already in the lowest levels (phase I) of the *central orygma*.

73 The terms burnishing and polishing are often used synonymously in the literature on Neolithic pottery, although the two are technologically distinct. Rice (1987, 138) defines burnishing as done with a hard tool, like a pebble, bone, or sherd to compact and reorient the fine clay particles of the slip or vessel surface. It is typically done when leather hard or dry and is evidenced by parallel strokes on the surface of the pot. Polishing is also done on a dry surface, but with a soft tool (like a leather cloth) and produces a uniform luster without the parallel facets produced by burnishing (Rice 1987, 138).

74 Vitelli 1984, 125.

75 Several Middle Neolithic kilns are now identified in western Thessaly at Imvrou Pigadi (Kyparissi-Apostolika 2012) and another Middle Neolithic kiln at Magoula Rizava (Krahtopoulou *et al.* 2018); a Middle Neolithic clamp kiln was also recently documented at Kouphovouno in the Peloponnese based on soil micromorphology (Ballut *et al.* 2017). Previously, the only secure evidence for Neolithic kilns came from the Late Neolithic site of Kryoneri, Nea Kerdyllia in Eastern Macedonia (Malamidou 2016; 2007, 301): this may have even been an early attempt to

(e.g. straw, dung, and green wood) was not used.[76] Firings were sometimes of short duration as indicated by the abundance of gray and black cores, from their incomplete oxidation;[77] yet at other times, the fabric is completely oxidized (Fig. 8a). The fact that charred vegetal temper, shell, and calcareous inclusions remain visible in the vessel sections and surfaces also attests to low firing temperatures of short duration. The range of surface colors and the simultaneous occurrence of partially reduced and fully oxidized cores confirms that several different firing techniques were known and that these effects should be attributed to experience rather than experimentation. Some color variation may be attributed to secondary firing effects either from the use of the vessels, burnings in pits, or destruction of houses.

VESSEL MORPHOLOGY AND TYPOLOGY

The vessel shapes can be broadly grouped into jars and bowls of various sizes. There are no truly closed vessels (with the exception of miniature versions of jar shapes), as the openings of jars were high concave collars that were wide enough to permit their interiors to be finished. [78] Jars are primarily variations on a globular form (Fig. 10). Variations in rim inclinations and lip forms define the different types: S-profiled (inward-leaning upper walls with everted rim or with gentle angles under the rim), open "hole-mouth" jars (globular bowls with inward-leaning/curved upper walls), simple high and short concave collared jars.

The vast majority of bowls are hemispherical and of varying depths and heights (Fig. 11). They may be broadly defined, based on the ratio of depth to diameter: shallow hemispherical (convex; height < diameter), deep hemispherical (height > diameter), and hemispherical (height ≈ diameter). Other kinds of bowls include straight-sided and subtly S-profiled (created by slightly everted and tapered rims). Conical and cylindrical bowls were rare. Small bowls with diameters less than 4 cm can be considered as cups, if not miniature vessels.

Vessel size, as based on rim diameter can roughly be categorized as: small (< 12 cm), medium (12–18 cm), and large (>18 cm). Very few vessels have diameters larger than 24 cm, but the existence of even larger vessels is suggested by very thick-walled body and some small rim fragments, although their shape is undetermined (Fig. 12a). Typically, the same shape is found in a range of sizes and fabrics.

The wall thickness and lip shape can vary within the same vessel (see sherds in Fig. 12b, right) even though lip consistency was the aim of the potter. The rims of most bowls are also not perfectly level around the bowl and undulate in height. Vessel openings (as well as bases) were not always perfect circles. There is not much variation in lip form and most lips are gently tapered or rounded. Other rim types are rare (e.g. flat rims with external thickening, blunt rims). The sinuous shape of S-profiled bowls and jars are created by the angle of eversion of the tapered or rounded rim.

Flat, disc, and ring bases are the primary types in all phases (Fig. 13a). The angle of the wall of the vessel from the base can be broadly defined as having either a low (<30˚) or high (>30˚) profile. Rounded bottoms do not exist. True ring-bases are rare and exclusive to medium-sized

separate the fuel from the pots (Papadopoulos and Nerantzis 2014, 39).

76 Perlès 2001, 214.

77 Perlès 2001, 213; Vitelli 1997, 23–5; Rice 1987, 153, 155–6.

78 In the technical sense, a "neck" is a restriction of the opening of a vessel, in contrast to a "collar," which begins at the point of maximum diameter and does not significantly reduce the opening like a neck (Rice 1987, 212). The examples from Mavropigi-Fillotsairi could be called collar-necked jars.

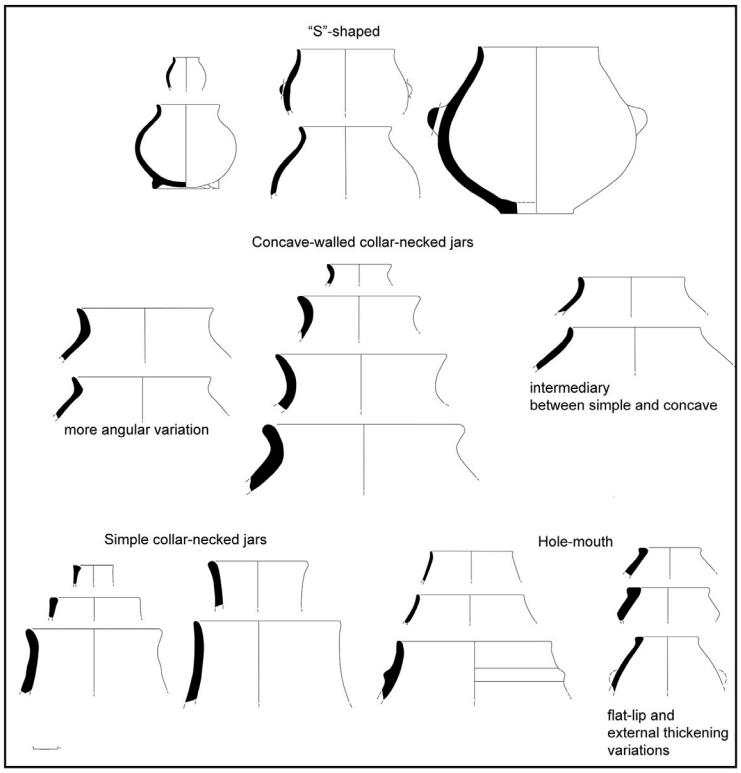

Fig. 10. Jar morphology.

and small and fine-ware vessels. Nearly all ring-bases are more accurately described as concave disc bases, due to the addition of more clay where body and ring join on the underside, rather than a clear ring base whose junction involves only the outer edge of the base (Fig. 13a middle-right). Several methods of construction of concave bases were documented, including the use of spiraled cylindrical coils, a thick central disc, or simply the use of a coil-slab and slathered clay (Fig. 9d).

Flat bases do not have added clay on the base, in contrast to disc bases; they are made simply by the using a flattened slab of clay to form the base. Sometimes the center of disc bases was slightly concave. Some of the larger vessels with disc bases had their bases attached at the end of the forming process (with the vessel inverted), as seen in the additional clay slathered over the joins (Fig. 9a.2). There are also a handful of flat and disc bases with plain weave and split twine matt impressions (Fig. 13b), showing that they were made on mats or baskets.

A greater variety of base-types are documented in phase III than in phases I and II. These include oval-shaped bases (disc, concave, and flat) on small monochrome vessels, small, short feet (probably tripod) of either conical or cylindrical shape, and a unique rectilinear-shaped base (Fig. 13a, bottom left). The small feet seem to belong to small globular or S-profiled vessels, some of which were painted Red-on-white. One example from the *lakkos orygma* was attached by thrusting the leg through the vessel wall, as shown by its plug-like end (Fig. 9e).[79] This method was not used for attaching lugs.

Round and oval-shaped string-hole lugs were commonly used and there are no true (loop

79 Five examples of "thrust lugs" or "plugs" were found at Nea Nikomedeia (Yiouni 1996, 62) and they are also noted at Early Neolithic Elateia (Weinberg 1962, 175).

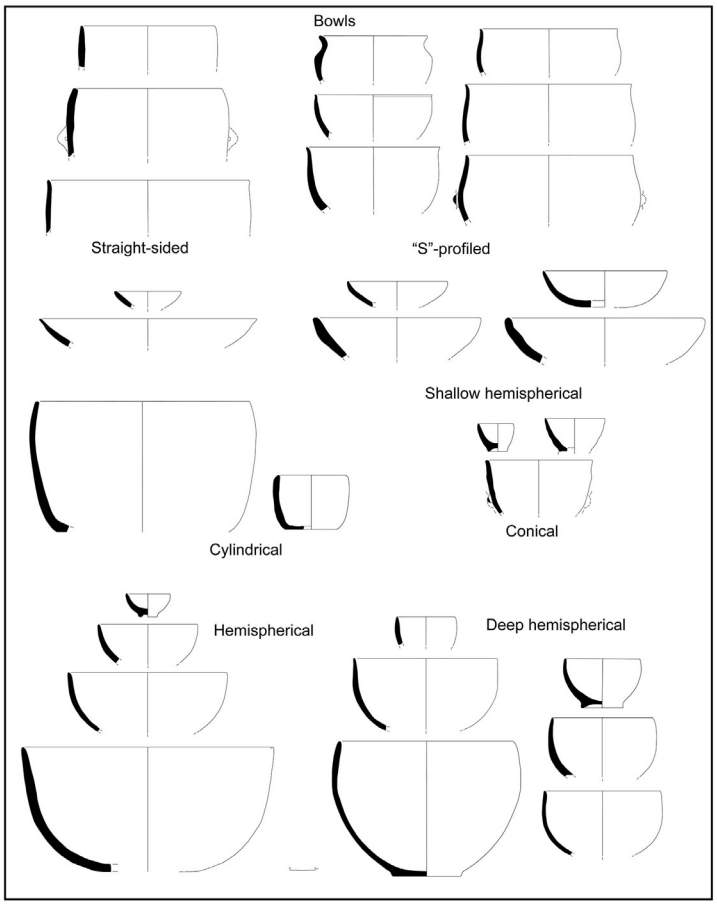

Fig. 11. Bowl morphology.

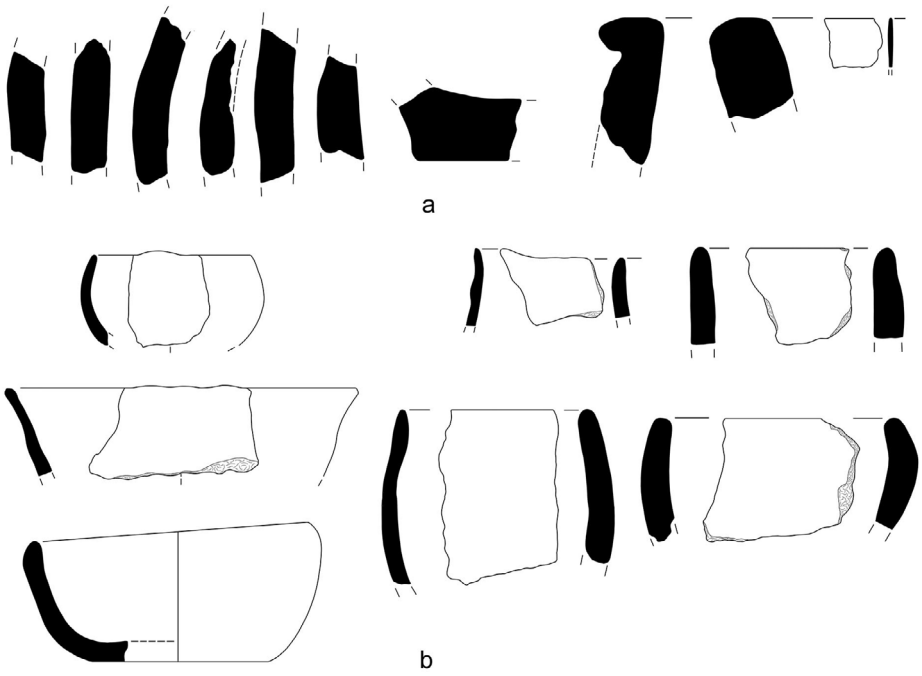

Fig. 12. (a) Examples of very thick and thin sherds. (b) Sherds with uneven, undulating rims, and rims with uneven vessel walls.

