Provenance and proximity: A Technological Analysis of Late and Final Neolithic Ceramics from Euripides Cave, Salamis, Greece

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Abstract
This paper examines application of the provenance hypothesis in areas of complex regional geology, where all potential sources of raw materials cannot be isolated or taken into account. With a few notable exceptions most pottery of the Late and Final Neolithic in Central and Southern Mainland Greece is considered to be locally produced by non-specialist household potters. Nevertheless small quantities of pottery with fresh volcanic fabrics have been found in largely non-volcanic areas and interpreted as imports. This interpretation has been questioned and alternative local sources proposed either in isolated palaeovolcanic units amongst otherwise non-volcanic rocks or through reuse of imported artefacts such as millstones made from fresh volcanic rock. In this study we examine evidence for pottery exchange at the Cave of Euripides, located opposite the island of Aegina, a potential source of imported volcanic materials in the region. The analysis uses petrography to identify raw materials, production technologies and provenance of the pottery. Results show that most pottery at the cave was produced locally. It is argued that grog and sparry calcite tempered fabrics are indicative of shared technological knowledge amongst potters in different communities. Pottery imports are identified based on their fresh volcanic inclusions. They are consistent with pottery fabrics from Aegina and distinguished from the local palaeovolcanic rocks that occur in close proximity to the cave.

Keywords: Neolithic; Greece; Aegean; Ceramics; Distribution; Exchange; Thin section petrography
1. Introduction
Petrography is a powerful method for determining pottery provenance based on the composition of rock and mineral inclusions incorporated within the clay body at the time of production. However, using these compositions for provenance determination introduces demanding requirements because all potential sources should be taken into consideration so far as possible when identifying (a) whether or not pottery at a site was locally produced or imported and (b) if the latter then identifying its likely origin. According to the provenance hypothesis, variation between potential sources needs be greater than that within a single source (Wilson and Pollard, 2001) so that each candidate source can be discriminated. Fulfilling these requirements is particularly challenging in geologically complex areas where similar raw materials may occur in several locations, sometimes as small, isolated outcrops that may be heterogeneous in nature and unrecorded in the geological literature. In such situations the possibility that viable raw materials occur locally within the regional geology can call into question an interpretation that pottery was imported and the networks of movement that this may represent. This situation has arisen in the study of pottery exchange in Central and Southern Greece during the Late (LN) and Final Neolithic (FN) periods, 5300 to 4500 BC and 4500 to 3200 BC respectively (Demoule and Perlès 1993: 366, fig 2), and this paper aims to address some of these problems based on analyses of pottery from the Cave of Euripides on the Island of Salamis (Fig. 1).

1.1 Previous analytical studies on Neolithic ceramic imports in Central and Southern Mainland Greece
Grey, black burnished and matt-painted wares occur widely in the LN of Central and Southern Mainland Greece, but in general pottery styles appear to be more numerous, regionally restricted and varied in the levels of skill expressed compared with the preceding Middle Neolithic (MN) (Phelps, 2004, 65ff.; Perlès, 1992; Perlès and Vitelli, 1999; Vitelli, 1993a, b). Moreover, LN and FN assemblages contain significantly larger quantities of coarse ware (Perlès and Vitelli, 1999) indicating a greater concern for pottery in its utilitarian role rather than as a prestige material for display and exchange. These developments have been interpreted as the outcome of localized production by non-specialist household potters (Vitelli, 1993b) with evidence of pottery exchange for the most part remaining limited.
A comparable situation has been argued for Thessaly (Perlès and Vitelli, 1999) where LN and FN pottery is predominantly local and imports are limited, although consistently present, especially in LN (Schneider et al., 1991; Pentedeka and Dimoula, 2009). Recent petrographic and chemical analyses have however begun to challenge this interpretation. Extensive and overlapping networks of MN and particularly LN pottery exchange, mainly in grey and black burnished wares, have been identified in Thessaly based on evidence from vessel morphologies, decoration, production technologies and inclusion compositions (Pentedeka 2008, 30-36, 211-216; 2011). Similarly, long-distance exchange has been recognised through examination of pottery from the Cave of Cyclops, on the island of Youra (Quinn et al., 2010), in the northern Aegean. The case of Youra is striking because, in its present form, this small island is limited in both its range of lithologies (limestone, phyllites, quartzites, conglomerates and sandstones) and sources of clay for pottery production. The presence of pottery containing volcanic, serpentine and schist inclusions incompatible with local geology is therefore particularly conspicuous and has been interpreted as evidence for far wider pottery exchange networks operating in the MN and LN than had hitherto been recognized. The degree of geological contrast between pottery fabrics and regional geology at Youra is however rare in many parts of Mainland Greece.

