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Local Clay Sources as Histories of Human–Landscape Interactions: a Ceramic Taskscape Perspective

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Abstract In this paper, we argue that pot-making should be considered in its broader landscape to reveal not only its articulation with the many other quotidian tasks undertaken by a community but also how ancient people oriented themselves in that landscape. We address this point in the context of two small Neolithic communities in southern Calabria, Italy, by treating archaeological ceramics as congealed taskscapes and implementing a novel methodology to unravel the interactions among people, materials, and landscapes. We examine how clay sources are distributed in the local landscape, what the qualities of the clays within them are, and what specific materials the Neolithic potters used in making their pots. We ask not only where in the landscape potters went to get their raw materials but also where they did not go. Their selective engagement with the landscape reveals a social understanding of parts of the landscape considered "appropriate" and "relevant" to pot-making (inland areas) and parts that were not (coastal areas). We also ask what other tasks potters could have undertaken while collecting clays. The co-occurrence of resources in the landscape highlights the need to consider the interlocking of various daily tasks and reveals which tasks could have been perceived as socially related. By explicitly considering the task of pot-making in its landscape, this paper reveals the relational and mutually constitutive articulation of both in everyday life.

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Introduction

Ceramic studies regularly involve provenance analyses that firmly link the task of pot-making with the landscape, yet rarely consider the full implications of these data for understanding how people oriented themselves in their local landscape and, by extension, how they perceived their surrounding world. Instead, once ceramics are shown to be local, attention moves away from the landscape. The knowledgeable ways in which potters interact with their raw materials and techniques and the social contexts within which they learn and practice their craft become the focus, as if pot-making begins only once a pot is about to be formed. However, clay source selection is part of the pot-making task and requires the spatial and temporal engagement of potters with their broader landscape. This engagement should not be taken for granted. Neither are raw materials distributed homogeneously over undifferentiated landscapes nor do potters move in the landscape randomly or solely with the purpose of acquiring potting resources. Ignoring the people–landscape interactions can make pot-making appear spatially homogeneous and isolated from other daily tasks, limiting our understanding of ancient practices. Furthermore, recent work in landscape studies has argued that the relation between practice and space/time is mutually constitutive (*e.g.*, Ashmore 2002; Ashmore and Knapp 1999; Basso 1996; Bender 2002, 2006; De Certeau 1984; Ingold 2000; Lefebvre 1991, 1992). It is precisely through the performance of everyday tasks such as pot-making that people experience a social sense of space and time, which subsequently influences the organization of their lives. Thus, by continuing to disengage pot-making from its landscape, we obscure opportunities to identify important and meaningful loci of ancient life.

A shift is needed in how we, as archaeologists, treat geological survey and provenance data. By realizing that sources of raw materials are not isolated locales but instead reveal histories of interactions among people, materials, and entire landscapes, we can place pot-making in its landscape. To address this point, in the present paper we examine the heterogeneous and interconnected ways in which the inhabitants of two small and neighboring Neolithic sites in southern Calabria, Italy, engaged with their local landscape and made it meaningful, negotiating for more than 500 years which parts were "appropriate for pot-making" and which ones were not.

Sources, Materials, Things, and Meaning

Provenance analyses have now become routine in the examination of ancient pottery. Most of the times the question asked of them is simple: Are the ceramics found at a particular site local or exotic? If they are shown to be exotic, identifying their source becomes critical. Distant sources and the materials and goods that come from them are considered socially, economically, politically, and ideologically important. They suggest connections with people and places far away, information flow, economic and political alliances, but also access to esoteric and mystical knowledge, all of which provide avenues for the establishment of prestige and status to those who can control them (*e.g.*, Brumfiel and Earle 1987; Earle 1991; Helms 1988, 1993). The imported goods themselves, being pieces of important and meaningful places rather than of pragmatic value necessarily, are recognized as playing an active role in the articulation of social relations and the creation and maintenance of alliances (*e.g.*, Bradley 1982, 1984; Bradley and Edmonds 1993; Dillian and White 2010). The importance, social relevance, and salience of distant sources and materials are, thus, immediately apparent.

If distant sources are important, filled with "foreign exoticism" and "cosmic mysteries" (Helms 1988, p. 9), precisely because they are not local, where does that leave local sources? Are we to assume that they lack importance, meaning, or internal differentiation? Are the goods made from them equally lacking in value and meaning, being mundanely commonplace?

Over the last several decades, archaeologists have increasingly acknowledged the centrality of local raw materials and the things made from them in how people get to know themselves and the world around them. It is argued that their importance and meaning derives from the mutually constitutive and historical interactions among people, materials, and things in the performance of technical acts. A technical act (making pots) is a social act (being a potter) because it takes place in the context of a community with preexisting history, traditions, preferences, and memories that are tacit and corporeal as much as they are conceptual and social (*e.g.*, Bourdieu 1990; Dobres 1999, 2000, 2010; Lemonnier 1992). In this way, technical acts are also historical, reproducing and challenging larger social structures (*e.g.*, Giddens 1984; Ortner 1984). No individual performance can be understood outside the context of the long-term sustained practice of multiple performers, and no social structure is ever homogeneous and uncontested.

At the same time, technical processes and things are not just passively materializing meanings that people impose upon them for their social purposes. They actively engage humans in social acts and interactions (*e.g.*, Gell 1998; Meskell 2005; Miller 1998, 2005). Thus, making a pot in a particular way is what "makes a potter" and why "being a potter" can vary greatly within the same context and through space and time. This is not the same as saying that potters make choices with the explicit intention of identifying themselves as members of a group, or as a self-reflexive way to get to know who they are. This may or may not be the case for any particular potter or choice. The point is that technical acts "entangle" (Hodder 2012) people, materials, and things in mutually constitutive relations. When a mother sits down with her daughter, but never with her son, to show her how to make a pot, they are not only making pots. Through this seemingly mundane, non-salient, and quotidian practice, they are also making what it means and feels to be a potter, a woman, a daughter, a mother, an apprentice, and a teacher in that community, which is itself a historical product (Michelaki 2008).

The argument that people make themselves as they make their world, which in turn shapes them, has recently been extended beyond technical acts and things, to raw materials and their properties (Boivin and Owoc 2004; Boivin 2008; Conneller 2011; Ingold 2007, 2012). Conneller (2011, p. 5) has argued that people perceive materials not by what they are but through what they can do. Material properties assessed by the hands of potters are neither objective variables nor arbitrary cultural interpretations, but rather histories of interactions (Ingold 2000, 2007, 2012; Chemero 2003; Gillings 2011, 2012). They are revealed in the process of a particular task being undertaken by a particular person. For example, a certain source of clay may have properties that are ideal when a master potter makes a water jar, but are inappropriate when s/he makes a large storage pot, and disastrous when a novice tries the same tasks. The same clay may also have properties ideal for constructing thermal tiles for jet engines, but neither the novice nor the master potter will experience them. The potter's and the engineer's perceptions of clay are different, realized through their different practices, which themselves have different material effects (Conneller 2011). Thus, the meaning and perception of materials is historical and relational, emerging through the life-time engagement of skillful people with materials in the process of a particular craft (Ingold 2012, p. 434).

Sources as Histories of Interactions—Pot-Making as Part of the Landscape

In discussions of the sociality of technical acts, the materiality of social relations and the relational qualities of raw materials, sources, and their distribution over the landscape rarely make an appearance (although see Jones 2002, pp. 126–131). This is the outcome of our archaeological perceptions, born out of our archaeological practice and does not reflect the importance of sources themselves. As ceramic specialists, we encounter ceramics first and then move backward to reconstruct the processes that produced them. Because we tend to encounter sources last and through specific sherds, we often think of clay sources as specific and isolated locales with particular chemical and mineralogical profiles. The degree of chemical and mineralogical variability in locally available clays, the performance characteristics of these clays during manufacture, the energy expenditure required to access the materials, and the social and political relations that can restrict or enable that access are some of the factors that ethnoarchaeological projects have painstakingly outlined as key in resource selection (Costin 2010). Thus, what is relevant about a clay source seems to be primarily its distance from the potters, the raw materials within it, and the sociopolitical relations of people having and/or needing the materials, rather than the arrangement of these materials over the landscape (*e.g.*, Arnold 1985, 1993, 2000; Aronson *et al.* 1994; Deal 1998; Kramer 1997; Neupert 1999, 2000; Stark *et al.* 2000).

Potters, however, encounter entire landscapes, where clays, even when they exist in close proximity to villages and have similar characteristics, do not exist in isolation. Rather, they exist in relation to other resources (*e.g.*, rocks and minerals, wood, etc.) and/or features (*e.g.*, the sea, mountains, powerful or lazy rivers, etc.), which can afford other tasks as well (*e.g.*, cultivating fields, collecting fuel, etc.). Hence, the distribution and arrangement of resources in a given landscape can afford potters different possibilities of action and can influence how they move over the landscape, which ultimately affects which materials they choose. For example, the co-existence of multiple resources in a given place affords the possibility of undertaking a variety of tasks at the same place and/or time, the scheduling of which can impact spatially, temporally, and socially the discovery and selection of clay sources and, thus, of pot-making. Gosselain and Livingstone Smith (2005) have described several cases in sub-Saharan Africa where potters discover clay in the process of undertaking other tasks, especially the ones that require close observation of the soil (*e.g.*, fetching water, tending gardens, digging foundations, etc.). Kelly *et al.* (2011) have shown through both ethnographic examples from around the world and archaeological examples from the American southwest that, although clay mining is hard work, potters often select sources that afford them a multitude of tasks at the same time, even when they have to travel further to reach them. Arnold (1993, p. 73) has noted that most Quinua potters making pots for a variety of uses other than cooking and brewing maize beer prefer to collect clay from along the banks of an eroded stream bed in a hamlet near their village. Neupert (1999, p. 62) also has noted that in Paradijon, Philippines, men excavate clay from a variety of sources situated exclusively in rice fields at the outskirts of the town, a process that requires considerable social negotiations.

Seeing the sources potters select not only as specific locales but also as histories of the movements of people and their interactions with each other and with their landscape allows us to place the study of pot-making firmly in the scope of landscape studies. Scholars here, as in social geography and in place and space studies, have shown that it is exactly through these interactions that places derive their meanings (*e.g.*, de Certeau 1984; Lefebvre 1991, 1992; Pred 1990; Soja 1989). Places neither determine human action nor are they a neutral slab on which any group of people can assign any meaning. "It is from the relational context of people's engagement with the world… that each place draws its unique significance" (Ingold 2000, p. 192).

Of the many authors who have tackled the mutual constitution of people and space, we draw heavily here on the work of Tim Ingold and his concept of taskscape. A taskscape refers to the "mutual interlocking of the entire ensemble of tasks" that knowledgeable people undertake in a given environment as part of their normal day-to-day life. "Just as a landscape is an array of related features, so—by analogy—the taskscape is an array of related activities" (Ingold 2000, p. 195).

The relation among tasks is both spatial and temporal. Tasks require movement through the landscape that is rhythmic, interwoven with the spatial arrangement and rhythms of other tasks, as well as with the rhythms and movements of other living things (*e.g.*, plants and animals) and phenomena (*e.g.*, daily and seasonal cycles, tides, earthquakes, etc.), as shown repeatedly through ethnoarchaeological work.

The social understanding of any particular task comes from its spatial and rhythmic relation to the many other tasks that are performed, usually by many people working together, as part of daily life. Over time, the rhythmic movements of people, if persistent, become sedimented into the landscape. As Gosselain and Livingstone Smith (2005) have observed in their ethnoarchaeological work in sub-Saharan Africa, finding clay in particular contexts builds expectations that those are the contexts where materials are to be found and orients potters[1] in particular ways within their landscapes. Although a great variety of clays may surround them, their quotidian tasks guide them repeatedly to only certain clays. The performance of habitual tasks in a specific landscape, then, over time orients the movements of potters in that landscape and generates perceptions of where the "appropriate" clays are. Hence, the social

[1] In this paper, we use the term "potter" very loosely to refer to people engaged with the task of pot-making, whether they were recognized as "potters" by their community or not. It is possible that raw materials were not collected by the same individuals who formed the pots, just as it is possible that the people who formed the pots may have not been the same as the ones who decorated them, or the ones who fired them. It is not possible to know, especially in our Neolithic case, whether "potter" was even a recognized and distinct identity.

understanding of any particular place comes over time from all the various tasks that take place there.

There is no doubt that the temporal and spatial arrangement of daily tasks and thus the temporal and spatial perceptions generated by them may also be profoundly interwoven with cosmological understandings of the world. For example, in Siberia, Khanty taboos surrounding the landscape prohibit specific activities in certain locales (Jordan 2001). The particular cosmological meaning may or may not be accessible to us archaeologically. However, the patterned use of space generated by it will be accessible, and a taskscape perspective can help us unveil it.

The relationship between taskscape and landscape is deeply historical and generative. At any point in time, a landscape contains all the previous sedimented taskscapes that impact and structure the current taskscape, which, in turn, affects future potential taskscapes. The historicity of the taskscape/landscape relation and the key role of tasks in this relationship are what make taskscapes so appealing archaeologically.

Shifting Methodologies

We argue that to operationalize the concept of taskscape in ceramic analysis, we must treat archaeological ceramics themselves as congealed taskscapes, since they are the products of the rhythmic interactions among people, materials, things, and landscapes that make up the task of pot-making. To do so demands a novel methodology that, first of all, requires more intensive geological surveys, especially around archaeological sites of interest. By designing micro-regional surveys to examine how clay sources are distributed within a given landscape, what their relation is to other local resources and features, and how internally homogeneous each clay unit is in terms of its raw material qualities, we can explore what a landscape could afford potters.

Secondly, by complementing characterization studies and laboratory test-tile experiments with extensive replicative experiments in the field, we can examine not only the "scientific" qualities of local clays (*i.e.*, what clays are) but also what they could afford potters (*i.e.*, what potters could do with them). We cannot know, of course, the skill of any past potter or how they experienced their raw materials, but that is not the question. The question is: Given our skill, are all the geological clay samples similar or different in what they allow us to do as we try to replicate the pots we find archaeologically? Can we make small and large pots, use coiling or pinching with the same ease, manipulating all samples in the same way? In a lot of archaeological contexts, this material engagement (after Renfrew 2004) is the closest we can come to participant observation.