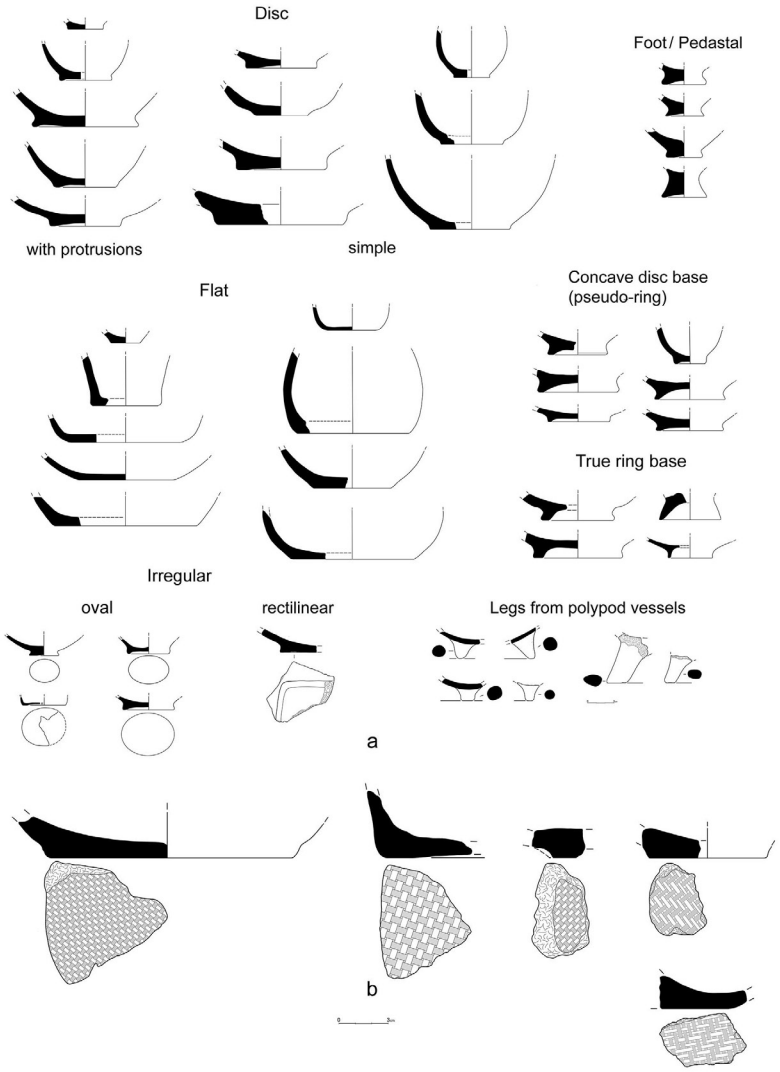

Fig. 13. (a) Base morphology. Scale 1:6. (b) Flat bases with plain weave and split twine mat impressions.

or strap) handles (Fig. 14). Pierced string-hole type lugs were used on bowls and jars, and perforated both horizontally (Fig. 14a) and vertically (Fig. 14b). The lugs were either placed at the vessel belly or slightly below on jars and hemispherical bowls or a few centimeters below the rim on bowls. Vertically-pierced string-hole lugs tend to be flatter to the vessel body, while the horizontally-perforated type protruded further.

These lugs may have been used to attach a covering or lid made of a perishable material (cloth, leather, basketry, or wood). Pots with ring and disc bases were probably meant to rest on the ground or a shelf, although vessels with string-hole lugs would have enabled them to be suspended, and there are a few instances of use-wear abrasion on the bottom of bases suggestive of this use (alternatively this wear pattern may indicate reuse as a bobbin) (Fig. 5c).[80]

Lugs were attached with or without scoring (nail-pinching and scratching were also documented) and sometimes they were added when the vessel body was too dry to allow them

80 A different abrasion pattern was noted at Kovačevo, which suggested a different type of suspension (Vieugué 2014, 626, fig. 6).

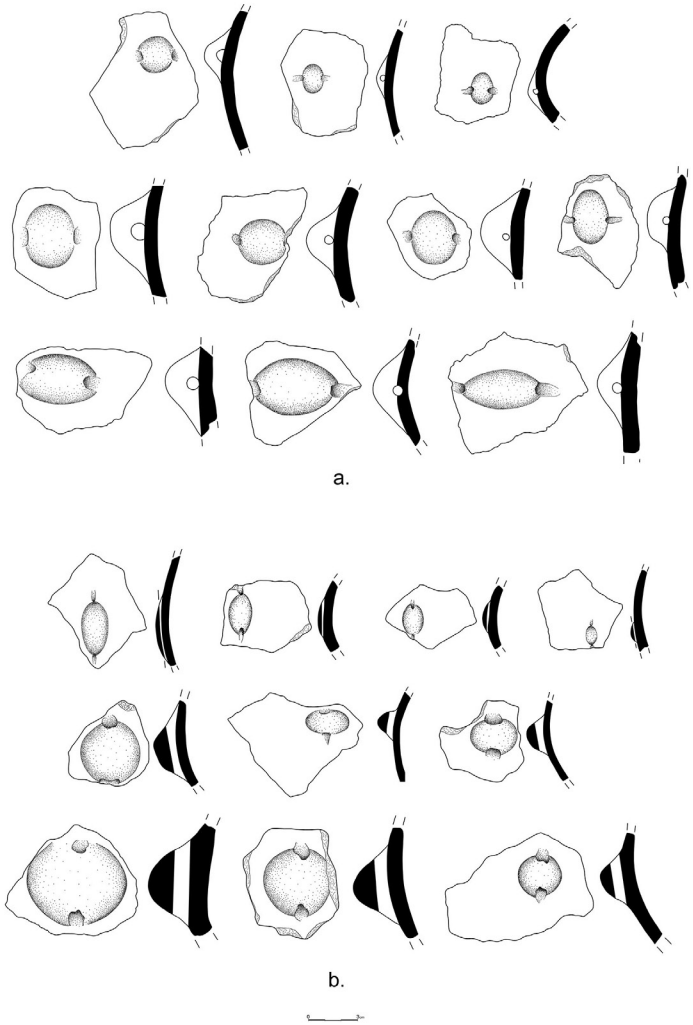

Fig. 14. Perforated lug-handle morphology: (a) Horizontally perforated lugs. (b) Vertically perforated lugs.

to properly adhere. The perforated lugs are most commonly found detached from the vessel body. Lugs were attached as balls of clay, modelled, and then pierced, or alternatively, a stick may have been pressed against and into the surface of the body and a ball of clay modeled around it (the stick could either have been removed later or left to burn away during firing). Both the impression of the stick and the direction of perforation can often be seen on the exterior surface, the stick impression is also visible on examples where the lug has detached from the vessel body (Fig. 9f).

There is no strict correlation of shape, fabric, and surface treatment in the monochrome and decorated pottery, but there are a few types that do stand out. These include maroon-slipped bowls[81] with small, flat added plastic pellets or string-hole lugs on their belly (Fig. 15b top row). This maroon slip was not used on impressed, incised, and finger-pinched vessels. Those vessels tended to be more brown or tan and the reddish-brown slip that was sometimes used is a different shade and thickness.

Cylindrical bowls, conical bowls, shallow hemispherical bowls, and small cups are only found

81 Munsell colors (7.5R 3/8) dark red and (5R 3/6) dark red.

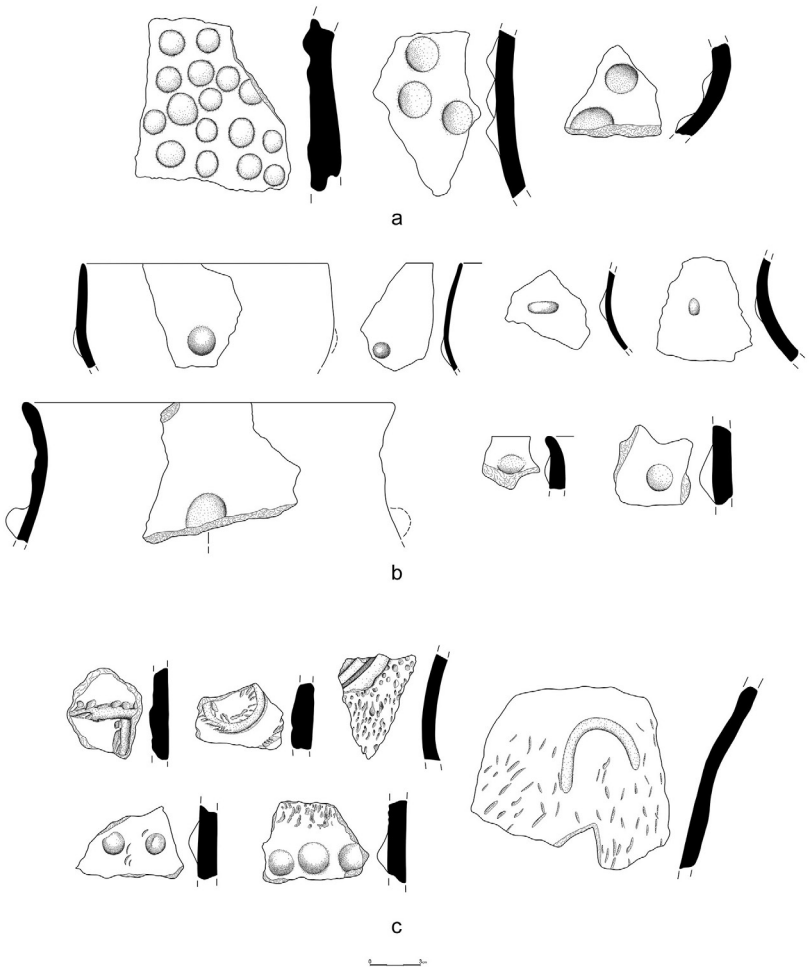

Fig. 15. Added plastic decoration: (a) Multiple circular added plastics. (b) Single round and ovular added plastic pellets. (c) Plastic decoration with along with impressions, incision, and finger-pinches.

in the monochrome repertoire. Oval and rectilinear bases are only documented in monochrome and feet or legs are never used on impressed, incised, and finger-pinched pots. Flat lips with internal or external thickening on small hole-mouth jars are only found in monochrome and further seem confined to phase II.

DECORATED POTTERY

The decorated pottery from Mavropigi-Fillotsairi consists of several types of painted decoration (White-on-red, Red-painted, and Polychrome) and impressed, incised, and finger-pinched pottery. Plastic decoration was also added to both monochrome and decorated vessels. These last consist of a few types with groups of rounded protruding plastic pellets (Fig. 15a) and others with individual flatter oval pellets (Fig. 15b); curved bands of plastic decoration (Fig. 15c) also occur on incised, finger-pinched, and impressed pottery, but the complete motifs remain unknown. One jar collar is decorated with added plastics to create a "face-pot", it comes from phase III in the *central orygma*.[82]

82 Karamitrou-Mentessidi *et al.* 2016, fig. 8.

IMPRESSED, INCISED, AND FINGER-PINCHED DECORATED POTTERY

The impressed, incised, and finger-pinched pottery from Mavropigi-Fillotsairi is characterized by a preference for a dense, overall rough surface with limited negative space, rather than careful tool impression and organization of elements into motifs as in decorated pottery. It differs from broadly similar pottery dating to the beginning of Middle Neolithic in other regions of Greece such as Thessaly, Central Greece, and the Ionian Islands of Lefkada and Corfu).[83]

Ready-made objects (wooden sticks or reeds, bones/bone tools, and smooth pebbles) were used rather than specifically designed tools, probably because the tool was rarely neatly impressed into the damp clay, which suggests that reproducing the shape of the tool was not the aim of the potter. Often the tool was inserted at an angle and dragged through the surface to create both depressed and raised areas. Due to this fact and the lack of any specialized tool, it is difficult to neatly categorize or even describe every lumpy, mushy, and irregular surface treatment, but there are a few more easily identifiable reoccurring types (Fig. 16). The impressions of nails, finger pinches, finger-tips (Fig. 16a) or finger pinches in rows were also used, although infrequently, in combination with incision (Fig. 16b). Variations of incision and impression include deep, roughly parallel lines, scratched as if performed with a comb; deep, broad, randomly incised lines; "stab-and-drag"; and impressions from small circular and oval-shaped tools (Fig. 16c).