In Central and Southern Mainland Greece extensive petrographic analyses of LN and FN pottery from the Corycian and Kitsos caves (Courtois, 1981a, 1981b; Dimou 1981), Thorikos (on the coast east of the Kitsos cave) and Karystos (De Paepe, 1982) (Fig. 1), have demonstrated that production was predominantly local to each site. Nevertheless, importation has been suggested to explain the occurrence of some pottery containing fresh volcanic material at sites situated in otherwise predominantly non-volcanic areas. At Chaeroneia LN black ware with distinctive fabrics containing volcanic beach sand and micaceous clays may indicate contacts with Euboea (Parker and Tzavella-Evjen, 1995). Pottery with altered pyroclastic inclusions at the Corycian cave, above Delphi, was attributed to local palaeovolcanic sources but examples containing fresher volcanic inclusions were thought to be from areas of more recent volcanic activity in the Aegean (Courtois, 1981b; Dimou, 1981). Four pottery samples from the Kitsos cave, in the predominantly metamorphic region of Attica, contain fresh to partially altered volcanic inclusions interpreted as potentially coming from
the islands of Euboea, Aegina, the Cyclades or the Dodecanese islands further to the southeast (Courtois, 1981a). FN pottery from Aspis, in the Argolid, is predominantly local containing quartz, calcite and mica schist, but coarse fabrics with quartz, mica and probably pyroclastic inclusions natural to the clay (Touchais, 1980) may be imports.

Doubts have been raised about these suggestions of pottery imports from the Aegean based on the pottery in question being absent in potential source areas, such as the Cyclades, and the likelihood that pyroclastic inclusions could be derived locally from the transported weathering products of remote older igneous and palaeovolcanic rocks (Jones, 1986, 375). There are indeed numerous scattered outcrops of igneous and, more specifically, volcanic material in Central and Southern Mainland Greece. For example, gabbroic, basaltic and tuffitic rocks occur within the central Argolid ophiolitic mélange (Xatzipanagiotou et al., 1988), porphyritic volcanic rocks and tuffs occur amongst shales and limestones of the Peloponnesian Tyros Beds (Lekkas and Papanikolaou, 1977), and a thin bed of dacitic to rhyolitic tephra was recently discovered in argillaceous rocks and sandstones at Xylokastro in the northern Peloponnese (Vasilatos et al., 2010). These examples illustrate the range of potential sources that provenance determination would have to take into consideration. While the nearest and most significant sources to a site should be compared with pottery fabrics it is not possible to account for every occurrence of volcanic material. There comes a point where it is more likely that pottery with fresh volcanic inclusions was imported than that potters exploited small, remote exposures of pyroclastic material, especially when pottery with similarly unusual fabrics is found at a number of sites.