Finally, by comparing the results of the characterization analyses of archaeological ceramics with those of the geological samples, we can establish not only which sources the ancient potters chose consistently but also which ones they did not. By paying attention both to the selected *and* the ignored sources, the pattern of the potters' engagement with the landscape can emerge, which, in turn, reveals their orientation and, ultimately, their perception of which parts of their landscape were "appropriate" for pot-making and which ones were not.

Moreover, by considering the distribution of the sources selected and ignored in relation to other resources and features, we can reveal which tasks could have been undertaken together and were potentially perceived as linked and which ones were not

(Roddick 2013). For example, it is easy to assume that the collection of clay for pottery and that for architectural daub was connected and the two tasks (pot-making and house-making) were socially linked, but that may have not always been the case and should instead be a question that requires investigation.

Treating archaeological ceramics as congealed taskscapes allows us to explore loci that were meaningful in the lives of past people, yet ephemeral enough to have left no discernible evidence on the landscape itself (like mining great quantities of clays could). We could never examine the spatial aspect of a task like small-scale pot-making by looking for it only in the landscape. At the same time, we cannot understand the interconnection of pot-making with other tasks by looking only at pots themselves. A taskscape approach allows us to do both as well as explore how a sense of place and long-term perceptions of a landscape arise.

In the present paper, we operationalize the concept of taskscape in the context of two small (~25 people each) and neighboring Neolithic communities in southern Calabria: Umbro Neolithic and Penitenzeria (Figs. 1 and 2). This context is challenging. The sites are small and quotidian. Umbro Neolithic is a rockshelter that yielded evidence of everyday social life—yet its available space could have not afforded year round habitation. Penitenzeria, less than 300 m away, revealed a midden that suggested intensive and year round habitation. Our ceramics were all found in layers together, suggesting no differences in how various wares were deposited. The landscape lacks monuments, ritual caves, or burials that could indicate potentially meaningful spaces. Furthermore, the southern Calabrian landscape is incredibly dynamic. Regular and

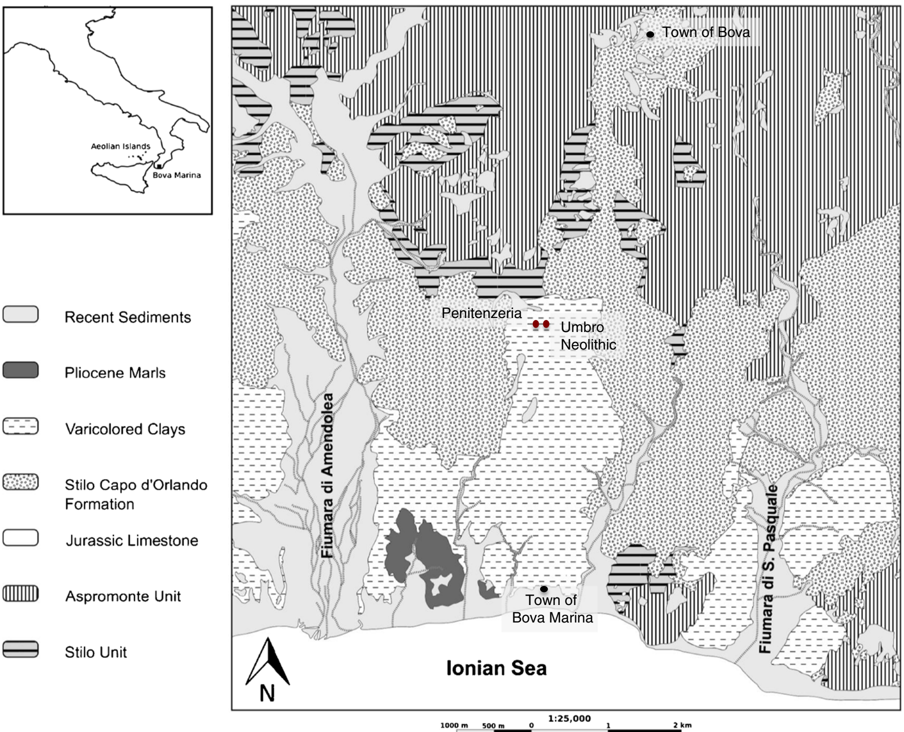


Fig. 1 Geological map of the Bova Marina region modified from Michelaki *et al.* 2012

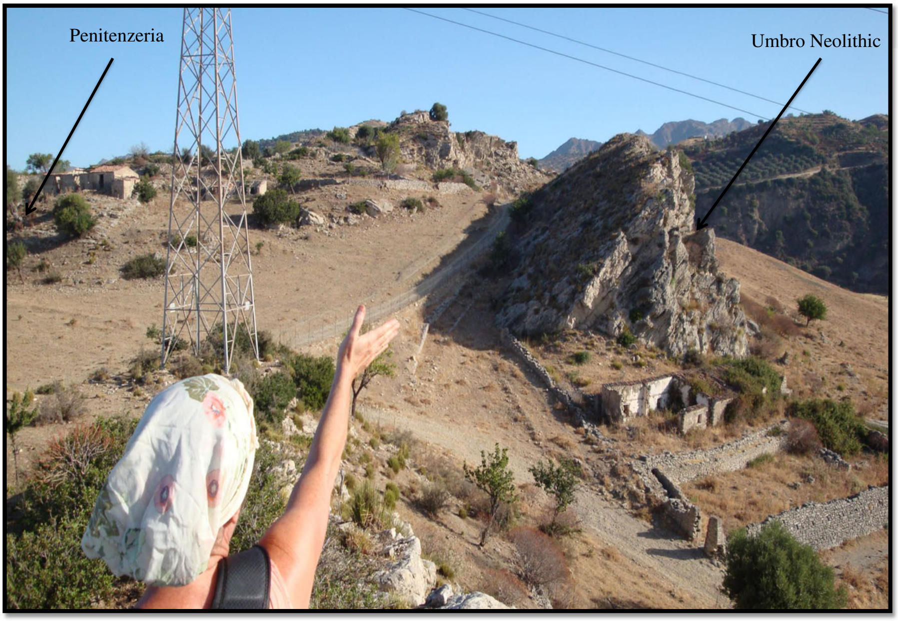


Fig. 2 Umbro Neolithic and Penitenzeria are located less than 300 m away from each other, on the Umbro plateau (photo by K. Michelaki)

often powerful earthquakes, volcanic eruptions, tsunamis, severe storms, mudslides, erosion, and deforestation make the possibility of identifying today the specific locales Neolithic potters had used unlikely and the effort futile. Yet, the main geological units (Fig. 1 and Table 1) remain arranged on the landscape as they were in the Neolithic. It is our desire to show that by treating sources as histories of interactions and ceramics as congealed taskscapes, we can still use our provenance data to explore how people engaged with their landscape even in this archaeologically challenging case. We expect that in regions with richer archaeological, ethnoarchaeological, and ethnographic fieldwork and in landscapes less dynamic than ours, our theoretical and methodological approach will yield even more nuanced understandings than we can produce here.

Background: Umbro Neolithic and Penitenzeria in Their Landscape

Umbro Neolithic and Penitenzeria are both located on a small (<1 km in diameter) limestone outcrop, half-way between the modern towns of Bova Marina and Bova (Superiore) in southwestern Calabria (Figs. 1 and 2), Italy. This outcrop is known locally as the Umbro plateau. At 400 m above sea level (masl), their inhabitants could see hills of sedimentary rocks and minerals spreading to their south, gradually coming to fertile plains composed of recent alluvium right by the Ionian Sea coast, 5 km away (Fig. 3). On clear days, they could see across the waters to Sicily. When Etna, Sicily's largest volcano, would smoke and explode, they could see the lava running down its slopes and feel the tremors under their own feet. To their north, the Aspromonte massif looked like a dark gray wall of hard metamorphic rock (Figs. 1 and 4). Within 5 km

Table 1 Summary of local geology (based on Cavazza and DeCelles 1993, 1998; Cavazza and Ingersoll 2005; Cavazza and Barone 2010; Davies *et al.* 1969; Heymes *et al.* 2008; Parise *et al.* 1997; Pezzino *et al.* 2008)

	Geological period	Geological unit	Description
Neogene carbonate and clastic sediments	Pleistocene–Holocene	Conglomerates and talus deposits	Terrestrial conglomerates and talus deposits
	Pliocene	Marls (PM)	Marls rich in foraminifera, with local intercalations of conglomerates. Part of the coccolith-rich, limestone–marl rhythms of Trubi formation. Devoid of significant terrigenous/conglomerate deposits
	Miocene	Sandstones, calcarenites, and conglomerates	Intercalations of shallow marine sandstones, calcarenites, and conglomerates, covering the SCOF unit and the Varicolored Clays
	Late Cretaceous–Oligocene–Early Miocene	VC	Mega-olistostrome of re-worked block-in-matrix mélange derived from the Ionian accretionary prism. Highly variable. Consists of highly sheared pelitic matrix containing Late Cretaceous microfossils and less deformed blocks of (a) Paleogene calcareous marly turbidites and (b) Oligocene–Early Miocene quartzofeldspathic turbidites. Both matrix and inclusions are exotic: mineralogy, geo-chemistry, fabric, and paleontological content different from all other stratigraphic units of the Ionian forearc basin fill
	Oligocene	SCOF	Sedimentary sequence of breccias and conglomerates. Covered by coarse-grained sandstones, themselves followed by finer sandstones and mudstones. Breccias comprised nearly exclusively by Stillo phyllites and Jurassic carbonates. Conglomerates and sandstones consist of Stilo phyllites and Aspromonte metamorphics and granitoids, as well as carbonate and volcanic clasts. Typically covers the crystalline basement. From Peloritani mountains in Sicily to the Serre massif in Calabria
	Jurassic–Cretaceous	Limestone	Limestone, covering Aspromonte and Stilo units in some areas
Hercynian metamorphosed crystalline basement	Up to Paleozoic	AU	Metamorphosed at amphibolite facies. Characterized by mica-schists, amphibolite, marble intercalations, and large bodies of augen gneiss and intrusive granitoids. Forms main part of Aspromonte massif in Calabria and upper structural unit of Peloritani mountains in northeastern Sicily
		SU	Metamorphosed at greenschist to low amphibolite facies. Characterized by metamorphic phyllite and metarhyolite. Intruded by granitoids. Meta-sedimentary rocks (*e.g.*, quartz–biotite, quartzofeldspathic, and quartz–chloritic biotite-bearing schists. Few basic schists and gneisses

VC Varicolored Clays, *SCOF* Stilo Capo d'Orlando Formation, *AU* Aspromonte unit, *SU* Stilo unit

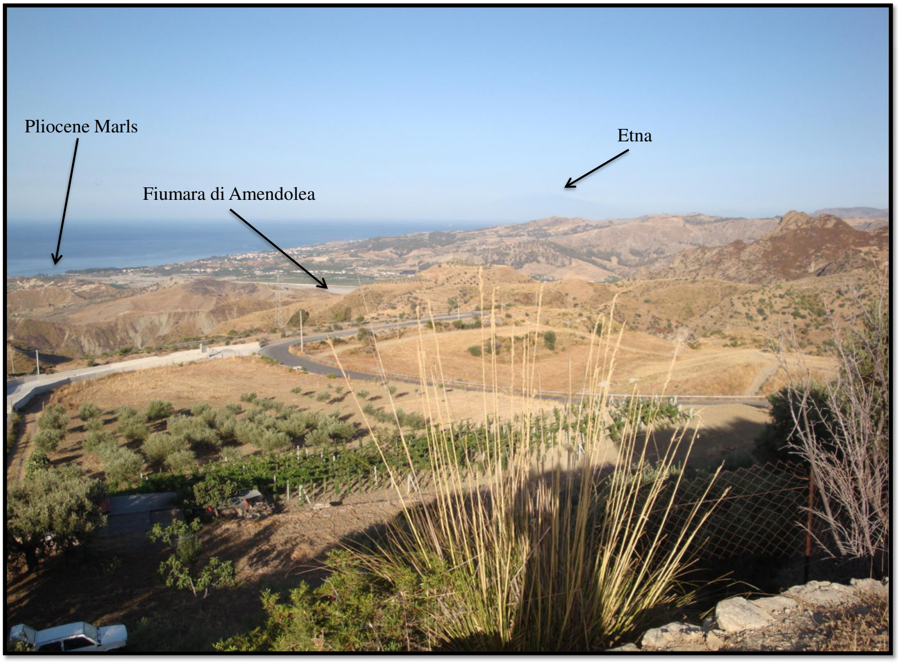


Fig. 3 Picture taken from the edge of Penitenzeria on the Umbro plateau, looking south towards the Ionian Sea (photo by K. Michelaki)

from their homes and through a terrain where steep hillsides were the norm and gentle slopes almost absent, they could reach 1,000 masl and be in the middle of Aspromonte's thick forests. To their east and west, they could see steep ravines dissecting the landscape and adding to its ruggedness. These seasonally flooded ravines (fiumaras) drain mountain areas and, due to their flow regime, have great transport and erosion capacity (Sabato and Tropeano 2004, p. 7). Most of the time they would have been inactive and their beds completely dry. When the rains came, however, from fall to spring, as is typical of Mediterranean climates, the fiumaras could swell with water rushing violently toward the sea, eroding the sides of sedimentary rocks, depositing material by the coast and turning the sea waters brown.