The types of finger manipulation include single and double (thumb and forefinger) nail impressions, fingertip impressions, and finger-pinches in which small oval-shaped pieces of clay are drawn upwards into small, triangular-shaped raised areas, leaving shallow impressions from the thumb and forefinger, sometimes with the impression of the fingernail (Fig. 16a). Nail impressions without finger-pinches or depressions were uncommon and tended to be more carefully made, regardless of whether only one nail or the thumb and forefinger were impressed. Longer, curved nail impressions were made by carefully rotating one's hand. Impressions of only fingertips were rare. Finger-pinches were made randomly over the vessel surface, arranged in neat rows or stacks, even flattened by burnishing to create an added-plastic effect, or used in conjunction with incision and impression (Fig. 16b).

Impressed, incised, and finger-pinched decoration was used primarily on the belly of medium- and large-sized hole-mouth and simple collared globular jars, but there are a few examples of S-profiled and concave-collared jars (Fig. 17a) treated this way. Large and medium straight-sided bowls were more commonly embellished than deep and hemispherical bowls (Fig. 17b). Bases of this type were nearly exclusively disc bases, with concave undersides (Fig. 18). Vertically and horizontally-perforated circular and oval-shaped lugs were also used on these vessels (Fig. 19a).

The use of a reserved band just below the rim and above the base makes categorizing and assigning rim and base sherds challenging, as shapes are shared between the impresso and monochrome repertoire. Added plastic decoration in the form of round, protruding pellets and plastic strips was also occasionally used on both types. Very rarely tool-made impression and incision was used in conjunction with Polychrome-painted decoration (Fig. 19b). A few sherds with impressed and incised motifs differ from the rest of the examples where the impression is delineated by incision (Fig. 19c). Incision was also used post-firing on red-painted pottery

83 Benvenuti and Metallinou 2002. In Thessaly, this type of decoration was associated with the 'Magoulitsa sub-phase' at the end of the Early Neolithic 3/Vor-Sesklo, based on the finds from Otzaki Magoula (Milojčić and Zumbusch 1971).

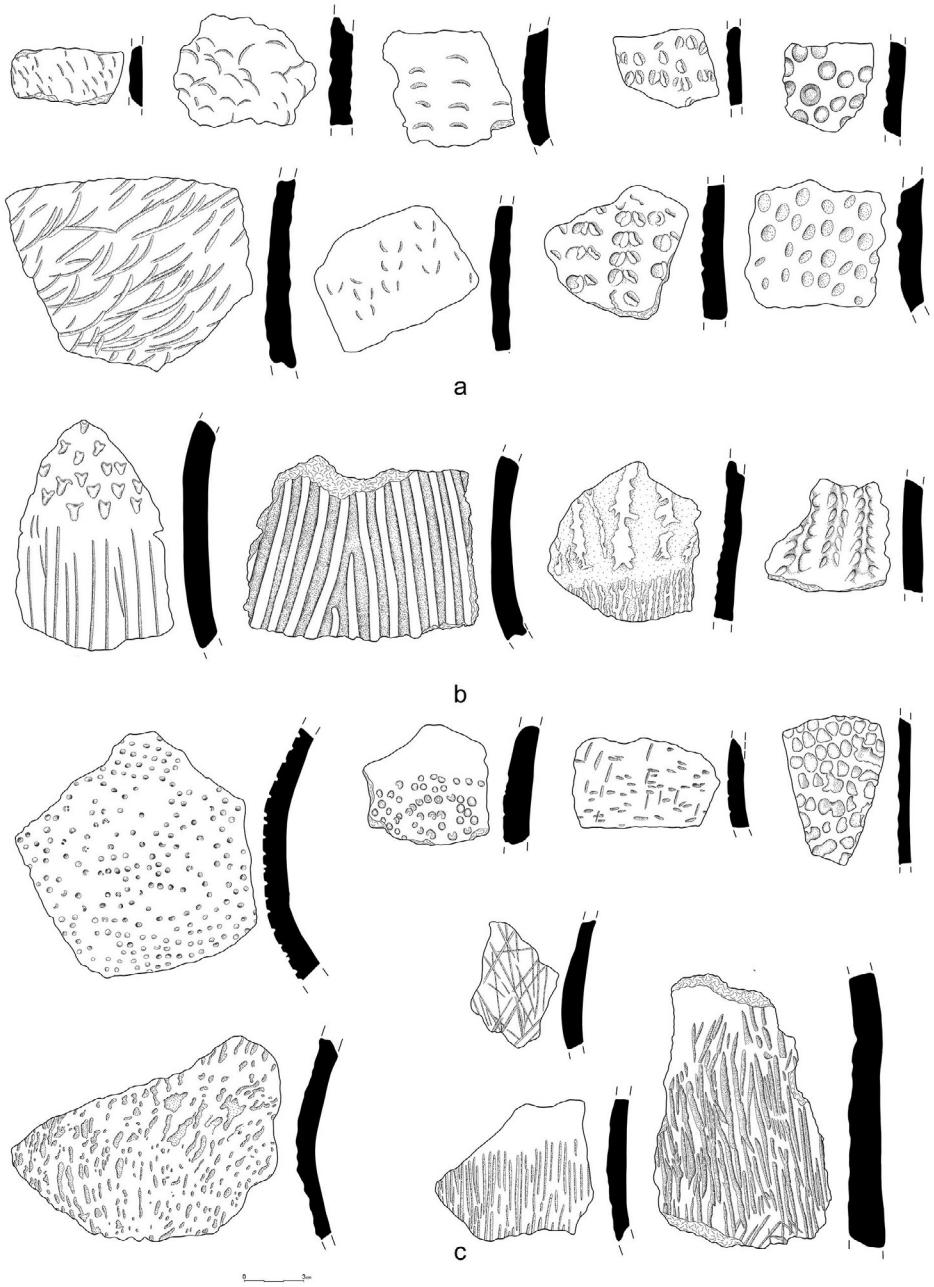

Fig. 16. Added plastic decoration: (a) Multiple circular added plastics. (b) Single round and ovular added plastic pellets. (c) Plastic decoration with along with impressions, incision, and finger-pinches.

to create a polychrome effect (Fig. 19d). Post-firing incision was also used on monochrome pottery (Fig. 19e).

In the literature, impressed, incised, and finger-pinched decoration, regardless of the fabric, vessel shape, method of surface manipulation (finger or tool), or stylistic differences, has increasingly been combined into the broad and ill-defined category of "impresso," as evidence of connectivity and mobility between vast geographic areas (e.g. Adriatic, Balkans, Anatolia, North Africa, the Near East, and the Black Sea).[84] These ceramic assemblages are not exactly or

84 E.g. Manen *et al.* 2018; Reingruber 2017; Çilingiroğlu 2016; 2010; Gasevych 2011; 2009; Güldoğan 2010; 2008.

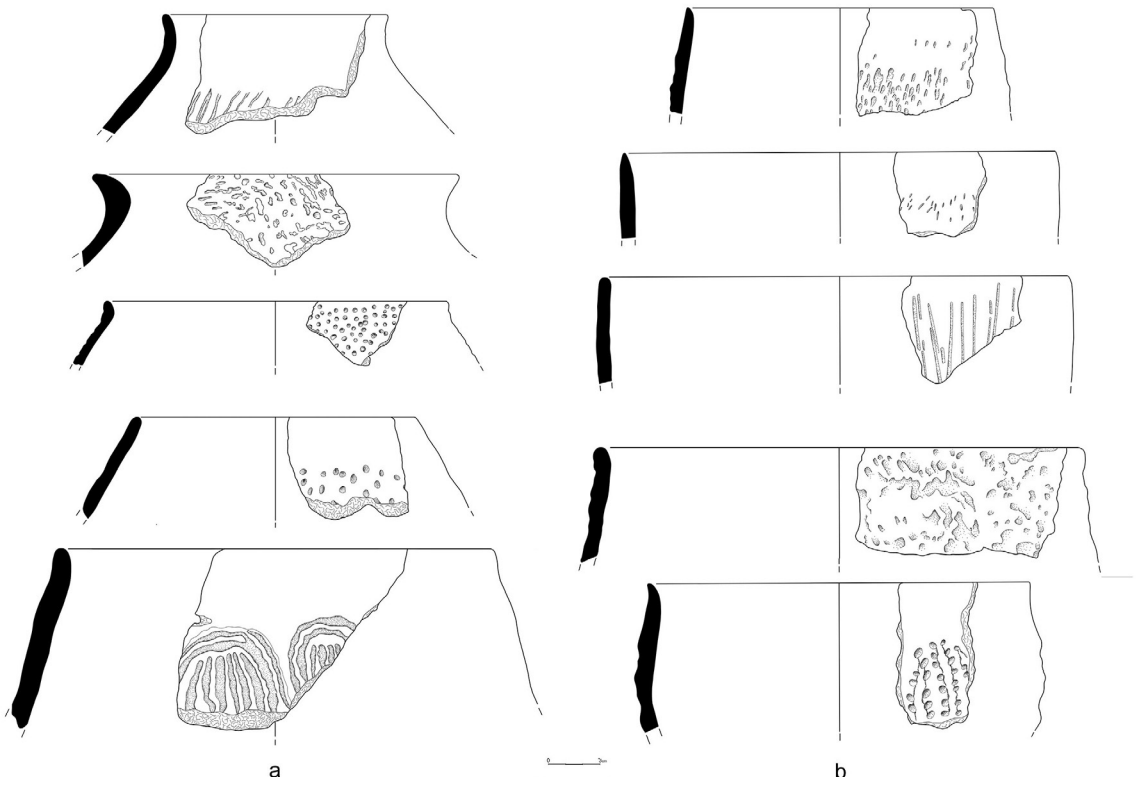

Fig. 17. Impressed, incised, and finger-pinched jar types: (a) rims and (b) bowls.

entirely the same, other than having a minority of sherds decorated with incision, impression, or finger-pinches.[85]

PAINTED DECORATION

Painted decoration consisted of three types (in order of increasing frequency): White-painted on a red slip (White-on-red), Red-painted on a white-slipped or reddish-tan surface (Red-on-white), and Polychrome (Red-and-white-on-tan). Polychrome seems to have been the earliest type of painted pottery used, followed shortly thereafter by Red-on-white in phase II. White-on-red was the least common painted style, and its use began later than Polychrome and Red-painted, but its precise beginning at Mavropigi-Fillotsairi cannot be pinpointed.[86] Although White-on-red and Red-painted decoration broadly resemble examples at other partly contemporary sites (e.g. Nea Nikomedia, Axos A, Giannitsa B, Argissa, Otzaki),[87] the parallels are not exact. Mavropigi-Fillotsairi has its own distinctive style, possibly due to geographical, chronological, and technological/cultural differences.