Another facet of this debate is the issue of what constitutes a local source. If imported artefacts, such as millstones, were reused as raw materials for pottery production then these materials could in effect be considered a local resource for the potters. Andesite millstones found at the Franchthi cave and elsewhere in the Argolid region have been attributed to sources in the Saronic Gulf based on hand specimen and thin section analyses, with the island of Aegina being considered a particularly strong candidate (Runnels, 1981, 68-71; Kardulias and Runnels, 1995, 112f.). In contrast, an andesite outcrop near to the Franchthi cave was rejected as a potential millstone source due to its weathered condition and differences in macroscopic properties (Vitelli, 1993a, 211
Pottery with andesite inclusions (Andesite ware) has also been found in small quantities at various points in the Franchthi cave Early to Final Neolithic sequence (Vitelli, 1993a, 1999, 38), and similar fabrics occur more widely in the region based on macroscopic studies of FN to Early Bronze Age pottery (Pullen, 1995, 2000). The irregular incidence of Andesite ware and the exotic and limited occurrence of andesite in the region suggest, ostensibly, that the pottery is a non-local product (Vitelli, 1993a, 208). A single sample of LN Andesite ware from Franchthi cave was studied by Cohen and attributed to Aegina. Furthermore the size and angularity of the inclusions implied that they had been added to the clay (Runnels, 1981, 103) as temper. With pottery production at Franchthi having been overwhelmingly local, and considering it unlikely that the potters travelled to Methana or Aegina to collect temper, Vitelli (1993a, 209) suggested that Franchthi potters might have reused imported andesite millstones as a source of temper. This interpretation recognised that petrographic provenance determination addresses the origin of the inclusions and only by association the origin of the pot. On this basis, Vitelli concluded that the available evidence weighed in favour of Andesite ware being a local product that incorporated reused imported andesite.

A comparable situation exists at the Kitsos cave, where not only was pottery found containing fresh volcanic inclusions (see above) but also two fragments of rhyodacite millstone for which the east coast of Aegina offered the closest petrographic match (Cohen and Runnels, 1981). Perlès (1992) has noted the absence of andesite flakes in debitage from Franchthi and Kitsos, indicating that the millstones probably were not worked on-site. Furthermore, the pottery is described as containing monogenetic, residual inclusions of andesitic tephra (Courtois, 1981a, 386) which appears to be inconsistent with the addition of andesitic debitage to an Attic clay derived from metamorphic or sedimentary rocks. In their study of local and long-distance pottery exchange in Early Neolithic Crete, Tomkins et al. (2004) specifically questioned the use of stone axes or potlids as sources of serpentinite or phyllite/schist temper found in pottery at Knossos. They found that fabrics dominated by serpentinite temper also contained mafic inclusions throughout the clay groundmass, indicating that both temper and host clay originated from the same non-local source. A similar interpretation may be drawn from the Kitsos results, although this does not rule out
the possibility that in other cases cross-craft interaction provided potters with local access to imported materials.

1.2 The Cave of Euripides

The Cave of Euripides is situated on southern Salamis, above the Bay of Peristeria (Fig. 2). It is formed in calcareous rock, at a height of 115m above current sea level and consists of two caverns fronted by a terrace. A spring located 10m below the cave seems to be the remains of the aquifer that contributed to its formation. The cave is a vantage point that provides an exceptional view over the Saronic Gulf (Fig. 3). More importantly for this study, it looks directly across to the island of Aegina, which has been proposed as a likely source for imported pottery and millstones in the region. It therefore presents an opportunity to seek evidence for imported Aeginetan pottery in the LN and FN assemblage and to conduct petrographic comparisons with palaeovolcanic rocks that crop out in proximity of the cave.

The current landscape of the Saronic Gulf is different to that of the LN and FN periods due to sea level rise following the last glacial period (around 19450 B.C.). At the beginning of the 6th millennium B.C. the southern coastline of Salamis is estimated to have been a few metres lower than the present level (Mari, 2007, fig. 5Г). By the end of the millennium, when the archaeological sequence started at the Cave of Euripides, Salamis was still connected through a land bridge to the peninsulas of Attica on its east side and Megara to the west (Mariolakos and Theocharis, 2001, 2003). It was transformed into an island by the middle of the Early Bronze Age (around 2550 B.C.). During the Neolithic prevailing environmental conditions favoured the creation of permanent settlements only on the southern part of Salamis (Mari, 2007), which would have been part of mainland coastal networks, and a possible route of communication between the Aegina and the mainland.