The Aspromonte protected the Umbro Neolithic and Penitenzeria inhabitants from strong northwestern winds and limited the amount of rainfall they received in comparison to what the Neolithic communities along the Tyrrhenian coast to their west received. The wettest days were during the winter, from October to the end of March, followed by the spring and fall. During the winter, the wet periods would last longer (~2 days) followed by dry periods of about 5 days, while in the spring and fall an entire week could go by without any rain. Although it rained less than along the Tyrrhenian coast, it rained harder. Terrain roughness increases from the sea to the land, along with the interaction between the storms from North Africa or the Balkans, and the orography of Aspromonte resulted in a larger number of heavy storms (Federico *et al.* 2009). Summers were hot and dry, sometimes with less than a week's worth of rain throughout the entire season. The breeze from the Ionian Sea would keep them cool during the hot summers, although the southern *scirocco*, hot and humid, could make the sea swell and the atmosphere oppressive (Farr

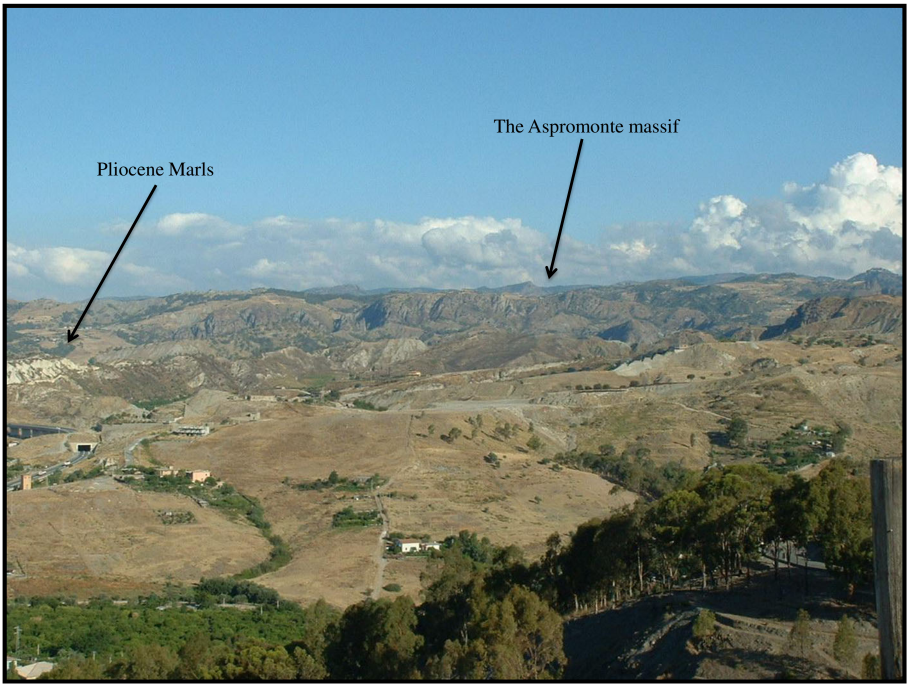


Fig. 4 Picture taken from a position to the southeast of the Umbro plateau, looking northwest toward the Aspromonte massif. Note how distinct the Pliocene Marls appear in the landscape, due to their light color (photo by K. Michelaki)

and Robb 2008). The seasonal variation in rainfall and temperature transformed the appearance of the landscape as well. From dry, brown, and dusty, the land would turn vibrantly multicolored, with a great number and variety of blooming plants.

In this landscape, the Ionian Sea, the Aspromonte massif, and the fiumaras of Amendolea and San Pasquale played a key role in how seasonal cycles were experienced. Layered on top of the seasonal rhythms, less frequent but regular events occurred, such as earthquakes, volcanic eruptions, and tsunamis, given Calabria's position on the Siculo-Calabrian Rift Zone (Catalano *et al.* 2008).

To these rhythms, we must also include those of occupation and daily life. Situated at the foot of the Umbro plateau, the rockshelter of Umbro Neolithic was probably never permanently occupied, but rather repeatedly visited from the Early Neolithic to the Copper Age (ca. 5,685–2,580 cal. BCE) (Robb 2003a, pp. 33–35). Less than 300 m away, on a small terrace (ca. 50×50 m) at the top of the plateau, the small, open-air site of Penitenzeria had a different rhythm: It was intensively occupied during the Early and Middle Neolithic (ca. 5,475–5,040 cal. BCE) (Robb 2003a, pp. 33–35).

Based on the size of the terrace, on the presence of architectural daub, and on the size of huts known from other parts of Calabria, Robb (2007, pp. 31–32) has estimated that no more than 25 people must have lived at Penitenzeria at any time, in no more than two or three small, one-room wattle and daub huts. They tended small gardens of domesticated cereals and legumes; kept small numbers of sheep, goats, cattle, and pigs; and mostly ignored marine resources (Foxhall *et al.* 2006, p. 23). While groundstone tools were made using locally available sedimentary and metamorphic rocks, their chipped stone tools were made overwhelmingly from imported materials. More than 90 % were made of black obsidian from Lipari in the Aeolian Islands, across from Sicily (Fig. 1 inset). They also used chert, mostly from Sicily, and only rarely from the local Condofuri source about 4 km to the west of their homes. Their polished stone axes, adzes, axe-amulets, and miniature axes were made of both local and imported, hard, metamorphic, and igneous rocks (Farr and Robb 2001, pp. 24–26; Farr 2002, pp. 33–36; Robb 2003b, pp. 45–46).

Most interestingly, these tiny communities made an impressive array of hand-built ceramic bowls and jars in colors that ranged from red and orange to brown, gray, and black and textures that varied from rough and coarse to smooth and shiny (Fig. 5). In the eyes of archaeologists and maybe even to those of the Neolithic inhabitants of the Bova Marina region, the stamped geometric designs of their finewares connected their region with all of southern Calabria and eastern Sicily in what is called the Stentinello culture and differentiated them from the communities of other regions to their north and east who instead chose to paint their decorative designs on buff-colored ceramic surfaces. Archaeologically, the ceramics recovered from the Umbro plateau are organized into three types based on their decoration: Impressed, Stentinello, and Undecorated (see Table 2 for summary of basic operational sequences and Fig. 5 for photographs of sherds).

Impressed pots tend to be larger[2] and coarser, with thicker walls, and decoration that includes impressions or incisions over most of the body, arranged randomly or orderly (Fig. 5a). Horizontal wall-thickness inconsistencies and coil breaks suggest that coiling was a common forming method. The walls are typically scraped, but not often consistently smoothed, leaving uneven walls and scraping marks still visible. Burnishing is often applied superficially on the exterior, but sometimes very carefully on the interior. Typical shapes include deep open buckets, sometimes with pedestal or flat bases, as well as shallower open bowls and slightly closed jars. They are thought of as cooking and/or storage pots.

Stentinello pots tend to be smaller[3] and finer, with thinner walls (Fig. 5b). Coil breaks suggest the use of coiling methods, although many of the small bowls could have been formed using a pinching technique. They are often carefully scraped and smoothed with even and well-burnished surfaces. Their decoration includes stamped, geometric designs, arranged along three horizontal bands. Typical shapes include open bowls of various depths and round bases, as well as globular flasks with cylindrical to conical necks. They are thought of as the eating, drinking, and serving vessels.

There are also Undecorated, but burnished pots of various sizes, shapes, and textures (*e.g.*, colanders, open bowls, globular jars, nearly spherical jars with no necks) that could accommodate a variety of functions (Fig. 5c). The fragmentary nature of our assemblage makes it difficult to define their size[4] and full range of shapes with

[2] We have no complete vessels and very few nearly complete vessels from the Neolithic levels of Umbro and Penitenzeria. Size is estimated based on rim diameter and wall thickness. The diameters of *Impressed* ceramics vary from 10 to 28 cm, 14 cm being the most typical. Two thickness categories can be separated: a thinner (5–15 mm) and a thicker (16–25 mm).

[3] *Stentinello* rim diameters range from 6 to 19 cm, with the range of 9–12 cm being the most common. The most common thickness in both sites is between 4 and 8 mm, but there are vessels as thin as 2 mm and a whole category of thick vessels (9–14 mm).

[4] *Undecorated* rim diameters can be divided into two groups: a smaller (5–15 cm) and a larger (16–30 cm), with outliers as large as 40 cm. Their thickness varies from 2 to 14 and 5 to 18 mm, respectively.

Fig. 5 Examples of the early to middle Neolithic ceramic types encountered in Umbro Neolithic and Penitenzeria: **a** Impressed, **b** Stentinello, **c** Undecorated, **d** Buff, and **e** Imported Stentinello (photos by K. Michelaki and J. Robb)

accuracy, since many fragments may represent undecorated zones of decorated pottery. Based on coil breaks, they were also formed using a coiling technique.

At the same time and as in other Stentinello communities, there is a small percentage of ceramics (in our case ca. 4 %) that look odd in the context of the rest of the ceramic assemblage (Fig. 5d). They are buff in color[5] with fine and smooth textures. While some are clearly painted with red or brown designs, most are severely eroded; as a result, neither the nature of their decoration nor the vessel shape of the Umbro/ Penitenzeria examples can be determined. These ceramics have been thought of as imports from Basilicata and Puglia to the east, exchanged for obsidian by communities where buff-painted ceramics were the norm. The implication has been that their exotic origin gave them great value, which, in turn, made them appropriate for deposition in funerary and ritual contexts (Malone 1985). Their function in settlement contexts has not been systematically considered.

Analysis: Sources as Histories of Interactions

The first step in our attempt to understand how the potters of Umbro Neolithic and Penitenzeria engaged with their landscape was to explore what that landscape and the materials within it could afford them. Our purpose in designing a raw materials survey was not to reveal the specific locales the potters would have used. As described above,

[5] In Umbro and Penitenzeria, "Buff" means colors that vary from pale yellow (2.5Y 8/2) to very pale brown (10YR 7/3, 10YR 7/4, 10YR 8/3, 10YR 8/4) to pale brown (10YR 6/3) to pink (7.5YR 7/4, 7.5YR 8/4) and reddish yellow (7.5YR 6/6).

Table 2 Summary of major operational sequence steps for each ceramic type made in Umbro Neolithic and Penitenzeria

Operational sequence steps		Impressed	Stentinello	Undecorated	Buff
					
Raw Materials	Source	Metamorphic (from variety of sources within the Metamorphic Unit)			Varicolored, possibly from source close to the Metamorphic
	Texture	Medium, coarse	Fine, medium, coarse		
Forming and finishing	Forming technique	Coils	Coils, pinching	Coils, possible pinching	No evidence
	Wall thickness	Thicker	Thinner	Thin to thick	Thin
	Surface finish	Smoothed, sometimes burnished	Typically burnished	Always burnished	Possibly burnished
	Decoration	Impressed, rarely with white paste inside impressions	Stamped, with possible cord impressions Some times with white paste and less frequently with red or yellowish paste	No decoration	Painted (in red and brown colors)
	Design	Lines and impressions of various tools, sometimes orderly arranged	Geometric designs, always horizontally arranged in bands	-	Bands
Firing	Atmosphere	Oxidizing, neutral, reducing, and sometimes alternating among them Occasional smudging			Consistently oxidizing
	Duration	Not long enough to burn organics from the core			Long enough to burn organics from the core
	Fuel/pot arrangement	Fire clouds suggest pots touched the fuel and/or other pots			No fire clouds
	Fired color	Orange, brown, gray, black			Buff
Tools	Tools required	Scraping and burnishing tools, sticks, shell, etc. for impressing, tools required for preparing the white paste	Scraping and burnishing tools, clay *stampini*, cords, tools required for preparing the white, red, yellow paste	Scraping and burnishing tools	Scraping and burnishing tools, brushes, binders, and other tools for preparing the paint
Rhythms	Production rhythm	Regular and frequent			Possibly regular but infrequent

the geological and environmental context over the last 8,000 years make it highly unlikely that any of the specific locales and materials used in the Neolithic are still available today. Instead, our goal was to understand how many different kinds of clay sediment units were available, how they were distributed in the landscape, what their properties were in comparison to each other, and how consistent or variable these properties were within each unit.

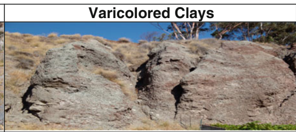
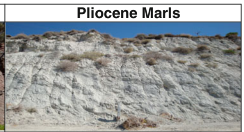
To this effect, we undertook a raw materials survey, collecting rock, mineral, and clay sediments from each geological unit in the area defined by the Ionian Sea to the south, the Aspromonte massif to the North, the fiumara di Amendolea to the west, and the fiumara di San Pasquale to the east (Fig. 1)—approximately a 4-km radius around the Umbro plateau. No Neolithic activity is known in the upland areas until the Late Neolithic, making the foothills of the Aspromonte a reasonable survey boundary to the north (Foxhall *et al.* 2006). The Ionian Sea is a natural border to the south. The area between the two fiumaras contains all the different major geological units found in the broader region of southeastern Calabria and was considered an appropriate initial stopping point. Given the verticality of the landscape and the fact that the Neolithic potters of the Umbro plateau could have only relied on their own bodies for the transportation of their raw materials, the overall 4 km radius of our survey fits within the 1- to 7-km distance often traveled by potters in ethnographically known cases (Arnold 1985, p. 50 and Table 2.1).

The exact location of our samples (n=41) and a detailed presentation of the mineralogical and chemical characteristics of the clays collected, based on X-ray diffraction, optical microscopy, and instrumental neutron activation analysis, can be found in Michelaki *et al.* 2012. Replicative pot-making in the field and experiments undertaken using standardized test-tiles gave us an intimate understanding of the mineralogical and chemical characteristics of the clay sediments, along with their texture, plasticity, plastic range, shrinkage, and firing behavior and the kinds of forming techniques, vessel shapes/sizes, textures, and colors they could afford potters. This work has also been published in Michelaki *et al.* 2012 and shall not be repeated in detail here.

In summary, we were able to identify three broad clay units that matched very closely the surficial geology (see Table 1 for a description of individual geological units and Fig. 1 for their distribution in the landscape): the Metamorphic and Stilo Capo d'Orlando Formation unit (from now on "the Metamorphic Clays"), the Varicolored Clays, and the Pliocene Marls. Although distinguishable, these units vary along a continuum and could afford different options to potters (see Table 3 for side-by-side comparison of the three clay units).