Quite distinctive from the painted repertoires of other sites is the fact that Polychrome

85 The term "impresso" was initially used to describe pottery decorated with incisions made with pointed tools, impressions with fingernails, triangular-shaped tools, and impressions of cockle shells (Cardium edulis/ Cerastoderma edule) in the Early Neolithic of the Adriatic. See Bonga (2019, 160–1) for a review of the term's use in Greece.

86 White-on-red painted pottery at Giannitsa B and Nea Nikomedia c. 6100 BC (Maniatis 2014, 207, chart 2; Chrysostomou 1997, 144, fig. 4).

87 White-on-red seems rare at the more southern sites in Central Macedonia (Urem-Kotsou *et al.* 2017, 328).

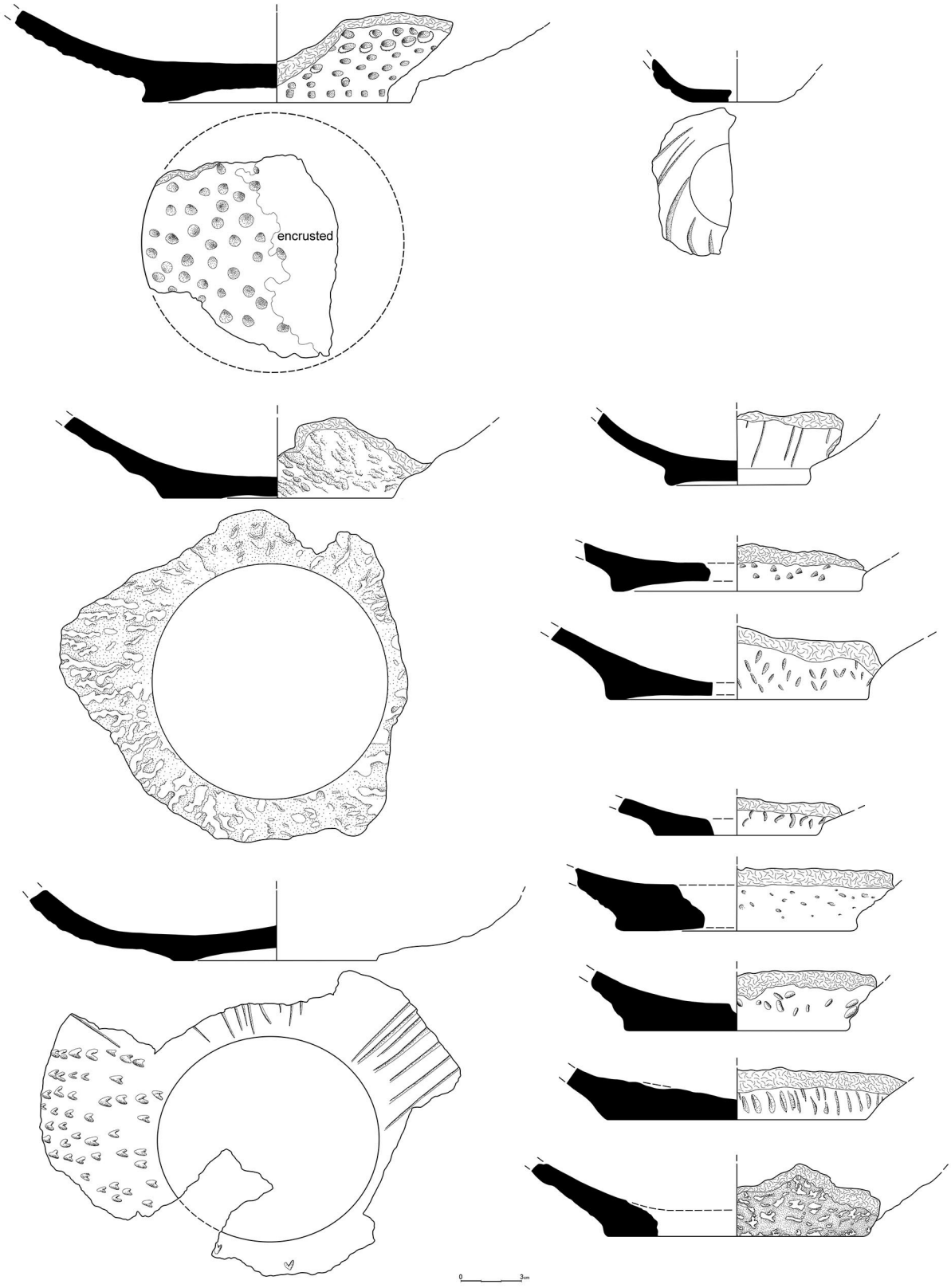

Fig. 18. Impressed, incised, and finger-pinched bases.

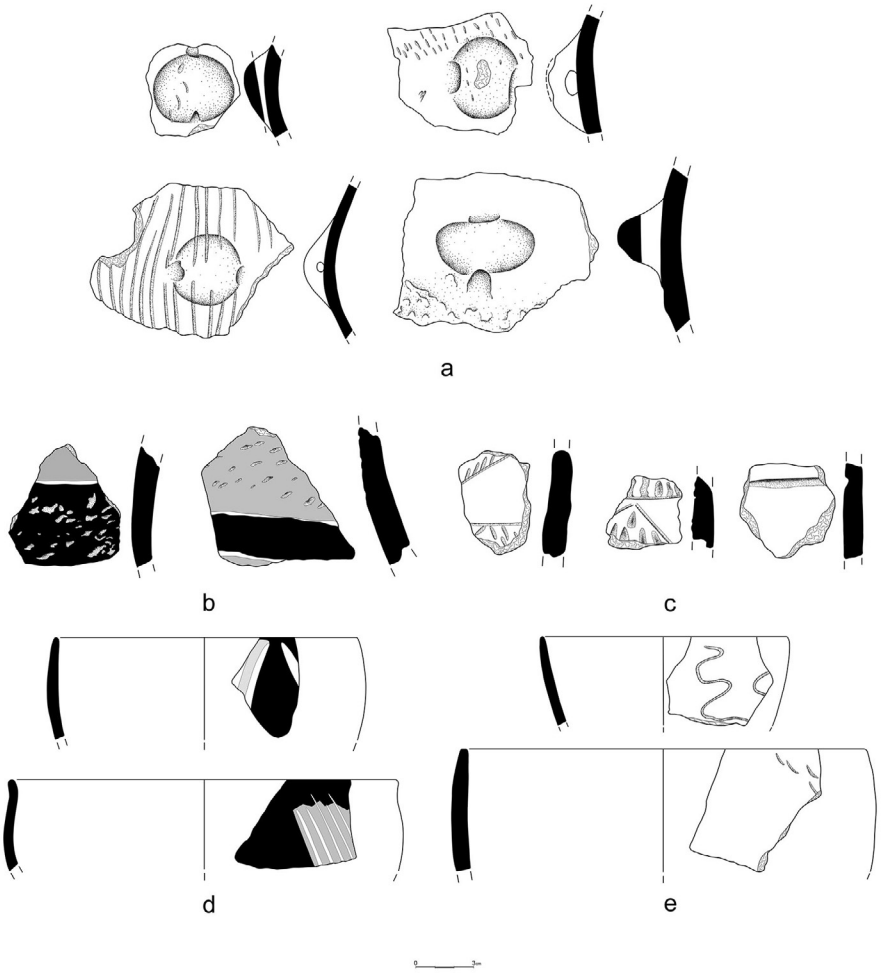

Fig. 19. (a) Impressed, incised, and finger-pinched string-hole lugs. (b) Polychrome-painted sherds with incision and impression. (c) Sherds with incised areas bounded by a border line. (d) Post-firing incision on Red-on-white vessels. (e) Post-firing incision on monochrome vessels.

pottery characterizes the bulk of the painted pottery, yet only one sherd is published from Nea Nikomedia,[88] one sherd is illustrated from neighboring Pontokomi-Souloukia,[89] and Polychrome sherds were mentioned (but not illustrated) from Varemenoi-Goules.[90] Surely this picture will change when the material from sites in the immediate vicinity of Mavropigi-Fillotsairi is fully examined.

POLYCHROME-PAINTED POTTERY

Polychrome (trichrome) is the most common type of painted decoration and is characteristic on pottery from Mavropigi-Fillotsairi. It is defined by the use of thin white-painted lines or dots to create an outlining border around a broader red-painted motif in order to clearly separate it from the tan-colored background (Fig. 6d.1-2). The use of small dots or two rows of dots

88 Youni 1996, 87, 132–3, fig. 5.34, no. 12.
89 Karamitrou-Mentessidi *et al.* 2014, fig. 5, second sherd from right, bottom row.
90 Saridaki 2019; Chondrogianni-Metoki 2004, 56.

appears in later contexts and may have been inspired by the use of red dot-edged bands. Sometimes the thin white lines do not closely follow the outline of the broadly-painted red motif, and in these instances, the white paint was applied prior to firing and was burnished; on other examples, the white-paint does not seem burnished, is slightly raised, and sometimes ill-preserved, which suggests post-firing application.

Polychrome motifs were arranged in oblique and vertical zones around the vessel, usually beginning from a thin red rim-band of some sort (e.g., wavy, straight). No vessels have an interior rim band and their interiors are either plain red or tan slipped. The ratio of foreground (white-outlined red motifs) to background (tan) in this style is approximately even.

Polychrome was primarily used on bowls (Figs 20, 21b) but in a few instances on hole-mouth and conical collared jars (Fig. 21a). The semi-deep hemispherical bowl with tapered, slightly everted rim, and small flattish oval-shaped vertically pierced lugs is the most characteristic shape (Figs 6d. 1 F, 20 top and second row, right). Other Polychrome-painted shapes were primarily S-profiled bowls, straight-sided and hemispherical bowls. Polychrome vessels typically have flat and concave disc bases (Fig. 21d).

The motifs consist of a dynamic mixture of curvilinear (arcs, curved bands, circles, wavy bands) and linear (lines, zigzags, triangle-edged bands, "checkerboard" squares joined at their apexes) elements (Figs 20-1). One side of a motif may be curved while the other is stepped or uses triangular elements. Groups of closely spaced parallel and thin red lines or thicker bands framed by thin white lines are another type of reoccurring motif. A few elements may be described as floral, such as the four and six-sided shapes from phase II on small, closed vessels (Fig. 21c, right). A minority of the elements on Polychrome vessels were also used for the other two painted styles. Groups of parallel lines, groups of lines bent at angles, and the use of parallel lines springing from a ground base line were also used for Red-painted pottery, whereas the use of small white dots is preferred for White-on-red vessels.

RED-PAINTED POTTERY

Red-painted was the second most frequent type of painted decoration (Figs 22-3). Overall, the motifs are characterized by an openness of space. The reliance on groups of parallel lines to create motifs differs from the use of broader shapes for motifs in Polychrome-painted pottery, although such are used for Red-painted pottery. The interior was usually self-slipped, with very few red-slipped examples. The use of small, flat, oval-shaped plastics is documented, as are oval and circular string-hole vertically-pierced lugs (Fig. 23d).

The Red-painted pottery consists of two variations: Red-on-white and Red-painted without the use of a white slip. Most frequently, the red was painted on a white-slipped background creating true Red-on-white, but at other times, the decoration was simply Red-painted and was applied directly to the beige, reddish-tan, or yellow-beige vessel surface. In this latter type, the decoration appears two-tone with less contrast between the foreground and background than in Red-on-white (Fig. 6c).