Anthropogenic deposits in the cave reached 0.30 m within chamber II and 1.43m in chamber VIII. Unfortunately ceramic, stone, metal, glass, bone, and shell finds of different chronological periods (Neolithic, Early Helladic, Mycenaean, Classical, Hellenistic, Roman and Late Byzantine) (Lolos, 2003) were mixed due to repeated disturbances, eradicating any remains of a stratigraphic sequence. The Neolithic
artefact assemblage nevertheless suggests that the cave was not used for habitation or storage. The absence of ceramic spindle whorls, millstones, rubbing stones and bone tools (perforators, needles or spatulas) indicates a dearth of settlement activities. Moreover, the large quantity of sherds from shallow or medium-sized bowls contrasts with the few from large wide-mouthed or closed coarse-ware vessels that would typically be more frequent in a settlement assemblage. Of special importance is the quality and kind of small finds recovered (Mari, 2003; Maniatis – Mari, to be published). Taking into consideration all the above, combined with the location of the cave by the south coast and its morphology (with small, law ceilinged, badly ventilated dark chambers), it seems the cave had an important role as a site of special, “ritual” function, possibly charged with symbolic value for the Salaminians and perhaps for inhabitants of neighbouring regions since the Neolithic period (Mari, 2007). This hypothesis is reinforced indirectly by the subsequent Greek myth according to which the cave was used as a habitation site by Kychreus, the first king of Salamis in the shape of a snake or half snake and half man. Despite the lack of stratified deposits, the Neolithic assemblage provides significant information on how people used the cave. As it was not principally a habitation site this raised the question as to what extent the Neolithic pottery was made locally or imported from the wider region. With respect to the latter, 2 km from the cave, on the southwest tip of the island, a few Late and several Final Neolithic sherds were found, which constitute remnants of a settlement later covered by the major Late Helladic site of Kanakia (Mari, 2007, 80, 2012), which has been under excavation since 2000 (Lolos, 2007). Surface finds also indicate the existence of two additional later Neolithic settlements in the same region (Lolos, 2012, 9).

2. Materials and methods

Comparative study of the Neolithic pottery shows that the Cave of Euripides was used for the first time around 5300-4300 B.C., i.e. during the Late (LN) and beginning of the Final Neolithic (FN) periods (cf. Demoule and Perlès, 1993, 366, fig 2). Approximately half of the excavated 3,747 sherds (total weight: 74kg) belong to undecorated coarse ware pots (Fig. 4: top and lower left). The remaining sherds come from decorated thin or thick-walled pots with estimated vessel-counts of: twenty-one coarse with plastic, incised, impressed, incised and pointillé, or painted decoration
Comparison of ceramics at several LN and FN sites in Southern Greece [for example, Kitsos cave (Lambert, 1981) and Marathon Pan cave in Attica (Diamant, 1974, 97-8; Papadimitriou, 1959), Akropolis South Slope at Athens (Diamant, 1974, 95), Skoteini cave at Tharrounia, Euboia (Sampson, 1993), Kolonna on Aegina (Walter and Felten, 1981; Felten and Hiller, 1996; Weißhaar, 1994), cave of Kolokotronis on Hydra (Mari, in press), Corinthia (Phelps, 2004), Aspis (Touchais, 1980), Aria (Douzougli, 1998) and Franchthi cave (Vitelli, 1999) in the Argolid, Alepotrypa in the Mani (Papathanasopoulos et al., 2011; Phelps, 2004)] reveals that LN pottery production maintained the same basic shapes across a range of wares. Thus development from earlier to later wares is largely attested through changes in surface treatment. Specific shapes of the grey burnished vessels copy those of earlier (beginning of the LN) black burnished ware, and shapes of matt- or bichrome painted ware may be reminiscent of black and grey burnished or even black-on-red pottery (Phelps, 2004, 65-103). Simple open bowls, collar or carinated bowls with a flat base, ‘fruitstands’ with a stem, and ‘amphora-like’ pots with a collar neck and vertical strap handles were produced throughout the LN. In these cases vessel shapes constitute part of the LN potters’ tradition, passing from one generation to another. From a functional viewpoint this suggests that day-to-day use of these pots likewise did not change significantly. It seems that the LN pots were fired by skilled potters who were well acquainted with the procedures necessary to produce hard-fired and light coloured vessels in an oxidizing atmosphere, or dark coloured vessels (cf. the black burnished variety) in a reducing or carbon-rich atmosphere. Other pots like those coloured grey (grey burnished variety) demanded an especially difficult to achieve, lightly reducing atmosphere (Vitelli, 1994). A different situation applies for the FN: many of these pots appear to have been less skilfully produced, which may indicate wider engagement in pottery making to cover household needs (Vitelli, 1995). Most of the fabrics are coarse and many of the ceramic vessels have undergone hasty low-temperature firings (Vitelli, 1995, 1999, 91). It is worth mentioning, however, that
burnished FN shapes like open convex bowls, collar bowls and collar jars originate in
the grey and black burnished wares of the previous LN phase (Phelps, 2004, 71-119),
and must have been constructed/made by experienced potters (Vitelli, 1999, 93, 103).