The Metamorphic Clays and the Pliocene Marls form the two extremes of the continuum. The Metamorphic Clays are widely distributed, mostly to the north and in the immediate vicinity of the plateau, but also in isolated areas all the way to the coast. They are related to the Hercynian metamorphosed local crystalline basement. In

Table 3 Summary description of geological clay samples and their properties based on Michelaki *et al.* 2012

	Metamorphic + SCOF	Varicolored Clays	Pliocene Marls
			
Field distribution	From north of Umbro plateau to the coast in association with rock outcrops and conglomerate exposures	From Umbro plateau to the coast on large rolling hills	Limited to the coast
Field color (unfired)	Bluish gray, gray, light greenish gray, light gray (Gley 1/2.5Y/5Y)	Weak red, reddish brown, light yellowish brown, light brownish gray, light gray, dark reddish (10R/2.5YR/5YR/10YR)	Very pale brown, pale yellow, light gray, white (10YR/2.5Y/5Y
Texture	Mostly coarse, but also medium	Mostly fine, and rarely medium (RMS 87), or coarse (RMS 67)	Fine
Clay minerals[a]	Mica/illite (24–32 %), chlorite (15–28 %), kaolinite (0–7 %)	Mica/illite (<5–25 %), smectite (10–65 %), chlorite (0–25 %), kaolinite (0–15 %)	Mica/illite (5–10 %), smectite (0–10%), chlorite (0–10 %), kaolinite (0–<5 %)
Carbonates[a]	0 % (except SCOF samples 62 [0.6 %] and 65 [10 %])	11–20 % (except samples 6, 66, and 88 [0 %])	55–64 %
Sandstone[b]	3–19 %	2–5 % (except RMS 71, 72 [0 %], and 67 [12 %])	0 %
Schist[b]	3–12 % (except SCOF samples 65 and 73 [0–0.7 %])	0 %	0 %
Plasticity	Balanced	Varied	High
Plastic Range	Wide	Varied	Narrow
Shrinkage	Not significant	Severe	Not significant
Fired color (700 °C)	Light reddish brown, reddish yellow (5YR/7.5YR)	Red, light yellowish brown, yellowish red, light reddish brown, reddish yellow, light brown, pink (10R/5YR/7.5YR/10YR)	Pink, pinkish white, light gray, very pale brown (7.5YR/10YR)
Fired color (800 °C)	Light reddish brown, reddish yellow (2.5YR/5YR)	Dark red, red, light red, yellowish red, reddish yellow (10R/2.5YR/5YR/7.5YR/10YR)	Pink, pinkish white, light gray, very pale brown (7.5YR/10YR/2.5Ψ)

[a] Mineral identification and percentages based on pXRD (Michelaki *et al.* 2012, Table 3, p. 241)

[b] Mineral identification and percentages based on optical microscopy (Michelaki *et al.* 2012, Table 4, p. 243)

contrast, the Pliocene Marls are concentrated along the coast, being the products of the limestone-marl rhythms of the local Trubi formation.

The Metamorphic Clays are typically light to dark gray in the field. They are coarse, residual clays that contain mostly sandstone and metamorphic aplastics (*e.g.*, phyllites, micaceous schists, granitic gneiss) but no carbonates—except for very few in some Stilo Capo d'Orlando Formation samples. The Pliocene Marls, on the other hand, are yellow or white, fine, sedimentary clays and contain frequent carbonates without any sandstone or metamorphic inclusions.

The Metamorphic Clays are plastic and have a wide plastic range. In that respect, they become workable even by the hands of the inexperienced who do not yet know the proper ratio of clay to water. The Pliocene Marls, on the other hand, have a very narrow plastic range. A little more water than necessary and they transform into a sticky unworkable mass, easily frustrating the novice. They are also highly plastic, making it challenging for the less skilled to keep the walls of pots from slumping. While the Metamorphic Clays turn reddish under oxidizing conditions, the Pliocene Marls remain light in color.

Although there is variation within each of these units with respect to clast size, frequency, and mineralogy, their overall properties are consistent. The Metamorphic Clays react similarly with water and afford reddish firing pots, from wherever one collects them within the entire Metamorphic and Stilo Capo d'Orlando Formation unit. Similarly, any clay from within the Pliocene Marls is very plastic and affords consistently light-colored pots, under oxidizing conditions and temperatures between 600 and 1,000 °C.

In the middle of the continuum are the Varicolored Clays, surrounding the Umbro plateau and continuing in large rolling hills all the way to the coast. They are a highly variable mélange of exotic origin, not related to the crystalline basement. Emplacement of the mélange was triggered by tectonic instability caused by the onset of the continental collision of the Corsica–Sardinia–Calabria–Peloritani microplate with the northern margin of the African plate during the late Burdigalian–Langhian time. The tectonic fabric of the mélange developed within the accretionary prism. The heterogeneous blocks enclosed within the highly sheared pelitic matrix (*i.e.*, the blocks of Paleogene calcareous marly turbidites and those of Oligocene–Early Miocene quartzofeldspathic turbidites) originated as basin-plain and trench (or trench-slope) deposits. Portions of these lower plate deposits were incorporated in the accretionary prism during subduction along the Ionian trench. Parts of the prism were then uplifted, eroded, and deposited en masse within the adjacent Ionian forearc basin during incipient collision along the southern margin of the Corsica–Sardinia–Calabria–Peloritani microplate (Cavazza and DeCelles 1998, p. 226; Cavazza and Barone 2010).

The Varicolored Clays are characterized mostly by their heterogeneity and overall inconsistency. Their colors vary in the field from various shades of red to various shades of brown and gray. They include greater frequencies of carbonate clasts than the Metamorphic Clays and fewer than the Pliocene Marls. However, the carbonates are not evenly distributed throughout the unit, nor are they correlated with the color of the clay in the field. For example, it is typical to encounter gray and deep red clays mixed with each other (see, for example, the photo for Varicolored Clays in Table 3). In some areas, the gray clays are rich in carbonates, while the red ones are poor (*e.g.*, raw materials samples 86 and 87), and in other areas, the exact opposite is true (*e.g.*, raw materials samples 66 and 67), without any further differences in appearance, texture, or plasticity (Michelaki *et al.* 2012). While they commonly include sandstones, they rarely have any metamorphic inclusions. On average, they shrink the most in comparison to the other two clay units, probably because they include larger amounts of smectite. Most importantly, however, their behavior with water and fire is not consistent. Their plasticity and plastic range can vary and so does their color when they are fired. Some clays within this unit can afford a light-colored pot (*e.g.*, light brown or pink), by 700 °C, while others will give a reddish firing one. Interestingly, by 800 °C and as the temperature rises further, the light colors disappear. In other words, this unit of clays could afford the making of a Buff pot, but only by someone knowledgeable in terms of which clays specifically could afford light fired colors and capable of keeping the firing temperature below 800 °C.

Pots as Contained Action: Selecting the Sample and Acquiring the Data

To understand the task of the potters, we turned our attention to a sample of sherds from both Umbro Neolithic and Penitenzeria, representing all ceramic types and macroscopic fabric variations within them (n=178) (Table 4). This sample was collected from the secure Neolithic layers of each site to represent potential chronological variations within and between the sites, but no such variations were detected. Based on the co-existence of all four ceramic wares in the same layers, we treat all wares as having been present at the same time in Umbro Neolithic and Penitenzeria. Our sampling also ensured that variation based on the presence, absence, and relative amounts of visible carbonates and/or schists and the texture of the sherds within each ceramic ware was also represented. Both the surfaces and a fresh cut on each sherd were examined under a ×10 magnifying lens and a low power binocular stereoscope to establish the macroscopic fabrics. The entire sample was then closely examined macroscopically. From it, further smaller collections of sherds were then selected for re-firing tests (n=60) as well as petrographic (n=84) and instrumental neutron activation (n=163) analyses, techniques that had also been used in the analysis of the local clays (Michelaki *et al.* 2012). Subtle decorative differences exist between Umbro Neolithic and Penitenzeria, suggesting either the presence of micro-styles or slight temporal differences. However, in this paper we treat the material from both as one entity, since neither mineralogical nor chemical analyses could separate them, indicating similar interactions with the local landscape.

We asked three questions of our ceramic sample: (1) Were the ceramics from the Umbro plateau made of local clays? (2) Did the potters collect clays from each of the three clay units we were able to identify? (3) Did they use all the clays they collected for each ceramic type, or did they only use certain sediments for certain types?

First we undertook re-firing tests (n=60) in an electric kiln (Cress Electric Kiln C-100E) under oxidizing conditions. Variations in the degree of oxidation of carbon and iron during firing can result in variations in color among pots that are otherwise identical (Rice 1987, p. 343). By re-firing a small chip, cut off of each ceramic sherd, at 900–950 °C, we eliminated the effect of firing, since 900 °C are both higher than the estimated original firing temperature of our sample and adequate for color from any iron in the sherds to develop fully (Rice 1987, p. 335). Maximum temperature was

Table 4 Summary description of geological clay samples and their properties based on Michelaki *et al.* 2012

ID	Type	Site	Period	Texture	Chemical group	Petrographic group
1191-14	Impressed	Umbro Neolithic	E–M Neolithic	Medium	NA	Fabric 1a
1284-5	Impressed	Umbro Neolithic	E–M Neolithic	Coarse	Metamorphic	Fabric 1b
1399-9	Impressed	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1302-6	Impressed	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1290-6	Impressed	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1252-8+9	Impressed	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1410-5	Impressed	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	Fabric 1c
1121-19	Impressed	Umbro Neolithic	E–M Neolithic	Coarse	Metamorphic	Fabric 1c
1330-2	Impressed	Umbro Neolithic	E–M Neolithic	Coarse	Metamorphic	Fabric 1c
1283-7	Impressed	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	Fabric 1d
1219-2	Impressed	Umbro Neolithic	E–M Neolithic	Coarse	Metamorphic	NA
1392-2	Impressed	Umbro Neolithic	E–M Neolithic	Coarse/very coarse	Metamorphic	NA
1025-A	Impressed	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	NA
1195-2	Impressed	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	NA
1022-29	Impressed	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1102-41	Impressed (rocker)	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1104-1	Impressed	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1211-A	Impressed	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1935-8	Impressed	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic	NA
1943-16	Impressed	Penitenzeria	E–M Neolithic	Medium	Metamorphic	NA
2051-59	Impressed	Penitenzeria	E–M Neolithic	Medium	Metamorphic	NA

Table 4 (continued)

ID	Type	Site	Period	Texture	Chemical group	Petrographic group
2131-37	Impressed	Penitenzeria	E–M Neolithic	Medium	Metamorphic	NA
2161-1	Impressed	Penitenzeria	E–M Neolithic	Medium	Metamorphic	NA
1931-16+17	Impressed	Penitenzeria	E–M Neolithic	Medium/coarse	Metamorphic	NA
1895-10	Impressed	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2119-7+8+9+10	Impressed	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2136-2	Impressed	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2160-26	Impressed	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2095-23	Impressed	Penitenzeria	E–M Neolithic	Coarse/very coarse	Metamorphic	NA
1303-1	Stentinello	Umbro Neolithic	E–M Neolithic	Fine	Metamorphic	Fabric 1a
1393-2	Stentinello	Umbro Neolithic	E–M Neolithic	Fine	Metamorphic	Fabric 1a
1129-1	Stentinello	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1a
1118-1	Stentinello	Umbro Neolithic	E–M Neolithic	Fine/medium	NA	Fabric 1b
1125-1	Stentinello	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1b
1430-B	Stentinello	Umbro Neolithic	E–M Neolithic	Fine/medium	Metamorphic	Fabric 1c
1328-1	Stentinello	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1291-2	Stentinello	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1430-A	Stentinello	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	Fabric 1c
1285-1b	Stentinello	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	Fabric 1c
1011-6	Stentinello	Umbro Neolithic	E–M Neolithic	Coarse	Metamorphic	NA
1025-14	Stentinello	Umbro Neolithic	E–M Neolithic	Fine	Metamorphic	NA
1030-1	Stentinello	Umbro Neolithic	E–M Neolithic	Fine/medium	Metamorphic	NA
1134-1	Stentinello	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	NA

Table 4 (continued)

ID	Type	Site	Period	Texture	Chemical group	Petrographic group
1231-A	Stentinello	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1035-7	Stentinello	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1118-23	Stentinello	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1219-A	Stentinello	Umbro Neolithic	E–M Neolithic	Coarse	Metamorphic	NA
2131-7	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	Fabric 1a
1831-1	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	Fabric 1a
2144-17	Stentinello	Penitenzeria	E–M Neolithic	Fine	NA	Fabric 1a
1642-5	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	Fabric 1a
2051-4	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
2158-13	Stentinello	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic	Fabric 1a
2119-4	Stentinello	Penitenzeria	E–M Neolithic	Medium	NA	Fabric 1c
2078-24	Stentinello	Penitenzeria	E–M Neolithic	Medium	Metamorphic	Fabric 1c
2139-2	Stentinello	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	Fabric 1c
1642-10	Stentinello	Penitenzeria	E–M Neolithic	Very fine	Metamorphic	NA
1860-4	Stentinello	Penitenzeria	E–M Neolithic	Very fine	Metamorphic	NA
1885-4	Stentinello	Penitenzeria	E–M Neolithic	Very fine	Metamorphic	NA
2092-3	Stentinello	Penitenzeria	E–M Neolithic	Very fine	Metamorphic	NA
2126-1	Stentinello	Penitenzeria	E–M Neolithic	Very fine	Metamorphic	NA
2114-2	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
2140-4	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
2158-15	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
2159-19	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
1693-1	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA

Table 4 (continued)

ID	Type	Site	Period	Texture	Chemical group	Petrographic group
1860-1	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
1887-1	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
2037-8	Stentinello	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
2063-1	Stentinello	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2138-3	Stentinello	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2138-4	Stentinello	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2166-7	Stentinello	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2093-23	Stentinello?	Penitenzeria	E–M Neolithic	Medium	Pliocene Marls	Fabric 3
1831-12	Stentinello?	Penitenzeria	E–M Neolithic	Medium	Pliocene Marls	Fabric 3
2086-3	Undecorated	Penitenzeria	E–M Neolithic	Medium	NA	Fabric 3
1934-28	Undecorated	Penitenzeria	E–M Neolithic	Medium/coarse	Pliocene Marls	Fabric 3
1392-8	Undecorated	Umbro Neolithic	E–M Neolithic	Coarse	Metamorphic	Fabric 1b
1252-4	Undecorated	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1088-A	Undecorated	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1070-A	Undecorated	Umbro Neolithic	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1215-13	Undecorated	Umbro Neolithic	E–M Neolithic	Fine	Metamorphic	NA
1070-B	Undecorated	Umbro Neolithic	E–M Neolithic	Fine/medium	Metamorphic	NA
1328-7	Undecorated	Umbro Neolithic	E–M Neolithic	Coarse/very coarse	Metamorphic	NA
1066-5	Undecorated	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1152-1	Undecorated	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1173-A	Undecorated	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
1210-A	Undecorated	Umbro Neolithic	E–M Neolithic	Medium/coarse	Metamorphic	NA
2118-5	Undecorated—ringbase	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic	Fabric 1a