The preserved shapes and decorative elements between the two types seem more or less the same, although the Red-painted without white slip specimens tend to be more neatly painted. Often in the Red-on-white examples, the edges of the lines and bands are not always painted with clean crisp edges but slightly undulate from the brushstrokes: this may have been an aesthetic choice. The reason for the coexistence of these varieties could be due to cultural choice, slight differences in chronology imperceptible in the stratigraphy, or the less common Red-painted without a white slip may even have been imports; future analysis will clarify these

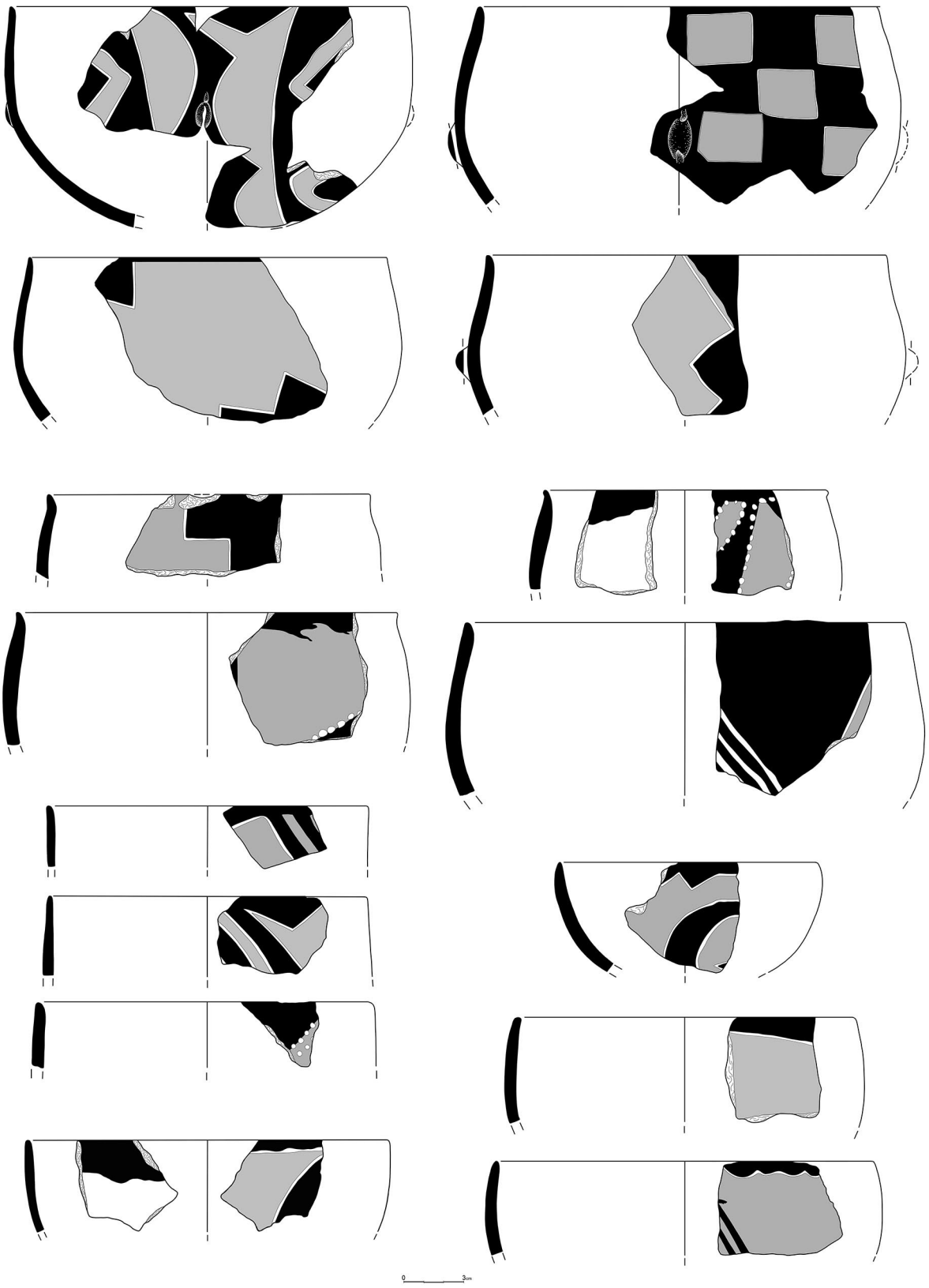

Fig. 20. Polychrome-painted bowl types and motifs.

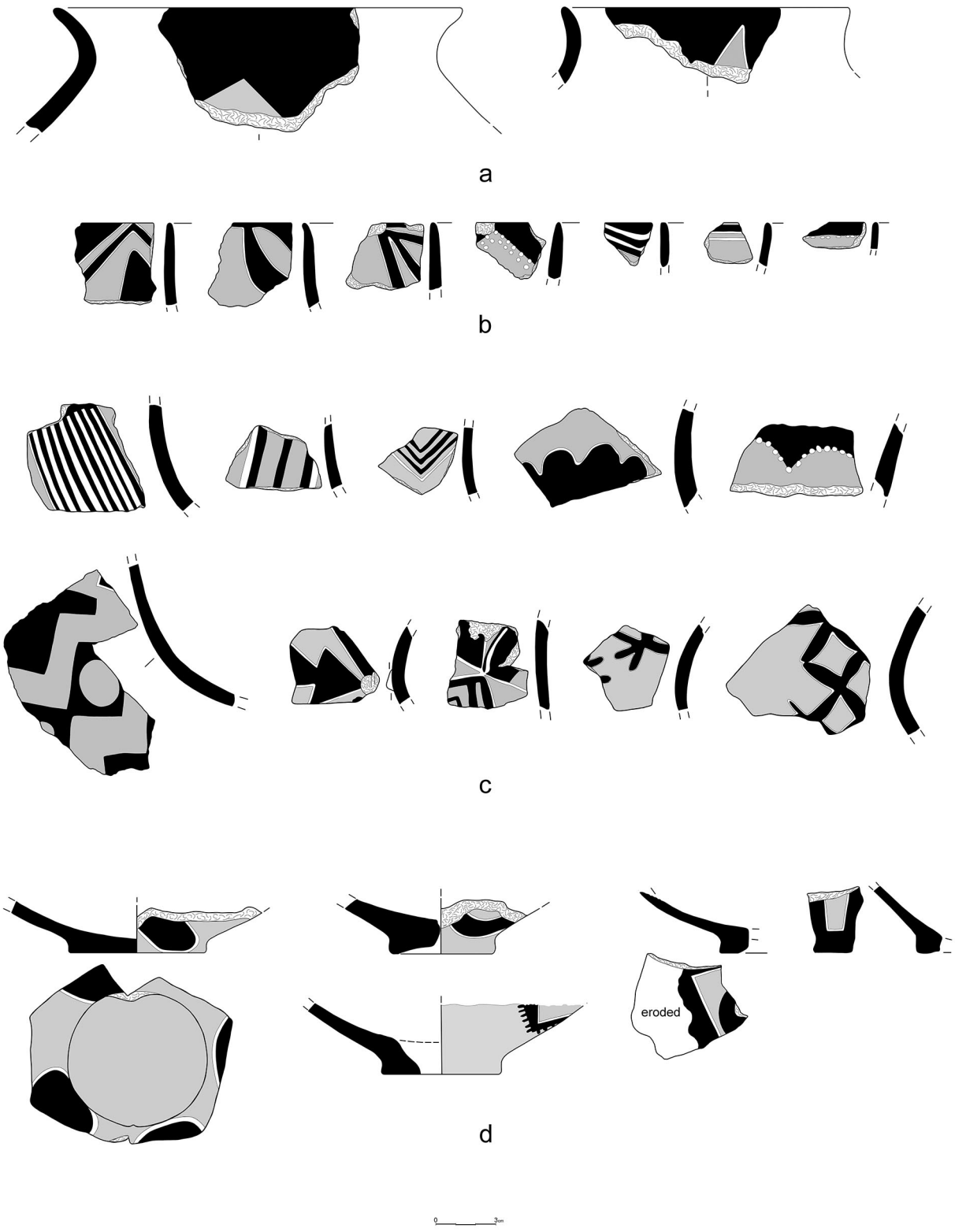

Fig. 21. (a) Polychrome jar sherds. (b) bowl rims. (c) linear and curvilinear motifs. (d) base types.

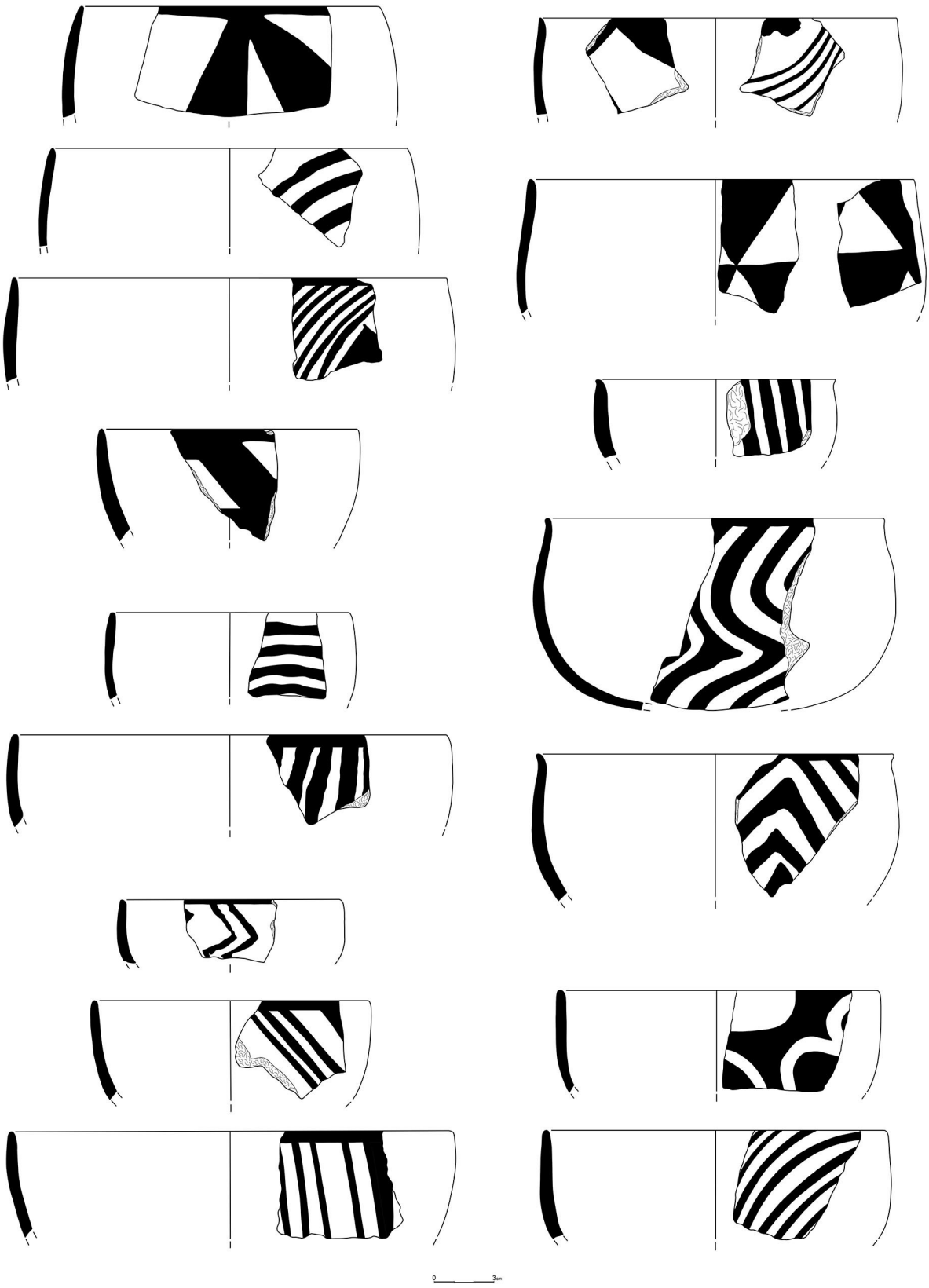

Fig. 22. Red-painted bowl types and motifs.