3. Petrographic results

Neopalaeozoic to Lower Triassic phyllites, quartzites and sericite schists, alternating
with shales, sandstones and greywackes crop out along the southeastern coast of
Salamis (Gaitanakis et al., 1978). The Cave of Euripides lies within the overlying
Middle to Upper Triassic limestones, dolomites and marbles which are traversed by
heavily altered palaeovolcanic rocks and tuffs. Twelve samples of geological
materials were collected in the vicinity of the cave (1-3) and from the coastal areas of
Peristeria and Kanakia Bays (4-12) (Fig. 2) to represent the range of lithologies
present in the area for comparison with the pottery samples. Rock samples 1, 7, 8 and
11 are quartz-muscovite schist and phyllite with accessory plagioclase, calcite and
opaque minerals. Samples 2 and 3 are fine-grained crystalline limestone. Samples 5
(Fig. 6a) and 6 are altered volcanic tuff composed of plagioclase altering to sericite
and epidote, mono- and polycrystalline quartz (the former corroded in some cases)
and fragments of silicified volcanic lava embedded in a silicified matrix of fine-
grained quartz, chlorite, epidote, opaque grains (probably iron-titanium oxides),
sericite and very rarely calcite. Samples 4, 9, 10, 12 are beach sands taken to identify
the varieties of rock present in local sedimentary detritus. The beach directly below
the cave was not sampled as construction of the modern road and mole may have
compromised local deposits. The beach deposits contain grains of polycrystalline
quartz, fine to coarse grained crystalline limestone, quartz-muscovite schist, altered
volcanic tuff and shell fragments (Fig. 6b).

A total of 109 samples of LN and FN pottery were studied using polarized light
microscopy and refiring tests. The pottery samples were selected by ware
classification based on fabric coarseness and surface treatment. Petrographic
descriptions are presented in the Appendix and the results summarized in Table 1.
Fabric groups are defined by the nature of the dominant inclusions comprising:
Phyllite, Calcareous, Sedimentary, Felsic (i.e. quartz/feldspar), Schist, Volcanic and
Grog (crushed pottery). In most cases these groups have been subdivided into classes
with more specific compositional and textural characteristics. Fabric groups and classes are referred to in the format of group name followed by class in parentheses, e.g. Phyllite (coarse packed rounded).

All petrographic samples were refired at 1080°C for one hour in an oxidizing atmosphere. This aims to eradicate variation from the ancient, lower temperature, firings to generate a basic distinction between clay bodies that refire red, red/yellow or yellow (Whitbread, 1995, 390). Different refired colours show that different clay bodies were used. Red and yellow refired colours also indicate whether the clays are likely to be non-calcareous or calcareous respectively. Table 1 shows that most fabrics in the Calcareous group refired yellow, whilst most samples in the remaining groups refired red. Five Phyllite group samples refired red/yellow, which may indicate different sources or mixed clays.