Table 4 (continued)

ID	Type	Site	Period	Texture	Chemical group	Petrographic group
1831-4	Undecorated—ring base	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic	Fabric 1a
2093-10	Undecorated—ring base	Penitenzeria	E–M Neolithic	Medium	Metamorphic	Fabric 1a
1642-8	Undecorated—ring base	Penitenzeria	E–M Neolithic	Fine	NA	Fabric 1b
2037-54	Undecorated	Penitenzeria	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1909-46	Undecorated	Penitenzeria	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1909-47	Undecorated	Penitenzeria	E–M Neolithic	Medium	NA	Fabric 1c
2101-1	Undecorated—pedestal base	Penitenzeria	E–M Neolithic	Medium	Metamorphic	Fabric 1c
2131-11	Undecorated—ring base	Penitenzeria	E–M Neolithic	Medium	NA	Fabric 1c
1960-5	Undecorated—ring base	Penitenzeria	E–M Neolithic	Medium	Metamorphic	Fabric 1c
1858-5	Undecorated—pedestal base	Penitenzeria	E–M Neolithic	Medium/coarse	Metamorphic	Fabric 1c
1955-20	Undecorated	Penitenzeria	E–M Neolithic	Medium/coarse	Metamorphic	Fabric 1c
1858-1	Undecorated	Penitenzeria	E–M Neolithic	Medium/coarse	Metamorphic	Fabric 1c
2158-21	Undecorated—pedestal base	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	Fabric 1c
1694-4	Undecorated—pedestal base	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	Fabric 1c
2089-7	Undecorated	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	Fabric 1c
1879-10	Undecorated	Penitenzeria	E–M Neolithic	Coarse	NA	Fabric 1c
2031-36	Undecorated	Penitenzeria	E–M Neolithic	Very fine	Metamorphic	NA
2131-38	Undecorated	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
1895-12	Undecorated	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
2021-1	Undecorated	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
2087-4	Undecorated	Penitenzeria	E–M Neolithic	Fine	Metamorphic	NA
1858-13	Undecorated	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic	NA
1959-11	Undecorated	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic	NA

Table 4 (continued)

ID	Type	Site	Period	Texture	Chemical group	Petrographic group
2036-4	Undecorated	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic	NA
2038-69	Undecorated	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic	NA
2048-8	Undecorated	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic	NA
1831-15	Undecorated	Penitenzeria	E–M Neolithic	Medium	Metamorphic	NA
2037-77	Undecorated	Penitenzeria	E–M Neolithic	Medium	Metamorphic	NA
2098-8	Undecorated	Penitenzeria	E–M Neolithic	Medium	Metamorphic	NA
2047-3	Undecorated	Penitenzeria	E–M Neolithic	Medium/coarse	Metamorphic	NA
1694-25	Undecorated	Penitenzeria	E–M Neolithic	Medium/coarse	Metamorphic	NA
2064-29	Undecorated	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2098-41	Undecorated	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
2117-7	Undecorated	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	NA
1882-10	Undecorated	Penitenzeria	E–M Neolithic	Very coarse	Metamorphic	NA
2094-12	Undecorated	Penitenzeria	E–M Neolithic	Very coarse	Metamorphic	NA
2100-3	Undecorated	Penitenzeria	E–M Neolithic	Very coarse	Metamorphic	NA
2142-1	Undecorated	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	Fabric 1d
2134-2	Undecorated	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	Fabric 1d
2035-24	Undecorated	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	Fabric 1d
2036-22	Undecorated	Penitenzeria	E–M Neolithic	Coarse	Metamorphic	Fabric 1d
1330-13	Buff	Umbro Neolithic	E–M Neolithic	Coarse	Metamorphic and/or Varicolored Clays	Fabric 2a
1108-1	Buff	Umbro Neolithic	E–M Neolithic	Fine/medium	Metamorphic and/or Varicolored Clays	Fabric 2b
2050-26	Buff	Penitenzeria	E–M Neolithic	Fine	NA	Fabric 2a

Table 4 (continued)

ID	Type	Site	Period	Texture	Chemical group	Petrographic group
1961-13	Buff	Penitenzeria	E–M Neolithic	Fine	Metamorphic and/or Varicolored Clays	Fabric 2a
1895-26	Buff	Penitenzeria	E–M Neolithic	Fine	Metamorphic and/or Varicolored Clays	Fabric 2a
2167-23	Buff	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic and/or Varicolored Clays	Fabric 2a
2035-6	Buff	Penitenzeria	E–M Neolithic	Fine/medium	Metamorphic and/or Varicolored Clays	Fabric 2a
2140-18	Buff	Penitenzeria	E–M Neolithic	Fine	Varicolored Clays	Fabric 2b
2183-4	Buff	Penitenzeria	E–M Neolithic	Fine	Varicolored Clays	Fabric 2b
1860-22	Buff	Penitenzeria	E–M Neolithic	Medium/coarse	Varicolored Clays	Fabric 2b
1943-18	Buff	Penitenzeria	E–M Neolithic	Very coarse	Varicolored Clays	Fabric 2b
2166-24	Buff	Penitenzeria	E–M Neolithic	Fine		NA
1895-18	Buff	Penitenzeria	E–M Neolithic	Medium		NA
1913-9	Buff	Penitenzeria	E–M Neolithic	Coarse		NA
1329-3	Diana	Umbro Neolithic	Late Neolithic	Fine	Metamorphic and/or Varicolored Clays	Fabric 2a
1111-18	Diana	Umbro Neolithic	Late Neolithic	Fine/medium	NA	Fabric 2a
1293-4	Diana	Umbro Neolithic	Late Neolithic	Fine/medium	Metamorphic and/or Varicolored Clays	Fabric 2a
1110-22	Diana	Umbro Neolithic	Late Neolithic	Medium	Varicolored Clays	Fabric 2b
1120-1	Diana	Umbro Neolithic	Late Neolithic	Medium	Varicolored Clays	Fabric 2b
1151-5	Diana	Umbro Neolithic	Late Neolithic	Medium	Metamorphic	Fabric 1e
1392-3	Diana	Umbro Neolithic	Late Neolithic	Fine		NA

Table 4 (continued)

ID	Type	Site	Period	Texture	Chemical group	Petrographic group
1017-19	Diana	Umbro Neolithic	Late Neolithic	Fine		NA
1108-18	Diana	Umbro Neolithic	Late Neolithic	Fine		NA
1113-1	Diana	Umbro Neolithic	Late Neolithic	Medium		NA
1127-1	Diana	Umbro Neolithic	Late Neolithic	Medium		NA
1118-3	Diana	Umbro Neolithic	Late Neolithic	Medium/coarse		NA
1153-2	Diana	Umbro Neolithic	Late Neolithic	Medium/coarse		NA
1215-A	Diana	Umbro Neolithic	Late Neolithic	Medium/coarse		NA
1051-26	Diana	Umbro Neolithic	Late Neolithic	Coarse		NA
2050-6+7	Diana	Penitenzeria	Late Neolithic	Fine/medium	Metamorphic and/or Varicolored Clays	Fabric 2a
2143-3	Diana	Penitenzeria	Late Neolithic	Very fine	NA	Fabric 1e
2164-4	Diana	Penitenzeria	Late Neolithic	Medium/coarse	NA	Fabric 1e
2036-11	Diana	Penitenzeria	Late Neolithic	Medium		NA
1840-14	Diana	Penitenzeria	Late Neolithic	Coarse		NA
1070-31	Buff/Diana	Umbro Neolithic	Neolithic	Medium		NA
1108-3	Buff/Diana	Umbro Neolithic	Neolithic	Medium		NA
1120-19	Buff/Diana	Umbro Neolithic	Neolithic	Very fine		NA
1161-A	Buff/Diana	Umbro Neolithic	Neolithic	Fine		NA
1171-A	Buff/Diana	Umbro Neolithic	Neolithic	Fine		NA
1070-C	Buff/Diana	Umbro Neolithic	Neolithic	Very fine		NA
2100-5	Buff/Diana	Penitenzeria	Neolithic	Fine	NA	Fabric 1e
1881-9	Buff/Diana	Penitenzeria	Neolithic	Fine/medium	Metamorphic	Fabric 1e
2030-14	Buff/Diana	Penitenzeria	Neolithic	Coarse	Metamorphic	Fabric 1e

Table 4 (continued)

ID	Type	Site	Period	Texture	Chemical group	Petrographic group
2036-37	Buff/Diana	Penitenzeria	Neolithic	Fine/medium	NA	Fabric 2a
1895-18	Buff/Diana	Penitenzeria	Neolithic	Medium	Metamorphic and/or Varicolored Clays	Fabric 2a
2166-24	Buff/Diana	Penitenzeria	Neolithic	Fine/medium	NA	Fabric 2b
2119-21	Buff/Diana	Penitenzeria	Neolithic	Fine		NA
1894-13	Buff/Diana	Penitenzeria	Neolithic	Medium		NA

Shading indicates the samples for which both petrography and INAA were performed achieved gradually in the kiln in 3.5 h and was kept stable for 1 h. After that, we turned off the kiln and allowed it to cool down overnight before the samples were removed. A Munsell soil color chart was used to record the colors of the sherds before and after the re-firing.

We also undertook a petrographic analysis of thin sections ($n=84$) to ascertain both the relation of our ceramics with each of the three local clay sediment units and the technological skill of the potters. Our method followed broadly Whitebread's technique (1995, pp. 365–396) and has been described in further detail in Michelaki *et al.* (2012, p. 240).

Finally, we submitted samples of 163 archaeological ceramics, for instrumental neutron activation analysis (INAA) at the Centre for Neutron Activation Analysis (CNAA), at the McMaster University Nuclear Reactor. After washing and drying the sherds to be analyzed, we cleaned off a 2×2-cm portion of each sherd by removing all surfaces with a diamond burr. We washed the exposed surfaces with de-ionized water and allowed the sherds to dry overnight. After pulverizing them in an agate mortar, we transferred them into labeled liquid scintillation vials by first damping each powdered sample into a filter paper cone. The samples were then dried in a desiccating oven at 100 °C for 48 h. All equipment and surfaces were scrubbed and rinsed with de-ionized water after each sample was prepared, to reduce the risks of cross-sample contamination and airborne dust. We then submitted the vials for irradiation and counting, the process of which has been described in detail in Michelaki *et al.* (2012, p. 240).

Once we received the analytical data, we first checked for reliability using visual assessments and bivariate plots (see Michelaki and Hancock 2011, pp. 3–8 for process and rationale). The data were then examined using bivariate plots, principal component analysis (PCA), as well as both hierarchical and K-means cluster analyses and discriminant function analysis. We considered the data for all the reliable elements, as well as the same data after they were logarithmically transformed ($\log_{10}$). Since our primary desire was to understand whether and how our ceramics matched the local clays, we then examined the three previously defined categories of local clays (Michelaki *et al.* 2012). The elements calcium (Ca), potassium (K), thorium (Th), barium (Ba), chromium (Cr), hafnium (Hf), cesium (Cs), and all the rare earth elements varied significantly among the three clay groups. We repeated the statistical analyses mentioned above using the logarithmically transformed data for only Ca, K, Th, Ba, Cr, Hf, Cs, as well as lanthanum (La) and europium (Eu) to represent the rare earth elements (see Baxter and Jackson 2001, Michelaki and Hancock 2011, and Michelaki *et al.* 2013 for the dangers of using too many uninformative elements in multivariate analyses).

The results presented here and all the associated graphs are based on the latter analyses, which provided the clearest picture for the relationship between archaeological sherds and local geological clays. Furthermore, the graphs shown in this paper focus specifically on the 69 samples for which we have both petrographic and INAA information (Table 4). These 69 samples include material from all known types (Impressed, Stentinello, Undecorated, Buff) as well as five examples of sherds that we could not stylistically assign with certainty to either Buff ceramics or Diana ceramics, the Late Neolithic type characteristic in southern Italy. They also include six clearly Late Neolithic Diana samples because during our mineralogical and chemical studies, we could not always separate them from Buff ceramics either. The Diana examples will be discussed here only as they relate to the Early and Middle Neolithic

Buff samples. No matter whether we examine only the petrographic data, only the INAA data, or a combination of the two, in essence our results remain consistent.

Results: Observing Patterns

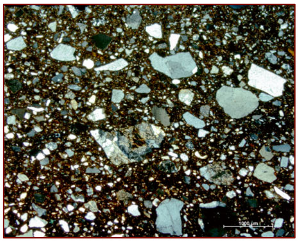
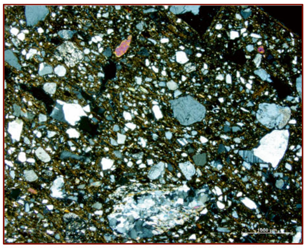
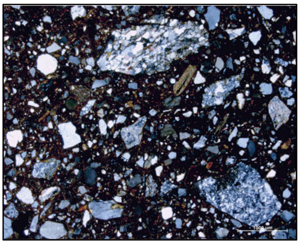
Our re-firing tests quickly revealed that all the Stentinello, Impressed, and Undecorated samples turned red (2.5YR 4/6 and 2.5YR 5/8). In comparison to the colors of our experimental test tiles fired at the same temperatures, these sherd colors were consistent with both the Metamorphic and the Varicolored Clays (see Michelaki *et al.* 2012, pp. 238–239 and Table 1). The majority of the Buff and some of the Diana samples, on the other hand, turned reddish yellow (5YR 6/8), with the exception of a single Diana sherd (2164-4), which turned yellowish red (5YR 5/8). These colors, although distinctly different from those of the Stentinello, Impressed, and Undecorated ones, are also consistent with both the Metamorphic and the Varicolored Clays. Finally, two of the Buff samples exhibited atypical colors. Sample 1961-13 turned reddish yellow (7.5YR 6/6) and sample 2183-4 turned pink (7.5YR 8/3), colors that are consistent with both the Varicolored Clays and the Pliocene Marls. In summary, what we learned from the re-firing tests was that the Stentinello, Impressed, and Undecorated ceramics were made with very similar clays, which were distinct from those used for the Buff and Diana.