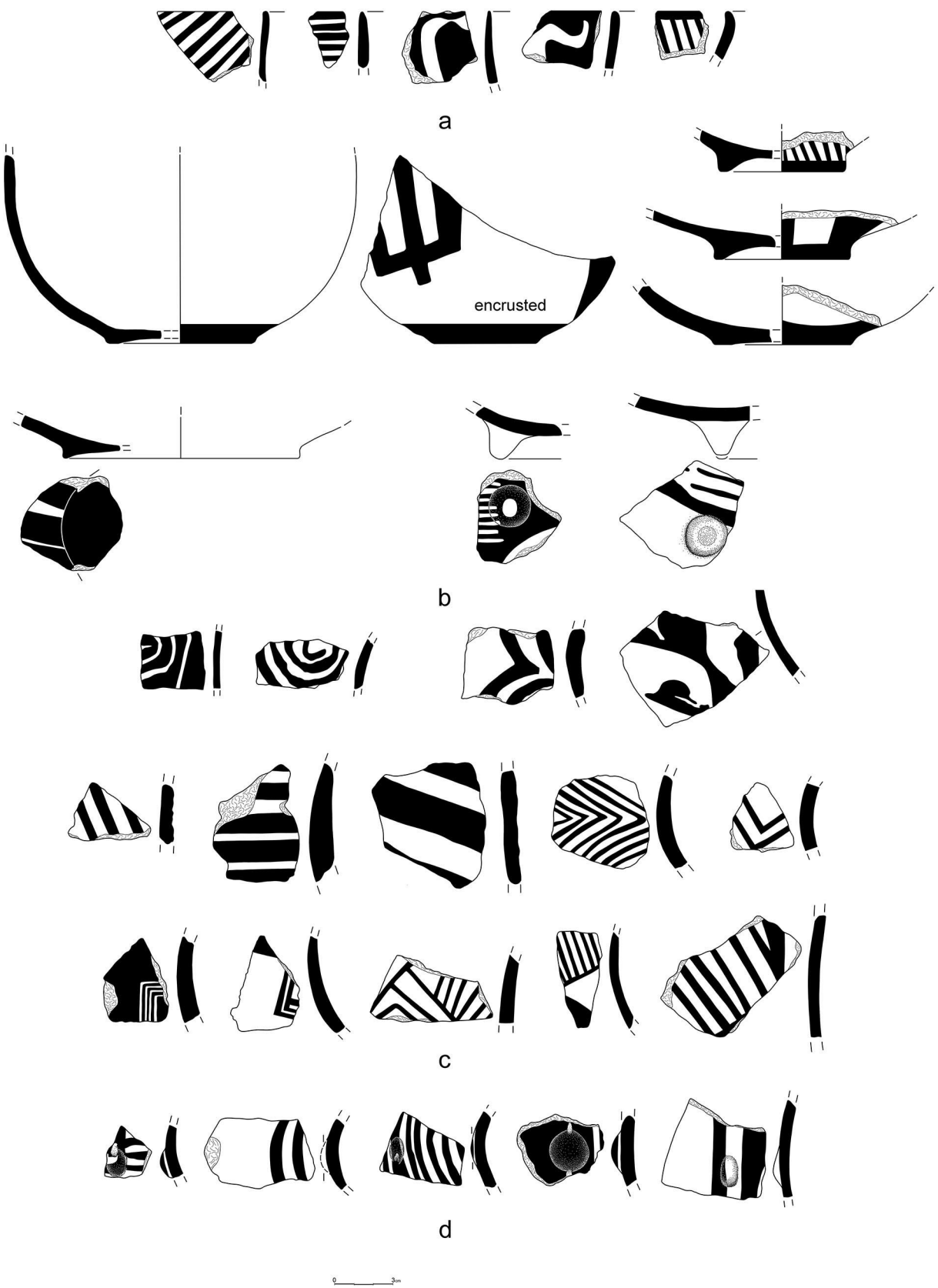

Fig. 23. (a) Red-painted bowl and jar rims. (b) linear and curvilinear motifs. (c) bases and short legs from vessels. (d) perforated string-hole lugs and added plastic pellet decoration.

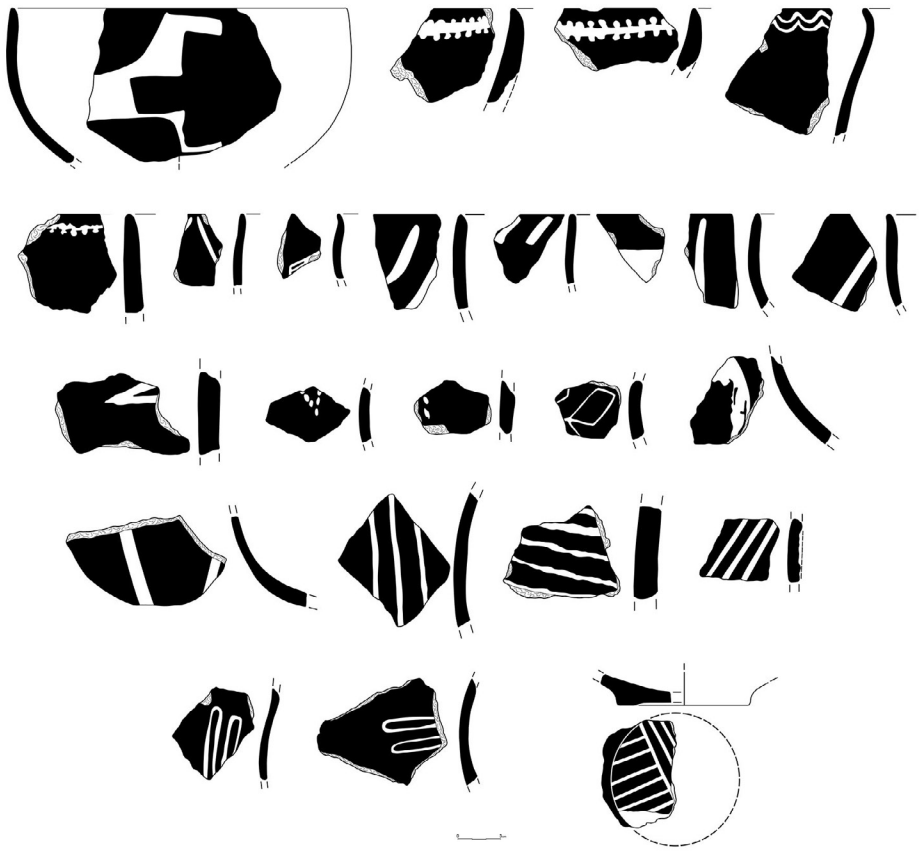

Fig. 24. White-on-red painted pottery shapes and motifs.

possibilities.[91] Due to the similarities between these two varieties, they are discussed here together.

Red-painted decoration was exclusively used for hemispherical, S-profiled, and deep hemispherical bowls with inward-leaning rims (Figs 22, 23a); concave disc bases and short feet were used (Fig. 23b). It does not appear to have been used on jars. Linear and curvilinear elements are not used together as in Polychrome but are kept separate (Figs 22, 23c). The linear elements include groups of parallel thick or thin lines arranged vertically, horizontally, or diagonally from the rim or from a thicker band. Stacked and parallel zigzags were also used. Broader geometric shapes such as triangles are also used as elements, either joined at their apexes, as their own motif, or along with groups of thinner, parallel lines. A few sherds contain groups of parallel lines making angles, some with new lines stemming from one of the lines (often perpendicularly) but it is unclear what the full motifs would have been.[92]

Irregular curvilinear motifs include spirals and groups of curving lines, sometimes forming

91 At Nea Nikomedeia, red-painted on cream-beige slip was common and the application directly on the burnished light-colored vessel surface rare (Yiouni 1996, 86). The converse was true at Revenia-Korinos, Ritini, Paliambela-Kolindros, and Varemenoi: red-paint was almost always applied on the burnished light-colored vessel surface and rarely on a white slip (Saridaki *et al.* 2019, 132; Urem-Kotsou *et al.* 2017, 328 and pl. VII, 341; Urem-Kotsou *et al.* 2015).

92 Although some of the design elements and motifs can be found in Washburn's (1984) classification into eight patterns and twenty-nine elements, the Red-on-cream at Nea Nikomedeia features broader-areas of decoration, few of which are found at Mavropigi-Fillotsairi (e.g. Classes A, H, G), where groups of parallels lines (linear or curving) seem to have been preferred; these were uncommon at Nea Nikomedia.

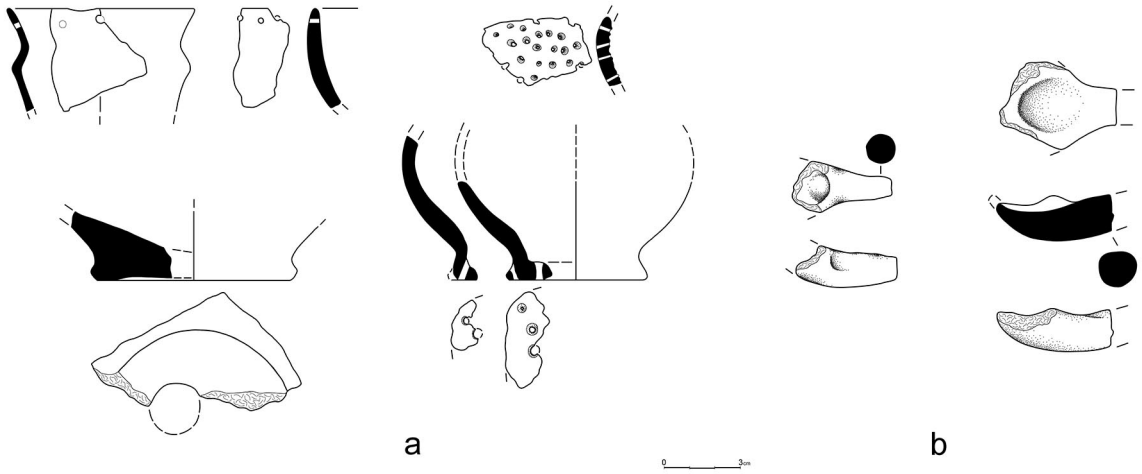

Fig. 25. (a) Sherds with multiple perforations. (b) Small spoons.

a part of a larger curvilinear wave-like element. A minority of the Red-on-white appear inverted as the space between the red areas is so closely reserved: a sort of optical illusion occurs.

WHITE-ON-RED PAINTED POTTERY

White-on-red painted pottery was extremely rare at Mavropigi-Fillotsairi and found in a highly fragmentary state, making it difficult to comprehend the motifs (Figs 24, Fig. 6e).[93] In some instances, the white was thickly applied and after burnishing. It was primarily used for thin lines or dots (as in Polychrome painted pottery). An exception is a hemispherical bowl that had a broad area of white applied to create a composite linear-geometric stepped motif (Fig. 24, top left); one side of the motif consists of a sweeping curved side while the other is a step-motif (similar to Polychrome painted examples). This bowl, and in general the White-on-red has a negative, "cut-out" quality.

The rest of the preserved elements consist of: slightly curved lines from just under the rim (possibly a garland-like motif), groups of parallel lines, groups of parallel lines stemming from a base line, short oblique ticks, small dots making rectilinear shapes, elongated double loops (possibly a floral-shape), a thinly-painted parallelogram-like shape, stacked wavy lines under the rim, and dot-edged bands below the rim.

Shapes include S-profiled, hemispherical, and straight-sided bowls and one instance of a hole-mouth jar. In contrast to the other painted pottery, the bowl interiors were typically red-slipped. One disc base featured groups of parallel lines; this was the only instance of a painted disc base in any of the painted categories (Fig. 24, bottom-right).