Most pottery samples belong to the Phyllite group, in which the common constituents of phyllite, quartz-sericite rock and limestone (Fig. 6c) are similar to geological samples 1, 7, 8 and 11, and to several inclusions within beach sands 4, 9 and 12. Occurrence of these inclusions throughout the size range in the ceramic fabrics indicates that they are probably natural to the clays. The greater rounding and better sorting of coarser inclusions in Phyllite (coarse packed rounded) (Fig. 6d) may constitute a distinct choice in clay preparation with phyllite sand being intentionally added to clays derived from local metamorphic rocks. Micromorphology of the Schist (amphibole epidote) class is characterised by the high proportion of epidote and related minerals. It is probably local based on the occasional occurrence of epidote rock fragments in Phyllite (quartz sericite) fabrics. Calcareous and Sedimentary group fabrics are also consistent with the local geology, notably geological samples 2 and 3. Inclusions in Calcareous (rounded limestone phyllite) fabrics (Fig. 6e) are similar to rocks in close proximity to the cave, whereas those in Calcareous (serpentinite) and Sedimentary (radiolarite) are more consistent with ophiolitic rocks in the northern parts of Salamis. The Calcareous (sparry calcite) class (Fig. 6f) is notable for its large, angular inclusions of coarse crystalline calcite. These inclusions were probably added as temper given their angularity and the ease with which calcite is rounded during transport. Felsic fabrics cannot be attributed securely to specific sources by petrography owing to the widespread occurrence of quartz and feldspar.
The Volcanic (fresh volcanic) class (Fig. 6g) is distinctly different from other samples at the cave. It is dominated by fresh inclusions of volcanic rock bearing plagioclase, green to brown hornblende and clinopyroxene in colourless volcanic glass together with inclusions of these individual components together with quartz and limestone. Inclusions of volcanic origin occur throughout the grain-size range, consistent with raw materials having been weathered in situ as part of a primary clay deposit rather than added as temper. The fresh character of the inclusions is in marked contrast to the palaeovolcanic rocks and tuffs in the vicinity of the cave as demonstrated in geological samples 5 (Fig. 6a) and 6, and in fragments present in beach sand sample 9 (Fig. 6b). The absence of any palaeovolcanic rock inclusions in the Volcanic (fresh volcanic) class most likely indicates a different source.

Samples of the Grog (grog) class contain predominantly grog composed of felsic silt fabrics, and very rarely calcareous sand and grog-in-grog fabrics, the latter grog reflecting characteristics of the host fabric. These fabrics lack inclusions indicative of a specific geological region. Grog also occurs in the Phyllite (quartz sericite) class, with nine of the 16 samples possessing very few grog inclusions. In this case the grog is predominantly composed of the host Phyllite (quartz sericite) fabric, though less optically active and more optically dense owing to the repeated firing. Less common in the grog of this class are felsic silt and calcareous sand fabrics and very rarely grog-in-grog. The Phyllite (quartz sericite) fabrics are consistent with local geology and it is clear that at least some potters using resources for this pottery also practiced grog tempering.

4. Discussion and conclusions

Petrographic results (Table 1) demonstrate the absence of any simple correspondence between the choices made in selecting and processing raw materials and subsequent surface treatments. Apart from incised ware, all surface treatments represented by more than one sample occur in more than one fabric class, and in several cases in more than one fabric group. Also notable is the lack of raw materials discrimination between coarse ware and pottery with more sophisticated surface finishes. The results also show that LN and FN pottery at the Cave of Euripides was made from a range of
raw materials that in most cases are consistent with local geology. However, three fabric classes show evidence of external connections.

The Calcareous (sparry calcite) and grog-bearing classes probably indicate wider communication of technological knowledge rather than pottery importation. Fabrics similar to Calcareous (sparry calcite) have been reported at several sites in Central and Southern Greece, including the Corycian and Kitsos caves, Thorikos and Aspis, and Early Neolithic pottery from Lerna (Jones, 1986, 398, Table 4.3). The sparry calcite probably comes from marble, coarse crystalline limestone and dolomitic rocks that are widely distributed in the region such that the pottery could have been made in numerous locations. These fabrics are distinctive to the naked eye, and it is likely that Neolithic potters made explicit choices when selecting this raw material, probably based on technological knowledge shared through inter-community networks.