Petrographic analysis supported the re-firing test results and refined their assignment to geological units (Table 5 and Figs. 6 and 7). Petrographically, the Impressed, Stentinello, and Undecorated samples belonged to the same fabric—fabric 1—which was consistent with the local Metamorphic Clays. Fabric 1 was characterized by the presence of rock fragments derived from granitic gneiss, as well as metapelitic (phyllite, biotite-, and muscovite-schist), metasedimentary (quartzite), and sedimentary (micaceous sandstone) rock fragments, the latter frequently exhibiting low-grade metamorphism in the form of schistosity, sorting, and quartz strain. Both metapelitic and sedimentary rock fragments were commonly chloritic, with some quartzitic examples (Fig. 6).

The relative frequency and size of these inclusions was used to define five subgroups within fabric 1. For example, subgroup 1a (Fig. 6a) was characterized mainly by granitic gneiss and 1b (Fig. 6b) by granitic gneiss and micaceous sandstone. Subgroup 1c (Fig. 6c) was the most common and consisted mainly of metapelitic and sedimentary grains, while granitic gneiss continued to be common. Subgroups 1a to 1c included Impressed, Stentinello, and Undecorated samples alike. Subgroup 1d (Fig. 6d) was similar to 1c, but the frequency of the phyllite and schist inclusions was greater in 1d, as was their size, which ranged up to 9 mm. This group included mostly Undecorated sherds and a single Impressed example. Subgroup 1e (Fig. 6e) was also similar to 1c; however, it contained a higher frequency of biotite and lower frequency of quartz, while as a group it was also finer in texture than all the other fabric 1 subgroups. It included Late Neolithic Diana samples and three Buff/Diana sherds that we could not stylistically assign with certainty to either Buff ceramics or Diana ceramics (Table 5).

INAA further supported the conclusion that fabric 1 was consistent with the Metamorphic Clays (Fig. 7a–e). In subgroup 1c, two samples (1430-A and 2158-21+22) appeared quite distinct chemically from the rest, with lower elemental concentrations (Fig. 7c). The same was true for sample 1283-7 in subgroup 1d with the

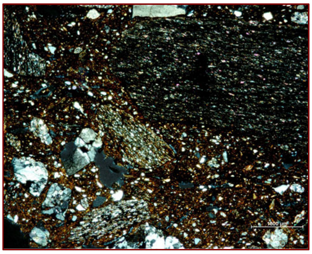
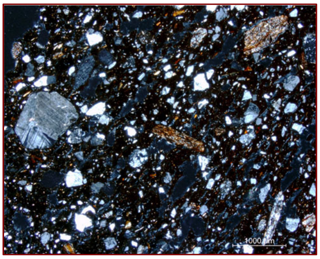
Table 5 Summary descriptions of petrographic fabrics for the Neolithic ceramic samples from UmbroNeolithic and Penitenzeria

Fabric	Samples by Ware	Description	Local clay group	Polarizing light micrographs of characteristic thin sections.
1a (*n* = 12)	*Stentinello (n= 8)* (1303-1; 1393-2; 1129-1; 1831-1; 2131-7; 2144-17; 1642-5; 2158-13) *Impressed (n = 1)* (1191-14) *Undecorated Ring Bases (n=3)* (2118-5; 1831-4; 2093-10)	Fabric 1a is a fine- to medium- textured fabric characterized by poorly to very poorly sorted angular to subrounded inclusions of sand (50 %) and silt (49.5 %) grains, randomly to clearly oriented and rarely bimodal. Inclusions consist of granitic gneiss, occasionally with some micaceous schist (1642-5; 2118-5; 2093-10) and their constituents, in particular typically heavily altered and sericitized orthoclase and/or microcline, sometimes metamorphosed quartz, biotite, and muscovite, sometimes with heavy chloritic alterations, rare plagioclase (oligoclase and rarely andesine), schist,and very rare amphiboles (hornblende: 2144-17; 1831-4). The ground mass is optically active and its color is characterized by variations of brown under both plain and cross-polarized light.	Metamorphic Clays	
1b (*n* = 5)	*Stentinello (n = 2)* (1118-1; 1125-1) *Impressed (n = 1)* (1284-5) *Undecorated (n = 1)* (1392-8) *Undecorated Ring Bases (n = 1)* (1642-8)	Fabric 1b is a medium-to coarse-textured fabric (except 1642-8: fine), characterized mostly by very poorly sorted subangular to subrounded inclusions of sand (50 %) and silt (49 %) grains,randomly to clearly oriented and rarely bimodal. It contains grains derived from granitic gneiss as fabric 1a and a variety of micaceous sandstone fragments, some of which are schistose and metamorphosed. The ground mass is optically active and its color is characterized by variations of brown under both plain and cross-polarized light.	Metamorphic Clays	
1c (*n* = 31)	*Stentinello (n=8)* (1430-B; 1328-1; 1291-2; 1430-A; 1285-1b; 2119-4; 2078-24; 2139-2) *Impressed (n=7)* (1399-9; 1302-6; 1290-6; 1252-8+9; 1410-5; 1121-19; 1330-2; *Undecorated (n = 9)* (1252-4; 1088-A, 1070-A; 2037-54; 1909-46; 1909-47; 1955-20; 1858-	Fabric 1c is the largest group, mostly medium to coarse in texture, characterized by very poorly sorted, subangular to subrounded inclusions of mostly sand (55 %) and silt (44 %) size, randomly to clearly oriented and sometimes bimodally distributed in the coarser samples. It contains phyllite and micaceous schist fragments along with metasedimentary (quartzite) and sedimentary (sandstone and biotite sandstone fragments that frequently exhibit low-grade metamorphism in the form of schistosity, sorting, and quartz strain) grains that are frequently chloritic. Granitic gneiss fragments are also common. The ground mass is optically active and its color varies in plain-polarized light from brown to olive yellow to yellowish red. Under crossed polarized light the color varies from	Metamorphic Clays	

exception of manganese (Mn) and cobalt (Co), which were both much higher than among the rest of the 1d samples (Fig. 7d), suggesting an additional quartzite dilution.[6]

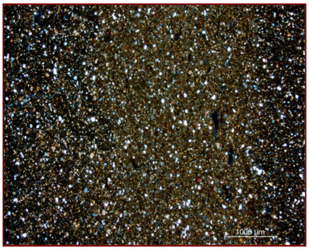
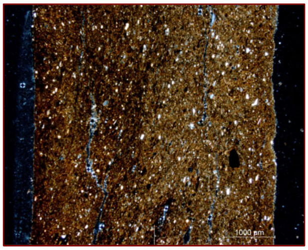
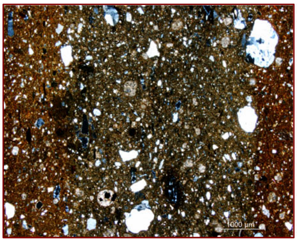
[6] It cannot be a zircon-rich quartz dilution, since when one plots hafnium (Hf) against thorium (Th), the correlation is positive, showing all the three distinct samples at the low end of the concentrations (Fig. 9). Many of the remaining analyzed elements plotted against Hf also behave the same way, implying that the source of variability is indeed an additional quartzite dilution and not zircon rich quartz, in which case scatterplots of silicon (Si), zircon (Zr), and Hf against any of the other silicate-related elements would have resulted in a negative correlation (Hancock 1982, 1984).

Table 5 (continued)

Fabric	Samples by Ware	Description	Local clay group	Polarizing light micrographs of characteristic thin-sections.
	1;2089-7; 1879-10) *Undecorated ring bases (n=2)* (2131-11; 1960-5) *Undecorated pedestal bases (n=4)* (2101-1; 1858-5; 2158-21; 1694-4)	variations of brown to black to brownish yellow to yellowish red.		
1d (*n* = 5)	*Impressed (n = 1)* (1283-7) *Undecorated (n = 4)* (2142-1; 2134-2; 2035-24; 2036-22)	Fabric 1d is a mostly coarsely textured fabric characterized by poorly to very poorly sorted, subangular to subrounded inclusions of sand (53 %) to silt (46 %) size, typically bimodally distributed and randomly to moderately oriented. Inclusions consist, like fabric 1c, of phyllite and micaceous schist along with sandstone, quartzite and micaceous sandstone fragments. However, the frequency of the phyllite/schist inclusionsis greater than in Fabric 1c, as is their size, which in 1d can vary up to 9 mm. As in 1c, both the metapelitic and sedimentary fragments are commonly chloritic, with few quartzitic examples. The groundmass is optically active and its color is characterized by variations of brown, under both plain and cross-polarized light.	Metamorphic Clays	
1e (*n* = 6)	*Diana (n = 3)* (1151-5; 2143-3; 2164-4) *Buff/Diana (n = 3)* (1881-9; 2030-14; 2100-5)	Fabric 1e is a very fine to-medium/coarse - textured group, characterized by very poorly to fairly sorted, subangular to subrounded inclusions of silt (61 %) and sand (38 %) size, randomly to moderately oriented. Inclusions consist of phyllite, muscovite schist and occasionally biotite schist, sandstone, micaceous sandstone and quartzite fragments that frequently exhibit low-grade metamorphism. Grains deriving from granitic gneiss are also common and frequently contain epidotes (zoisite). Fabric 2 is differentiated from Fabrics 1a-d by a higher frequency of biotite and lower frequency of quartz. The large size of individual biotite grains suggests that they derive from metagranitic parent materials rather than schists. The groundmass is optically active and its color in plain-polarized light is mainly dark yellowish brown, but also strong to yellowish brown, brownish yellow and yellowish red. In cross-polarized light - the color is characterized by variations of brown. We suspect that only Diana sherds belong to this fabric, although for 3 of the 6 members of this group we are uncertain whether they belong to Diana or to Buff sherds and have, thus, called them Buff/Diana.	Metamorphic Clays	

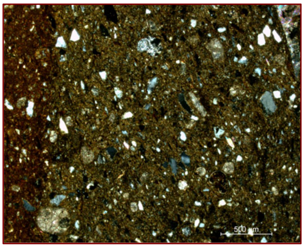
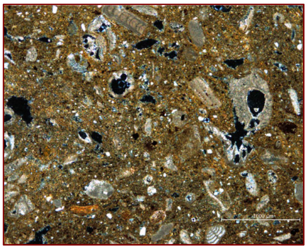
Fabric 2 described our Buff samples, along with some of the Late Neolithic Diana and the samples that stylistically could be either Buff or Diana (Table 5 and Fig. 8). It was consistently fine and characterized by the presence of carbonates (mostly foraminifera and other bioclasts, but also occasionally mudstone), as well as metapelitic

Table 5 (continued)

Fabric	Samples by Ware	Description	Local clay group	Polarizing light micrographs of characteristic thin-sections.
2a (*n* = 12)	*Buff (n=6)* (1330-13; 2050-26; 1961-13; 1895-26; 2167-23; 2035-6) *Diana (n=4)* (1329-3; 1111-18; 1293-4; 2050-6+7) *Buff/Diana (n=2)* (2036-37;1895-18)	Fabric 2a is a fine to fine/medium (except 1330-13: coarse) textured group, characterized by very poorly to poorly sorted, subangular to subrounded inclusions of silt (66 %) and sand (33 %) size, moderately oriented. Inclusions consist of carbonates (mainly foraminifera and other bioclasts, but also occasionally mudstone or calcite), very frequent biotite, phyllite and muscovite schists, as well as quartzite and sandstone, the latter frequently exhibiting low-grade metamorphism. Volcanic grains are also common, including devitrified pyroclasts and rarely feldspathic spherulites. Some grains derived from granitic gneiss are also present. The groundmass is optically active (except in 1111-18 and 2167-23: inactive). Its colour is characterized by variations of brown under both plain and cross-polarized light. An examination of inclusions in the groundmass suggests that this fabric type is consistent with both the Varicolored and the Metamorphic clays. The presence in the groundmass of fabric 3a of feldspathic spherulites points toward the use of Varicolored clays. However, the relatively few carbonates and more frequent plagioclase, especially present as andesine, which is associated with the Metamorphic clays, makes it possible that Metamorphic+SCOF sediments were used. There is a possibility that potters could have actually mixed sediments from both kinds of clays. In sample 2035-6 there are lenses within the matrix with inclusions in higher frequency and similar orientation that are distinguishable from the adjacent areas. However, such examples are rare and we do not believe they can be used as evidence of a consistent practice of mixing sediments. Petrography can certainly exclude the possibility that Pliocene Marls had been used, but is inconclusive about whether Metamorphic+SCOF or Varicolored Clay sediments, or their mixtures had been used.	Varicolored Clays, or SCOF Clays, or their mixture	 
2b (*n* = 8)	Buff (*n*=5) (1108-1; 2183-4; 2140-18; 1860-22; 1943-18) Diana (*n*=2) (1120-1;1110-22) Buff/Diana (*n*=1) (2166-24)	Fabric 2b is a mostly fine to medium (but also rarely very coarse) textured group, characterized by very poorly to moderately sorted, subangular to subrounded inclusions of silt (63 %) and sand (36 %) size, mostly moderately oriented. Inclusions consist of carbonates in high frequencies (mostly foraminifera, bryozoans, shell etc., and calcite, but also occasionally mudstone), as well as phyllite and muscovite schist, sandstone and quartzite. It differs from fabric 2a due to its higher frequency of bioclasts and lower frequency of biotite. The	Varicolored Clays	

(phyllite and micaceous schist) and sedimentary-derived grains (quartzite and micaceous sandstone with evidence of low grade metamorphism). It was a highly heterogeneous fabric, divided into two subgroups (2a and 2b), each of which remained highly heterogeneous.