USE OF CERAMIC VESSELS

At the most basic level, solid ceramic vessels are non-porous containers that hold different

93 White-on-red at all Early Neolithic Balkan sites constitutes a fraction of the assemblage, from a single sherd to a few percentages (Stojanovski 2017, 2)

materials of various forms: solids, liquids, foodstuffs, and other non-edible items. That the Early Neolithic ceramics from Mavropigi-Fillotsairi were designed and used with this generalistic function in mind is seen as the ceramic assemblage is dominated by small and medium-sized hemispherical bowls and medium-sized jars. They were most likely used for temporary and small-scale storage and the presentation and consumption of edible and inedible products at the household level.

The limited capacities of jars (c. less than 5 liters) indicate that they were likely not used for bulk or long-term storage, [94] but rather for more immediate storing, possibly only for certain items that were edible (e.g. medicinal plants, spices, resin, honey, pigments, salt).[95] Their open shapes would have made using the vessels for the transportation of goods beyond the settlement impractical (although it is not impossible that empty vessels circulated). Irregularities in the vessel walls, rims, and diameter did not affect the function of these vessels as containers.

In addition to holding solid objects and foodstuffs, jar shapes in particular may have been used to contain liquids because coarser and more porous fabrics facilitate the cooling of liquid contents;[96] alternatively, their interior surfaces may have been treated post-firing to make them less porous (e.g. tree resins, beeswax)[97] but there is no macroscopically visible evidence for such treatments. Impressed, incised, and finger-pinched jars may have facilitated a better grip and easier handling of the vessels when full of liquids.[98] Bowls of all types could have been used for serving and consuming liquids or dry foods. Vessels with string-hole lugs may have been hung up to free up floor space or the lugs may have facilitated the attachment of a lid.[99]

Consistent with other Early Neolithic assemblages throughout Greece (e.g. Franchthi Cave, Achilleion, Sesklo, Nea Nikomedia, Paliambela-Kolindros, Revenia)[100] and the Balkans (proto-Starčevo),[101] the vessels do not seem to have been used for cooking food over a fire. This is made manifest by the lack of use-wear evidence, of the sort predicted by ethnographic literature[102] (e.g. attrition, abrasion, scraping, pitting, and sooting) and as shown to exist by a number of

94 This observation is based on parallels with sites in Central Macedonia (Urem-Kotsou *et al.* 2017, 326, 329) and with Vitelli's (1989, 26–7; 1999, 188) following Whittle's (1985, 59) estimate of how many grams of seed per acre were necessary for one household. It was concluded that the small capacity (less than 4 liters) and low numbers of Early Neolithic vessels were not enough to accommodate grain storage for sowing, eating, and maintaining a surplus. The use of storage vessels in northern Greece is more characteristic of the Middle Neolithic but seems to have begun during the late Early-Neolithic/early Middle Neolithic transition (e.g. in Western Macedonia at Varemenoi-Goules and Roditis-Paliambela, and in Central Macedonia at Sossandra, Paliambela-Kolindros, Revenia, Mikri Volvi, and Revenia-Korinos (Urem-Kotsou 2017, 76–8; Georgiadou 2016; 2013, 94).

95 Aside from Varemenoi-Goules, where plant-based lipids were detected in residues (Whelton *et al.* 2018), traces of these other perishable consumables have not yet chemically been detected. They are known, however, from the Late Neolithic in Greece. Beeswax was found at Dikili Tash (Decavallas 2007) and bitumen resin at both Stavroupoli and Makryialos (Urem-Kotsou *et al.* 2004; Urem-Kotsou *et al.* 2002a; 2002b). Salt is increasingly being realized as a valued commodity, for its value to animals, humans, and food preservation but is not yet not documented in Greece (Weller 2015; Harding and Kavruk 2013; Tasić 2012; Di Fraia 2011).

96 Low-fired calcareous-tempered fabrics may have also been used to produce watertight vessels (Vitelli 1999 192–3; Budak 1991).

97 Rice 1987, 163–4. Post-firing treatments are typically added to seal surfaces, decrease permeability, or increase vessel strength.

98 Thissen 2017, 86; Vuković 2013, 668–71; Vuković and Svilar 2013.

99 "String-hole pots may have been categorized emically along size classes and lug types, where discrete but essential variations in terms of size, location, and orientation (horizontal or vertical) suggest that they were geared toward different but presumably related uses" (Thissen 2017, 87).

100 Urem-Kotsou *et al.* 2017, 326, 329; Yiouni 2004, 13; Vitelli 1993a, 214; 1989; Bjork 1995, 97–102; Wijnen 1993, n. 40.

101 Vuković 2013, 667.

102 Skibo 2015, 1992.

studies;[103] however, this cannot be utterly ruled out, as the nature and preservation of such traces is difficult to establish with archaeological ceramics (the more so, if indirect heating with hot ash or coals was used).[104] Furthermore, technological arguments (e.g. quartz inclusions, incomplete/low-fired pottery, and surface treatments) put forward against the use of vessels over a fire consider only the optimizing factors rather than real material constraints: such would imply that only a vessel designed as a cooking pot could be used as a cooking pot.[105] As argued above, the choice of clays and inclusions does indeed look to be mainly related to the manufacture of the pots, not their intended use.[106] Boiling or stewing could have been accommodated by utensils in other materials, such as baskets covered with plaster, clay, mud, dung, or pitch, or skin bags and bark trays. Roasting or parching could have been done directly in hot ashes or coals.[107]

Similarly, processing of foodstuffs (with or without indirect heat) that leave no scratches and scrapes – such as soaking, fermenting, or scalding – cannot be ruled out, but these processes have left no characteristic use-wear traces, such as pitting.[108] Abrasive use-wear traces from Mavropigi-Fillotsairi were not found in the ceramics studied thus far, but such traces of abrasion were documented at Giannitsa B,[109] Kovačevo in Bulgaria, and Blagotin in Serbia.[110] On the inner walls and lower portions of some vessels there is a whitish-beige crust, similar to the ones noted at other Early Neolithic sites, such as Paliambela-Kolindros,[111] Revenia-Korinos, and Ritini in Greece.[112] Future residue analysis on these examples from Greece will shed light on the nature of the former contents.[113]

The few specialized ceramics possibly related to food processing include at least two vessels from phase III with multiple pre-fired pierced holes in their base or walls, which may have been

103 Vuković 2006; 2010b; 2013; Tsirtsoni and Yiouni 2002, 84–5; 2002, 103–10.

104 Skibo 2015; Vieugué 2014.

105 Tsirtsoni 2009, 45–6. Although the rough surfaces of impressed, incised, and finger-pinched pottery do not contribute to thermal properties (Young and Stone 1990), these vessels still could have been used for heating and cooking liquids and stews.

106 This practice continued into the Late Neolithic period; at Dikili Tash the raw material choices were related to the manufacturing of the pots, not their intended function, and no specific cooking fabric was identified. Tsirtsoni and Yiouni 2000, 84–5; 2002, 106.

107 Perlès 2001, 197, 216.

108 Pitting due to fermenting was noted at Blagotin in Serbia (Vuković 2006; 2009; 2010a; 2011; 2017b).

109 Although systematic studies of use-wear on Early Neolithic pottery from Greece are entirely lacking, stirring via rotary motion was documented at Giannitsa B (Chrysostomou 2003, 495, fig. 3). Although Chrysostomou depicts a bow drill, Perlès (2001, 224, n. 49) does not think it was in use during this period. Other means of rotary motion include the friction drill or pump fire drill, which uses a flywheel to generate friction. Scraping abrasion from food preparation in a deep bowl was noted at Nea Nikomedeia (Yiouni 2004, 16, pl. I). Abraded rims were noted at Blagotin in Serbia (Vuković 2011).

110 Bowls from Kovačevo showed use-wear trace of grinding or mashing (Vieugué 2014, 626, fig. 5).

111 These crusts are alternatively referred to as slips, coating, treatments, and crusts (Papadakou 2011, 55–6, figs. 9, 77–82 ; Papadakou *et al.* 2015, 16, fig. 10; Urem-Kotsou *et al.* 2017, 327, fig. 3b). It is possible that these crusts were produced post-depositional on vessels that once contained certain items, rather than being the preserved remnants, as seen at Kovačevo in Bulgaria, where residue analysis determined a beige crust to be bone powder (Vieugué *et al.* 2015; 2009).

112 While Vieugué *et al.* (2015, 506) suggest that the beige crusts from Giannitsa, Nea Nikomedeia, Achilleion, Melissochori, Chalki in Greece and Anzabegovo, Govrlevo, Rakitovo and Karanovo in the Balkans may also be bone powder, but none of these crusts have been chemically analyzed. Preliminary results of chemical analysis of white crusts from Paliambela-Kolindros, and Revenia-Korinos indicate that the crusts could have derived from bone (Stratis 2015, cited in Urem-Kotsou *et al.* 2017) but the final results are not yet published.

113 Residue analysis of Early Neolithic pottery in Greece is a recent and ongoing avenue of inquiry with only three sherds from Achilleion in Thessaly (Björk 1995, 83–7, 123–4) and the three sites of Apsalos, Paliambela-Kolindros, Ritini in Central Macedonia (Whelton *et al.* 2018; Evershed *et al.* 2008) having been tested.

used as strainers or fumigators (Fig. 25a). Small spoons with shallow cavities and short handles would have been impractical for stirring or eating but may have been used for measuring (Fig. 25b).[114]

Most of the small- and medium-sized monochrome bowls may have been used for the daily serving and consumption of foodstuffs, with painted versions reserved for certain events of social significance. The consumption patterns of vessel types across the site will be fully presented in the final publication, when open areas are integrated into this analysis. At present, a notable concentration of decorated vessels was found in pit 106. Given the fact that only a few houses were probably in contemporaneous use, the consumers of the pottery probably consisted of a nuclear or extended family rather than a larger social group, except, perhaps, on special occasions.[115]

The contexts and fragmentary nature of the sherds and their deposition at Mavropigi-Fillotsairi demonstrates that the inhabitants utilized the durable ceramics beyond their original function as containers. The fact that the broken vessels were mended by boring holes though the pieces (Fig. 5a) and tying them together with a piece of string or leather indicates that ceramic vessels were considered important enough to be repaired, as does their removal from houses upon their abandonment.

Although the function of pierced or un-pierced sherd discs (Fig. 5b) remains unknown, despite their ubiquity at early Neolithic sites, some of the purported possible uses include counters, tokens, game pieces, lids, loom weights, spindle whorls, or used to steady the top or bottom of a rotating drill shaft, or weighted as a spindle whorl to a bow-drill.[116] When vessels could no longer be mended, the sherds were reused in other ways, including as fill for house foundations.

CONCLUDING DISCUSSION

The ceramic data from Mavropigi-Fillotsairi greatly enhances and expands the record of Early Neolithic ceramics in Greece, even though only a portion of the large volume (several tons)[117] of ceramic material from Mavropigi-Fillotsairi has been studied and presented (c. over 60,000 sherds) here. The number of jars, bowls, and cups in all sizes and made with a range of fabric types, inclusions, and fired under different conditions speaks of a well-established ceramic potting tradition and technology.[118] The simultaneous use of three styles of painted pottery, a multitude of impressed, incised, and finger-pinched decoration alongside undecorated pottery underscores this fact and raises a variety of social questions central to the study of Neolithic ceramics in Greece (e.g. status and gender of the potters, the use of pottery, meaning of decorated pottery, movement of people, technological transfer, and exchange).[119]

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114 Elsewhere, clay spoons and ladles have been proposed for ritual offerings (Gimbutas 1974, 210–1; Perlès 2001, 269) as well as "more mundane uses such as their use during social gatherings or collective meals" (Chourmouziades 1982, 50 ; Papaeuthumiou-Papanthimou 1998, 268; Perlès 2001, 270), heating or drying small amounts of a substance (Immerwahr 1971, 13), or for collecting flour from a millstone (Treuil 1983, 243).

115 Halstead 2015, 37.

116 See Perlès 2001, 205–51 for a discussion of sherd discs. Sherd discs may have also to scrape out irregularities during vessel formation (Thissen 2017, 83).