Further indications of shared technological knowledge are evident in the widespread use of grog. Grog constitutes the significant tempering component in Grog (grog) fabrics and given the limited quantities of other inclusions in these fabrics it was probably a technological necessity for controlling the plasticity, drying and firing of the pottery. Grog constitutes only a small proportion of the coarse inclusions in Phyllite (quartz sericite) fabrics suggesting that its addition did not substantially change the working properties of the clay body. The procedure of adding grog may have been more important than the physical outcome; for example grog could have been added for symbolic or social reasons (Smith, 1989). If it was simply incorporated accidently from the potting environment then traces of grog would probably be present in other fabric groups. A similar pattern of grog use is evident at the Cave of Cyclops on Youra where it occurs both alongside phyllite and limestone inclusions and as a dominant aplastic inclusion in its own right (Quinn et al., 2010). Grog also occurs in FN fabrics from Aspis (Touchais, 1980) while inclusions of grog-like character were noted at the Corycian and Kitsos caves (Courtois, 1981a, 1981b; Dimou 1981), the cautious description reflecting similarities in some cases between grog, argillaceous rock fragments and clay pellets (Whitbread, 1986; Cuomo di Caprio and Vaughan, 1993).
The Volcanic (fresh volcanic) class is petrographically very similar to the four samples with volcanic inclusions from the Kitsos cave described by Courtois (1981) and to ceramic fabrics from the island of Aegina. The Cave of Euripides fabrics refired red, indicating that they are noncalcareous, and in compositional terms (see Appendix) they correspond to the Fabric Group 1 noncalcareous volcanic fabrics of Bronze Age Aeginetan pottery (Kiriatzi et al., 2011, 93–100). These fabrics contain andesitic volcanic rock and its constituents of plagioclase (rarely alkali) feldspar, brown, green and brown-green amphibole (probably hornblende), clinopyroxene, biotite, micritic limestone and very rare to absent microfossils. Other sources of fresh volcanic rock do occur in the region (Fytikas et al., 1987/1988) and these cannot be excluded without further analysis. In this respect, microprobe analysis of amphiboles in five Middle Bronze Age pottery samples believed to be Aeginetan showed that those in two samples are compositionally consistent with Aegina, but amphiboles in the remaining three have higher potassium, possibly indicating an alternative source beyond the Saronic Gulf (Dorais and Shriner 2002). In terms of the current analysis, however, the Volcanic (fresh volcanic) class has more in common with a potential Aeginetan source than with local production on Salamis.

As noted above, the region is geologically complex with the occurrence of several small, isolated exposures of volcanic material. The geological samples taken in proximity to the Cave of Euripides may not therefore account for all volcanic deposits in area. The Phyllite (quartz sericite volcanic) class is essentially Phyllite (quartz sericite) in composition but contains rare inclusions of fresh volcanic rock and green to brown hornblende. The close similarity to Phyllite (quartz sericite) fabrics strongly favours a local source on Salamis for the Phyllite (quartz sericite volcanic) class, indicating that some fresh volcanic rock does occur in the region. These fabrics could not be produced on Aegina, where metamorphic rocks are absent (Fytikas et al., 1987/1988). More intriguing is the presence in one sample of a single grain of grog composed of the Volcanic (fresh volcanic) fabric (Fig. 6h), demonstrating that fragments of an imported vessel were present when the local pot was made. The contrast in composition between the grog and host fabric is striking. Finer grains in the grog are plagioclase, hornblende and quartz whereas finer grains of the host fabric are poly- and monocrystalline quartz and mica derived from the phyllite, reflecting the different clay sources used. The Phyllite (quartz sericite volcanic) class shows that
where fresh volcanic inclusions are present in raw materials on Salamis they are likely
to be accompanied by metamorphic inclusions, thereby distinguishing them from
Aeginetan raw materials. It may also be significant that no inclusions of altered
palaeovolcanic rock were identified in pottery samples from the Cave of Euripides,
suggesting that potters did not source their raw materials from areas with local
volcanic deposits.