Table 5 (continued)

Fabric	Samples by Ware	Description	Local Clay Group	Polarizing light micrographs of characteristic thin sections.
		groundmass is active in some samples (1108-1; 1120-1; 1110-22) and inactive in others (2183-4; 2140-18; 1943-18). Its color varies from yellowish red (2166-24; 1293-4) to variations of brown in plain-polarized light and is characterized by variations of brown in cross-polarized light. The high amounts of bioclasts and lower amounts of biotite make it consistent with Varicolored clays.		
3 (n=4)	Stentinello (*n*=2) (2093-23; 1831-12) Undecorated (*n*=2) (2086-3; 1934-28)	Fabric 4 is a medium-textured group, characterized by very poorly sorted, subangular to rounded inclusions of sand (64%) and silt (36%) size. Inclusions consist of very high frequencies of bioclasts (foraminifera, bryozoans, and corals), along with isolated quartz and orthoclase grains, muscovite, and very rare amphiboles. Interestingly, biotite, which is common in all the other fabrics, only appears in trace amounts. The groundmass is optically active and the color is characterized by variations of brown under both plain and cross-polarized light. An examination of inclusions in the groundmass suggests that this fabric is closest to the Pliocene Marls, yet not only does it lack biotites that are common in these sediments, it also contains a higher frequency of muscovite. The total absence of plagioclase and the low frequency of K-feldspars also make this fabric stand out in comparison to the rest of the sediments in our region. In De Angelis (1960: 197) the thin section of one Stentinello sherd, from the site of Stentinello in eastern Sicily, is described as being compact with foraminifera, with scarcely any remnants of a sandy component, including only extremely rare and small pieces of quartz. This description, although far from adequate to make us suggest that these pieces might actually be imports from Sicily, opens up a venue that seems worth pursuing.	Non-local. Possibly from Sicily?	

Petrographic examination of subgroup 2a (Fig. 8a, b) revealed the presence of inclusions associated with both Varicolored Clays (*e.g.*, feldspathic spherulites and microfossils) and Metamorphic Clays (*e.g.*, phyllite, muscovite schist, and granitic gneiss fragments, along with higher frequencies of plagioclase, particularly andesine). Although petrography could exclude the use of Pliocene Marls, it remained inconclusive about whether Metamorphic or Varicolored Clays had been used.

Similarly, INAA excluded the use of Pliocene Marls, but could not align with certainty the ceramic samples with either the Metamorphic or the Varicolored Clays. In Fig. 7f, five of the ten members of subgroup 2a appeared well within the Metamorphic Clays, while the remaining five appeared lower, between the Varicolored and the Metamorphic Clays. Cluster analysis (both hierarchical and K-

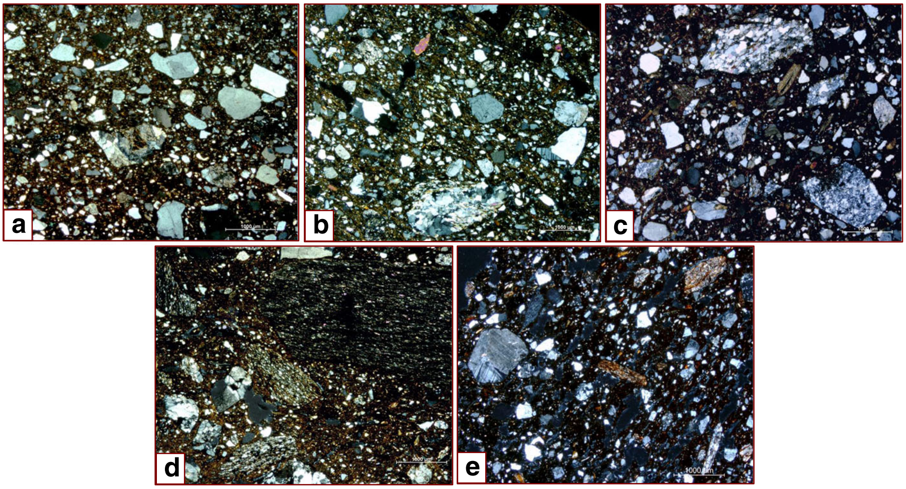


Fig. 6 Photomicrographs of characteristic thin sections from each subgroup of Fabric 1: **a** fabric 1a, **b** fabric 1b, **c** fabric 1c, **d** fabric 1d, and **e** fabric 1e (photos by G.V. Braun)

means with three clusters) grouped all but one of the samples with the Metamorphic Clays.

It is possible that potters were using mixed sediments. There are several areas in the immediate vicinity of the Umbro plateau where Varicolored Clays come right up against the Stilo Capo d'Orlando Formation component of our Metamorphic unit.

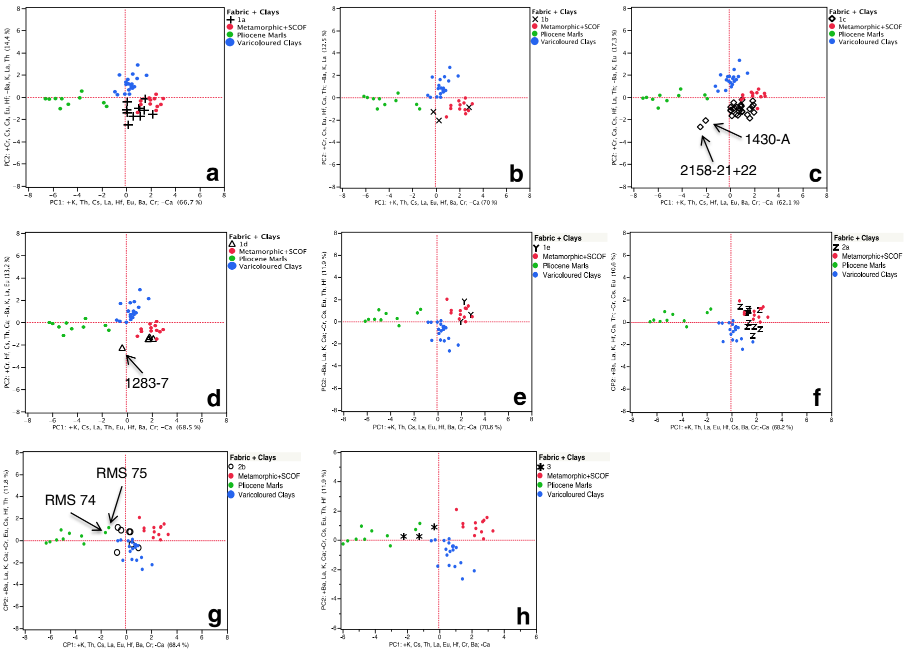


Fig. 7 PCA of log10 Ca, K, Na, Ba, Cr, Cs, Hf, La, and Eu for archaeological ceramics and geological clays from the Umbro plateau and its vicinity: **a** fabric 1a, **b** fabric 1b, **c** fabric 1c, **d** fabric 1d, **e** fabric 1e, **f** fabric 2a, **g** fabric 2b, and **h** fabric 3

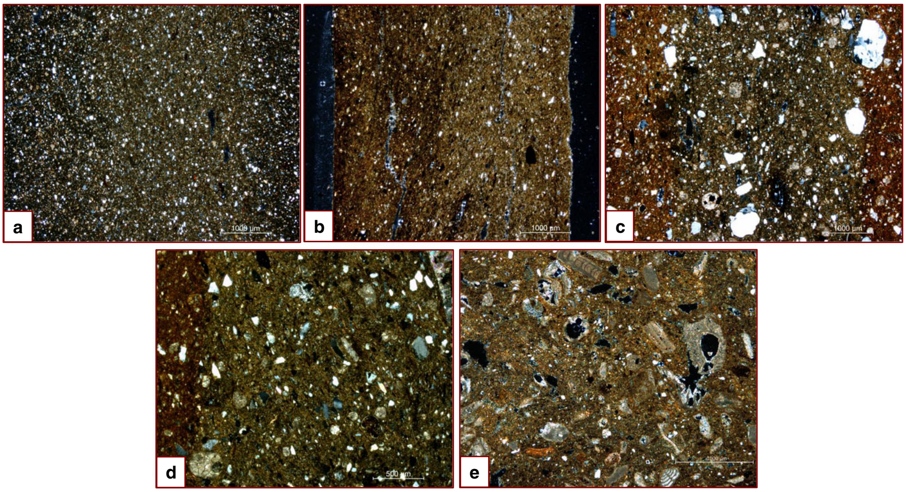


Fig. 8 Photomicrographs of characteristic thin sections from each subgroup of fabric 2 and of fabric 3: **a** fabric 2a, **b** fabric 2a, **c** fabric 2b, **d** fabric 2b, and **e** fabric 3 (photos by G.V. Braun and K. Michelaki)

Clay sediments from those areas could easily contain grains characteristic of both units, and the exact location of clay collection could affect whether more Metamorphic or Varicolored components would end up in the final clay paste. It is also possible that potters were intentionally mixing clays from Metamorphic and Varicolored areas. Such a practice is widely witnessed ethnoarchaeologically [*e.g.*, among the potters of Paradijon in the Philippines (London 1991, pp. 187–188; Neupert 1999, p. 62), among the Shipibo-Conibo of Peru (DeBoer and Lathrap 1979), the potters of Thrapsano in Crete (Voyatzoglou 1974), and several communities across sub-Saharan Africa (Gosselain and Livingstone Smith 2005, p. 38)]. It is very hard to distinguish archaeologically between natural clay variability and heterogeneity caused by intentional mixing (Quinn 2013, pp. 161–171). In our ceramic sampling, there is only one example that could potentially suggest intentional clay mixing. In sample 2035-6, lenses were visible in thin section containing inclusions in higher frequencies and differing orientation than those of the surrounding clay matrix. At the moment, however, we cannot rule out the possibility that this phenomenon resulted from the incomplete preparation of a naturally heterogeneous clay.

Subgroup 2b differed from 2a because of its higher frequency of bioclasts and lower frequency of biotite, which further aligned it mineralogically with the Varicolored Clays (Fig. 8c, d). Principal component analysis of the INAA data for fabric 2b aligned three sherds (1329-2, 2140-18, and 1110-22) with the Varicolored Clays and four (1943-18, 1120-1, 1108-1, and 2166-24) with raw material samples (RMS) 74 and 75, the sandiest of the Pliocene Marls (Fig. 7g). Cluster analysis (hierarchical and K-means) grouped all sherds together with the Varicolored Clays and assigned RMS 74 and 75 with the Varicolored Clays too. As explained in Michelaki *et al.* (2012, p. 242), however, it is only a quartz dilution that separates RMS 74 and 75 from the Pliocene Marls, and they should not be thought of as belonging to the Varicolored Clays. Thus, we argue that INAA supports the petrographic evaluation that potters used Varicolored Clays to make the pots belonging to subgroup 2b.

Finally, there were also two sherds with stamped Stentinello-like decorative designs that even macroscopically looked different from the remaining of our Stentinello sherds, since their fabric seemed packed with bioclasts. Two more Undecorated sherds looked macroscopically identical. Petrography confirmed that these four sherds were distinct from the remaining assemblage and even from the local geology and comprised fabric 3.

Fabric 3 consisted of very high quantities of bioclasts (foraminifera, bryozoans, and corals), along with isolated quartz and orthoclase grains, muscovite, and very rare amphiboles (Table 5 and Fig. 8e). An initial examination of these inclusions suggested that this fabric most closely resembled the Pliocene Marls, a possibility that seemed supported by INAA (Fig. 7h). However, a number of characteristics separate fabric 3 from all of the sediments collected in our region. Fabric 3 contains biotite only in trace amounts, while it is common in all of our local sediments. Similarly, it lacks plagioclase and has a lower frequency of alkali feldspars. It also includes higher amounts of muscovite than our Varicolored Clays. As a result, we argue that fabric 3 is not consistent with our local geology and suggests a potential import to the Umbro plateau. De Angelis (1960, p. 197) describes the thin section of one Stentinello sherd from the site of Stentinello in eastern Sicily as compact with bioclasts, having a scarce sandy component and including only extremely rare and small pieces of quartz. Although this description sounds similar to our fabric 3, it is not adequate to suggest that these pieces belong to (a) pot(s) that came from eastern Sicily. However, this is a hypothesis worth pursuing

In summary, our analyses showed that the vast majority of the sherds found on the Umbro plateau are consistent with the local geology, except for the four samples of fabric 3 that may indicate an import, possibly from Sicily. We also showed that to make these pots, the Umbro potters used sediments from within the Metamorphic and the Varicolored Clays, but not from the Pliocene Marls. They used a variety of sources from within the Metamorphic Clays for their Impressed, Stentinello, and Undecorated pots and a great variety of sources from the Varicolored Clays, including possibly sources in proximity to the Metamorphic Clays, for their Buff pots. What can these patterns of local clays and local pots reveal about how the Umbro Neolithic and Penitenzeria potters engaged with their landscape, and what can this engagement tell us about their daily orientation in their landscape and their long-term perception of it?

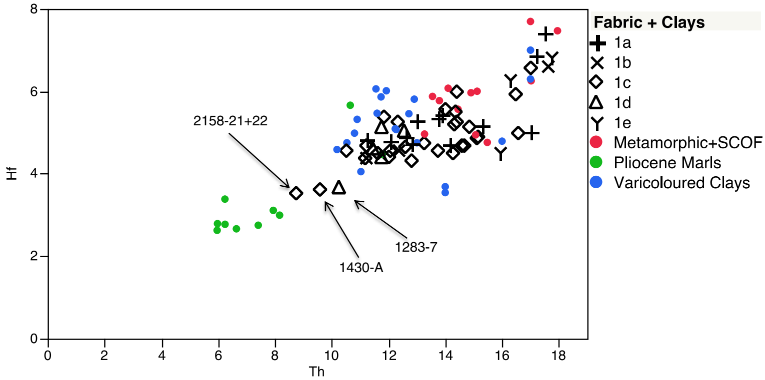


Fig. 9 Scatterplot of hafnium (Hf, ppm) *versus* thorium (Th, ppm)

Discussion: Points of Origin

Typically, the pattern identified in the previous sections—that the Umbro Neolithic and Penitenzeria potters used local raw materials, from the immediate vicinity of their homes—would be considered expected, given the size, technology, and organization of production in the Neolithic and would not be pursued further. Instead, attention would turn to the technology of actually putting the pots together. A taskscape perspective, however, requires that we probe deeper into the interactions of potters with their landscape.