117 Large quantities of ceramics are common at Early Neolithic sites in the Balkans (Thissen 2017, 85–6), including Greece (Yiouni 2004, 10, n. 38-9; 1996, 192).

118 Thissen 2017.

119 The concurrent use of these different categories suggests both the significance of the visual appearance of the vessels as well as the importance of carefully perpetuating the decorative tradition within the community

From the variations in shape, fabrics, and decoration it could be deduced that multiple people participated in the creation of pottery, [120] even if they were not involved in each and every stage of manufacture.[121] Engaging multiple members of the community in small-scale ceramic production for the household level would reduce the time and effort required for making vessels and would provide social opportunities and help cement cultural relationships. Gathering and processing clay, grinding pigments, forming, decorating, and firing pots may have been collaborative creative acts that involved several members of the community and were not limited to certain individuals.[122] It is also possible that whoever built a pot did not necessarily decorate it. Several hands are indicated by different forming and decorating techniques, but without obvious differences affecting the vessel shapes.[123] Amongst the decorated pottery, no two pots bear identical shape and decoration; this fact seems to be true throughout the Neolithic period in Greece whether decorated with paint,[124] burnishing,[125] or added plastic decoration,[126] and seems to indicate cultural choice and a lack of concern about standardization.

Aspects of the assemblage, such as the use of chaff temper, certain morphological features (e.g. the use of three small feet, string-hole lugs), and decorative types (e.g. White-on-red, impressed, incised, and finger-pinched) are reminiscent of Early Neolithic pottery that was traditionally thought to begin later, c. 6100 BC, in the central Balkans (Starčevo), the Pannonian basin (Starčevo-Criş-Körös),[127] and slightly later still in the Eastern Adriatic (e.g., Impresso/Cardium culture).[128] At Mavropigi-Fillotsairi, these "diagnostic" types are found simultaneously, and not only in a few contexts possibly dating as early c. 6400/6300 BC,[129] but also in contexts dating more securely to c. 6300 and 6200 calBC, just slightly earlier than previously thought for painted and "impresso" pottery in southeastern Europe and Greece (Fig. 3a).[130]

The technological achievement of Polychrome-painted pottery is noteworthy as it is otherwise virtually unknown in Greece until the Late Neolithic period, c. 5500 or 5400 BC.[131]

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and between generations, while remaining flexible enough to adopt and incorporate features from local communities and influences from the surrounding environments (Thissen 2017, 85–7).

120 Tsirtsoni 2009, 49.

121 Discrepancies in wall thickness, symmetry, and imperfections in slips and decoration may also suggest multiple potters in the form of apprentices (Thissen 2017, 85–7).

122 These suggestions differ from the arguments that the first pottery in Greece (at least from the Franchthi Cave) was produced by a limited number of craft specialists, particularly women, and that they enjoyed a high level of social status as potters and shamans: as made by Vitelli (1993, 254–5; 1995, 60–2; 1999, 188, 191–2; Perlès and Vitelli 1999, 102–3).

123 Vitelli also noted multiple concurrent potters at the Franchthi Cave and Paralia in the Early Neolithic (Perlès and Vitelli 1999, 96).

124 Mavridis 2008.

125 Kalogirou 1994, 14.

126 Vitelli 1977, 23.

127 Thissen and Reinbruber 2017.

128 c. 5950 BC (Müller 1988, 1994).

129 See above note 19 and Bonga (2019, 163). These "early" dates come from charcoal samples.

130 See above Absolute Dating and notes 61, 63-4 and Bonga (2019). It has also recently been demonstrated that painted pottery from the very beginning of the Neolithic in southeastern Europe (Krauβ 2011, 122; Stojanovsk 2017).

131 It should be noted that mineral pigments and organic paints (bitumen) were used to produce another type of Polychrome at Varemenoi-Goules (Urem-Kotsou *et al.* 2017, 474, Plate X, b; Urem-Kotsou *et al.* 2014, fig. 10, n. 4). Polychrome-painted pottery using both ferruginous and manganese-based pigments on the same vase, like that of Mavropigi-Fillotsairi, is currently unknown in the Middle Neolithic period of Greece. It is documented as the start of the Late Neolithic period (e.g. Tsangli phase in Thessaly with B3ζ and B3β), beginning c. 5500 or 5400 BC, when, it was believed, that potters first had full knowledge of the properties of mineral pigments and

Aside from the above mentioned sites in the immediate vicinity of Mavropigi-Fillotsairi with Polychrome-painted pottery, greater quantities of strikingly similarly decorated pottery is found at Early Neolithic Podgori I in the Korça basin in Albania. No polychrome pottery was recovered at Vashtëmi, but other ceramic features (e.g. spoons, small legs) and pottery (e.g. impressed, incised, and finger-pinched decorated)[132] are identical to those from Mavropigi-Fillotsairi.[133]

The similarities of the material culture between these sites, only a few days' walk away from one another, attests to the cultural complexity and frequency of interaction between these early farming communities. It suggests that sites in and around the plain of Ptolemaïda must be included in network of contacts and trade routes between the Korça basin, Central Macedonia, and Thessaly. The lithic evidence, also supports close interaction between these regions, as honey-colored flint or "silex blond" recovered at Mavropigi-Fillotsairi originated from northwestern Albania, even if was traded through Thessaly, as was obsidian from the Cycladic island of Melos.[134] It also demonstrates that the relationships between these areas were developed much earlier than previously thought,[135] and that the long-lasting intensity of these regional interactions should be more closely considered.[136]

It is worth considering also the relationship with early Polychrome pottery that occurs in Bulgaria and southern Thrace around c. 6000 BC and later, as it is related to the wider debate on the trajectories taken in the Neolithisation of Southeast Europe and Greece. Due to geographical distance, they may simply be two independent trajectories involving analogous (but unconnected) ceramic, technological, or cultural developments. Yet, the Polychrome pieces found at Aşağı Pınar in Turkish Thrace are considered imports from the Western Balkans,[137] and the long-distance procurement of Balkan flint from Bulgaria during the Early Neolithic period also suggests a high degree of mobility and exchange.[138] Polychrome is known in southwestern Bulgaria (e.g., Cavdar and Rakitovo) after 5900–5800 BC[139] and the Polychrome from Podgori I in Albania has been arguably linked to the material with Cavdar.[140] Population movement into Thrace from west to east has also been suggested recently on the evidence of painted pottery,[141] which raises the questions of the movement of people, pots, and technological ideas. The course of the discussion may also depend if one chooses to define Polychrome pottery as a subset of the white-painted pottery that appears

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firing techniques (Demoule and Perlès 1993, 392).

132 The type of impressed, incised, and finger-pinched decorated pottery found at Vashtëmi and Podgori is known in the Albanian literature as the Devollite type (Korkuti 1982; Prendi and Andrea 1981).

133 The exact dating of these sites remains unclear and has been contradictorily presented between excavation reports (Ruzi 2012, 4). Recent corings are reported at Podgori (Beta-253231, c. 6070–5970 BC) and Vashtëmi (Beta-253236, c. 6470–6370 BC) (Allen and Gjipali 2014, 109, table 1.) Although these corings remain to be substantiated by dates from the newly excavated archaeological levels, they seem to confirm the results of the recent macroscopic and archaeometric analysis that implied the antiquity of Vashtëmi (Andoni 2017; Ndreçka *et al.* 2017; Ruzi 2012).

134 Kaczanowska and Kozłowski 2016, 57, 72, 89.

135 Previously, the interaction between these regions was not known until the Late Neolithic (Lera *et al.* 2015).

136 The Polychrome pottery, for instance, uses "Thessalian" motifs, but the use of thin white outlines is a new element, possible "invented" in Western Macedonia.

137 Özdoğan 2011, 88.

138 Gurov 2018.

139 Lichardus-Itten *et al.* 2002, 129, fig. 19.3.

140 Bunguri 2014, 89.

141 Nikolov 2017, 73, 77 (contra Özdoğan 1997); Nikolov 2016.

c. 6100–6000 BC;[142] yet is has been also been argued that clusters of white-painted pottery are unrelated.[143]

The emerging pattern from the ceramics of Early Neolithic Greece is not only one of cultural preference and variability at both the site and regional scales, as shown by recent ceramic studies in the Pieria.[144] In contrast with sites in Central Macedonia, Mavropigi-Fillotsairi demonstrates a larger proportion of decorated vessels (c. 10%) in the assemblage. The variety of surface colors and decorative types at Mavropigi-Fillotsairi indicates the competence and mastery over their materials the potters enjoyed, and with which they felt comfortable to experiment.[145] This receptiveness to the concurrent use of several decorative systems, surface treatments, and colors of monochrome pottery also suggests frequent and sustained interaction with other communities, not only in the immediate plain of Ptolemaïda, but with those in the more distant basins and plains to the east, south, west, and northeast. [146] The geographical centrality of Mavropigi-Fillotsairi was embodied in the ceramic choices, which incorporates elements from all cardinal directions.

The inhabitants of Mavropigi-Fillotsairi may have been among the first Neolithic people to arrive not only in Western Macedonia but also into northern Greece (from the Near East or Anatolia),[147] even if the precise route they took cannot be clearly traced. They may have initially entered through Thrace, or from the Pagasetic Gulf and moved northward from Thessaly (possibly through the Sarantaporos pass down the middle Haliakmon River), or even from the great deltas of the Thermaic Gulf, following watercourses upstream.[148]

Early Neolithic communities, like Mavropigi-Fillotsairi, were always exploring and exploiting new and better resources in their broader surrounding areas. In this sense, the inhabitants of Mavropigi-Fillotsairi were at both the technical and physical frontier of Neolithic expansion into southeastern Europe.[149] The potters were pioneers in a new environment who identified and developed various clay sources and raw materials with different properties and so became skilled at not only a variety of technological processes in forming and firing their vessels, but also in approaches in decorating them.

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142 Bonga 2017, 378; Krauβ 2011; Schubert 1999.

143 Pavúk 2007. Stojanovski (2017, 8) dates Vashtëmi and Podgori after 5800 calBC, based on the complexity of the motifs and geographic association with sites in Pelagonia, but that dating would be too late by the one proposed in this paper.

144 Saridaki *et al.* 2019; Urem-Kotsou *et al.* 2017. These studies found that not only do the proportions of decorated types vary, but so do the clay procurement, processing, and firing choices. Revenia-Korinos and Ritini yielded a fair amount of painted pottery, but it was scarce at Paliambela-Kolindros and Varemenoi-Goules. Conversely, incised, impressed, and finger-pinched decorated pottery was common at Paliambela-Kolindros but rare at Varemenoi-Goules and Roditis-Paliambela. Potters at Paliambela-Kolindros exploited a range of non-calcareous clays sourced from up to 5 km away from the site and fired them to produce different surface colors, whereas at Revenia-Korinos potters selected a limited range of non-calcareous clays in the immediate area of the settlement and fired them to produce light colored surfaces.

145 Saridaki *et al.* 2017; 2014; Urem-Kotsou *et al.* 2017, 329; Dimoula 2017, 215.

146 Similar conclusions were made for sites in Pieria (Urem-Kotsou *et al.* 2017, 331).

147 Maniatis 2014; Perlès 2003.

148 It should be noted that the course (as well as the) source for the Haliakmonas River, which flows into the Aegean Sea is in the Pindus mountains near to the source for the Devoll River, which flows into the Adriatic Sea, is only some 35 km southeast of Vashtëmi and possibly these river courses, although not navigable, provided a continental route to both seas.

149 Thissen (2017, 80, 87–8) has also described the first ceramic communities of Southeastern Europe as pioneer-movers, some of whom were expert potters setting up their assemblages in the new environment.

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CAPTIONS TO FIGURES

All photographs, maps, and illustrations were produced by the author, unless otherwise noted.

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