There are alternative locations in the Saronic Gulf where fresh volcanic rock occurs
(Fytikas at al., 1987/1988). Aegina however is the closest source, lying in direct line
of sight of the Cave of Euripides and currently about 12km distant. It is therefore most
likely that pottery made in the Volcanic (fresh volcanic) fabric was brought from
Aegina to the cave. The volcanic peninsula of Methana has produced scant evidence
of Neolithic habitation (Mee and Taylor, 1997) and is therefore a less likely
alternative.

Volcanic (fresh volcanic) fabrics occur in a range of surface finishes, including black
burnished, grey burnished, burnished, red slip, slipped and coarse wares. All of these
finishes, other than slipped, were also produced using raw materials consistent with
local production. In many cases the exact shapes of the vessels cannot be determined,
but they include flat base fragments, coarse ware vessels with plastic decoration, a
grey burnished amphora, and black burnished vessels including a bowl and a vessel
with two mend holes. The lack of stratigraphy means that there is no record of
whether pottery with Volcanic (fresh volcanic) fabrics belongs to one or more specific
periods of occupation. Occupants of the cave may have acquired the pottery through
exchange, but the cave may at times have been visited by people from Aegina who
brought the pottery with them. In this case the movement of pottery would not
constitute evidence of exchange but rather a different type of social network.

This study has shown that, as with other LN and FN sites in the region, most pottery
from the Cave of Euripides was produced locally in a variety of surface finishes. The
wide occurrence of particular surface treatments, such as grey, black burnished and
matt-painted wares is indicative of shared technological knowledge at a regional level,
and this is further evident in tempering practices that specifically used grog or sparry
calcite. The lack of clear correspondence between surface finishes and petrographic
classes suggests that the final appearance and use of the pottery was not a significant
criterion during raw materials selection. Analysis of pottery from stratified contexts
may clarify this issue.

The possibility that local pottery was produced at the cave cannot be ruled out since,
notwithstanding the levels of skill shown in its production, relatively limited
investments in time or equipment would have been needed. Pottery production was
most likely a household activity however, and given the absence of clear evidence for
habitation at the cave local pottery was probably produced in nearby settlements,
perhaps in the area of Kanakia or elsewhere in southern Salamis. In this respect both
the vessels with Volcanic (fresh volcanic) fabrics and local pottery may have been
brought to the cave to support particular activities of the visitors. The apparent
preference in vessel shape, in the form of shallow or medium-sized bowls, rather than
surface finish, may be a reflection of this process.

The Volcanic (fresh volcanic) class at the Cave of Euripides is distinct from the local
pottery fabrics. The presence of volcanic material throughout the size range and the
lack of any metamorphic component in these samples shows that the pots were not
produced by tempering commonly used local clays with volcanic material. The
Phyllite (quartz sericite volcanic) class demonstrates the types of fabric that can occur
where local volcanic inclusions are present and it is clearly distinct from the Volcanic
(fresh volcanic) class. The possibility that transported stone could be used as a source
of temper is an important consideration, but no millstones were found at the Cave of
Euripides and the volcanic fabrics show no evidence of temper addition. It seems
more likely that the millstones and Andesite ware have common origins within a
regional exchange network. Whether the Cave of Euripides was part of such a
network is more difficult to determine. Pottery with Volcanic (fresh volcanic) fabrics
was imported to the cave, but in the absence of clear evidence for habitation it is open
to question whether the pottery was received by people at the cave in exchange for
other goods or was deposited directly by people visiting the cave from Aegina.

Acknowledgements
The authors thank Professor Yannos Lolos, the excavator of the Cave of Euripides for granting permission for this study. The Hellenic Ministry (now General Secretariat) of Culture is thanked for permission to sample the Neolithic pottery, and likewise the Institute of Geology and Mineral Exploration is thanked for permission to take geological samples from Salamis. Dr Vassilis Kilikoglou is thanked for discussion on technological properties of the pottery. The Fitch Laboratory, British School at Athens, is thanked of use of its facilities. Finally, the referees are thanked for their helpful comments on the manuscript.

Appendix 1. Supplementary data Cave of Euripides petrographic fabric classes

References


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