First, if we want to populate a landscape with potters, we must question what is their point of origin. Should we imagine potters starting from the Umbro plateau because pots were actually made there, or were pots actually made in other communities nearby? Models such as Arnold's exploitable threshold model (Arnold 1985, 2006, 2011; Kelly *et al.* 2011) predict that pottery production could certainly take place on the Umbro plateau. In fact, throughout the Mediterranean, Neolithic pottery is often shown to not move much (*e.g.*, Skeates 1992; Malone 2003; Vitelli 1993a, b). It is thus always expected that Neolithic pots were made where they are found (*e.g.*, Laviano and Muntoni 2006a, b; Morter and Iceland 1995). However, exciting new work (*e.g.*, Jorge *et al.* 2012 about Late Neolithic Portugal and Quinn *et al.* 2010 about Middle and Late Neolithic Greece) shows that this was not always the case. Furthermore, the miniscule size of the Early to Middle Neolithic communities in our region would have necessitated close and frequent interactions with the other equally miniscule communities scattered across the landscape. In light of this evidence, when our results show that the ceramics from the Umbro plateau were local, it is important to ask: "how local is 'local'?"

The main evidence we have that pots must have been made on the Umbro plateau is that in both Umbro Neolithic (n=12) and Penitenzeria (n=12), we find "stampini": small, cylindrical stamps made of clay that were used during manufacture to form the decoration of Stentinello pots (Robb 2005, pp. 51–52) (Fig. 10). Since the decoration had to be applied when the clay was still sufficiently wet, but before burnishing, it seems unlikely that Stentinello pots would be made elsewhere and then brought to the plateau to be decorated. Given that we cannot separate petrographically the Stentinello from the Impressed and the Undecorated in terms of fabrics, it also seems likely that they too were also made on the plateau.

When it comes to the Buff ceramics, the long-standing assumption has been that they were imports from further east, possibly Puglia or Basilicata. Such an

Fig. 10 Examples of "stampini" from Umbro Neolithic (*l*) and Penitenzeria (*r*)

assumption is reasonable, given the small percentage of Buff ceramics usually present in a Stentinello assemblage, how different they look from the majority of the assemblage, and how similar they look to the bulk of finewares made in eastern southern Italy.

Although we have not yet analyzed comparative ceramics and clays from those regions, there are several reasons why we argue that the Buff ceramics in our assemblage were made using materials from the immediate vicinity of the Umbro plateau (see also Muntoni and Laviano 2008 and Muntoni *et al.* 2009 for local production of Buff ceramics at the site of Favella in northern Calabria). First, one must not forget that Umbro Neolithic and Penitenzeria are surrounded by Varicolored Clays similar to the ones used in the production of Buff pots. Even the non-carbonate components of the Buff pots are consistent with the metamorphic geology at the immediate vicinity of our sites. Second, our analyses have shown that we cannot separate the Early–Middle Neolithic Buff pots from the Late Neolithic Diana pots, suggesting a long-term tradition in the use of these local clays. This fact, along with the challenging inconsistency of the Varicolored Clays as a unit, also makes it improbable that anyone other than those intimately familiar with the local landscape could be the makers of the few Buff pots on the Umbro plateau. Finally, examples of "stampini" made of Varicolored Clays and looking similar in color and texture to our Buff pots are found in both Umbro Neolithic and Penitenzeria. All this evidence together leads us to suggest that the Buff pots were also made on the Umbro plateau.

To summarize, it seems that all the different kinds of wares we have found in Umbro Neolithic and Penitenzeria were made at the sites themselves. This evidence does not exclude the possibility that pots were also coming into our sites from nearby contemporaneous communities like Bova Castello, for example, only 2 km away to the North, in the modern town of Bova. It does permit us, however, to think of the Umbro plateau as a place from where potters would embark on their daily activities in the broader landscape and to where they would eventually return.

Landscape Orientations

What we know about pot-making on the Umbro plateau is that potters there made more than 96 % of their pots (*i.e.*, the Impressed, Stentinello, and Undecorated ceramics) using sources from among the Metamorphic Clays, less than 4 % (*i.e.*, the Buff ceramics) using sources from within the Varicolored Clays (sometimes in combination with Metamorphic sources) and 0 % using Pliocene Marls.

A taskscape perspective necessitates that we look at these units in the landscape. The Metamorphic and the Varicolored Clays are widely available units and, most importantly, accessible in the immediate vicinity of Umbro Neolithic and Penitenzeria. The Metamorphic unit also affords the kinds of rocks people at both of our sites used for their groundstone tools. It further affords the red and yellow ochre they sometimes pressed into the stamped decorations of their Stentinello pots. GIS analysis (Robb and Van Hove 2003; Van Hove 2003, 2004) of the landscape around the Umbro plateau has also revealed that the first couple of kilometers (including both Metamorphic and Varicolored Clays) would provide access to ample water springs and space for agriculture and animal grazing. Neolithic farming for the limited size of our communities and in our rugged and vertical environment should be better described as garden-tending, for which the small flat areas available in the immediate vicinity of the plateau would be more than adequate. Given that the same area was regularly associated with clay, rock, and ochre collection and probably also with tending gardens, keeping animals, and fetching water, it is even possible to propose that these activities may have been associated with each other as well.

The Pliocene Marls are spatially concentrated by the Ionian coast (Figs. 1, 3, and 4). Disregarding them in the production of Buff pots could appear initially paradoxical. In terms of distance, the Pliocene Marls are not far from Umbro Neolithic and Penitenzeria (~3.5 km). Most importantly, we know that people did travel that distance because they did go to the coast to receive their obsidian, which came from the island of Lipari in the Aeolian archipelago (Fig. 1). In terms of the quality of clays within the unit, Pliocene Marls appear desirable. Based on our replicative and laboratory experiments, clay from this unit could afford pots made with both coiling and pinching methods, low shrinkage, and consistently light colors when fired in oxidizing conditions and a variety of temperatures. Furthermore, the Pliocene Marls unit was relatively homogeneous. A potter could select materials from anywhere within it and expect them to behave in the same way. These are characteristics desirable for making Buff pots and in some ways lacking from the Varicolored Clays, which are heterogeneous. Furthermore, the Varicolored Clays tend to shrink more than the Pliocene Marls, not all sources from within the unit can afford light colors, and even when they can, it is only when fired below 700 °C (Table 3).

A taskscape perspective helps us go beyond the distance traveled and the performance characteristics of clays, to also consider the "interlocking tasks" that would take place by the coast, affecting the movements of people and their selection of sources. Available evidence from both Umbro and Penitenzeria suggests that their inhabitants were not accessing the coast frequently. We have neither fishing tools nor faunal remains that suggest marine resources were a part of daily diet or were consumed regularly (Foxhall *et al.* 2006, p. 23 and see Robb 2007, pp. 123–124 for a similar trend over much of southern Italy, further supported in some cases by stable isotope analyses of skeletal material that also failed to show evidence of a diet consisting of marine resources). Such material would have survived had it been deposited, since we do find a very limited number of small shells occasionally. They are always worn, or worked, however, indicating their use as tools or decorations. Even the acquisition of Lipari obsidian would have required visits to the coast only infrequently: It has been estimated that at Penitenzeria, no more than 10 k of obsidian were imported during 500 years of intensive occupation, despite the fact that obsidian comprised nearly 90 % of their chipped stone tools (Robb 2007, p. 196). Clearly, the rhythms of obsidian acquisition—and blade making by extension—were not synchronous with those of pot-making.

Available evidence in an archaeological setting of course rarely means representative evidence. A large number of activities could have brought people to the coast without leaving any evidence (*e.g.*, swimming, collecting herbs, making salt, etc.). Our survey has not revealed any secure Neolithic sites by the coast, despite the results of our underwater geoarchaeology project, directed by Helen Farr (Southampton U.) and Ed Reinhardt (McMaster U.), which showed that the coastline in our localized region has not moved since before the Neolithic and that there is no submerged landscape (Farr *et al.*, in preparation), unlike in other parts of the Mediterranean (*e.g.*, Galilli and Nir

1993). Although the Neolithic landscape is not buried in our region under many meters of sedimentation, the dynamic activities of the fiumaras, the earthquakes, and the tsunamis could have eroded away any evidence of permanent Neolithic sites. It is equally probable, however, and more likely, in our opinion, that the Neolithic inhabitants of the region were very cognizant of the risks of placing permanent settlements right by the very active coast. Ultimately, what we can say with certainty, based on our petrographic and mineralogical analyses, is that a big part of the quotidian ceramic taskscape—and the tasks associated with pot-making—did not engage the coast, focusing instead inland, on the immediate vicinity of the Umbro plateau.

Treating the ceramics from Umbro Neolithic and Penitenzeria as congealed taskscapes has revealed the inland, rather than coastal orientation of the Neolithic potters. This orientation also included groundstone-tool making, ochre collection (and the tasks with which ochre was associated), water fetching, and garden/animal tending and has opened up the opportunity to examine whether these tasks had been spatially, temporally/rhythmically, and socially linked. As a group, they were certainly contrasted with the task of chipped stone tool-making, which was strongly associated with the coast and with rhythms different than the quotidian.

Long-Term Perceptions

The real impact of a taskscape perspective is revealed in the long-term scale, when we acknowledge that the inland—rather than coastal—orientation of pot-making lasted for at least 500 years. Chronological control better than that which stratigraphy and radiocarbon dating have afforded us might reveal small temporal patterns in the use of particular sources within the units of Metamorphic and/or Varicolored Clays. The orientation of the potters, however, remained the same, and for 500 years at least the Pliocene Marls were perceived as "inappropriate."

Preliminary results of Late Neolithic, Early to Middle, and Final Bronze Age materials from Umbro Neolithic, Penitenzeria, Umbro Bronze (also on the Umbro plateau), and Sant'Aniceto (less than 1 km away from the plateau) suggest that the inland orientation continued for another 4,000 years. Even in the Final Bronze Age, when there is evidence that the Pliocene Marls were used to plaster the floors of houses (Wolff 2013), potters continued to avoid them, showing how past taskscapes, sedimented into landscapes, can impact future taskscapes.

This pattern does not mean that for 5,000 years taskscapes remained unchanged. Our preliminary data show that in the Late Neolithic, the use of Metamorphic Clays declined (only paste 1e was used), while the use of Varicolored Clays continued as before (both pastes 2a and 2b continued). In the Early and Middle Bronze Age, the use of Varicolored Clays stopped and the use of Metamorphic Clays broadened (new fabric 1 pastes appeared). Finally, in the Final Bronze Age, sources from within both the Metamorphic and the Varicolored Clays were used again, but they were new ones, not encountered in earlier periods.

A taskscape perspective makes it clear that all these shifts are not only technological changes in the selection of raw materials; these shifts also represent changes in how people engaged with their landscape. They are changes in the social, spatial, and temporal associations of tasks and the people, materials, and things they weave together.

Conclusions

In this paper, we have found that by considering pot-making in its landscape we gain a better understanding not only of the task itself and its articulation with other quotidian tasks but also of how past people constructed a social sense of space. Ingold's (2000, pp. 189–208) concept of taskscape, referring to the interlocking of the multitude of tasks undertaken as part of everyday life, describes the mutual constitution of tasks and landscapes. Tasks derive their significance from their spatial and temporal relation to the many other tasks undertaken in a landscape, while any particular place derives its own significance from all the tasks that take place within it. We operationalized the concept of taskscape archaeologically by treating raw material sources as histories of movements and interactions and ceramics themselves as congealed taskscapes.

We focused on two small and neighboring Neolithic communities in southern Calabria, Italy. By combining an intensive raw materials survey, characterization analyses, as well as replicative and laboratory experiments, we revealed not only the variability of local clay sources, their distances from our sites, and the properties of the raw materials within them but also the distribution of clay sources in the landscape and their relation to other resources and features in the landscape. After performing similar characterization analyses on the archaeological ceramics, we compared the results to those of our geological samples to uncover both which sources the Neolithic potters had used and which ones they had disregarded, while also examining what other tasks could have been undertaken in the same areas.

We found that the Neolithic potters had used materials exclusively from the immediate vicinity of their homes, utilizing a variety of sources from the units of the Metamorphic and the Varicolored Clays, which also afforded them rocks for their groundstone tools, ochre for various uses, water, and adequate flat land for their gardens and animals. The local Pliocene Marls, concentrated by the Ionian coast, were never used, although they were not far from our sites and contained clays that could certainly afford the making of the local Buff pots. Based on available archaeological information, the coast was shown to have not been associated with quotidian tasks, such as fishing. The arrival of obsidian from Lipari certainly brought people to the coast, but infrequently, having rhythms that must have differed from those of pot-making. This inland—rather than coastal—orientation lasted for at least 500 years and possibly as long as 4,000 years, based on preliminary analysis of ceramics as late as the Final Bronze Age, revealing long-held perceptions of which parts of the landscape were appropriate and relevant to pot-making and which parts were not.

Treating archaeological ceramics as congealed taskscapes challenges the typical image conjured up when we talk about pot-making: potters forming pots in a static locale, typically at a habitation site. Previous work on the sociality of technology has heavily critiqued the image of the lone potter, working in social isolation (*e.g.*, Dobres 2000), as well as the idea that a single individual undertakes all the steps of the entire ceramic operational sequence (*e.g.*, Crown 2007). A taskscape perspective allows us to broaden the pot-making picture and include the "off-site" component of the task. It highlights the fact that long-term source selection and landscape orientations have to be learned, just like forming a pot has to be learned. Ingold (2000, p. 354), influenced by Gibson (1986, p. 254), argues that learning a task means becoming attuned to a particular landscape, its rhythms, and what it allows one to do during situated activities. Thus, raw material choices do not only tell us about how people in the past made pots. They tell us the histories of the learned and attuned interactions among people, materials, and landscapes.

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