Dynamic social changes in the Bronze Age society of Sardinia (Italy)

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Abstract

Social complexity in the Bronze Age society of Sardinia is studied by means of 'Ceramics Technology', analysing under a petrographic microscope 256 vessels sampled during 2013 and 2014, from 7 different nuragic settlements in the Marmilla region in south-central Sardinia.

Petrographic analysis highlighted great fabric variability: 42 different 'paste recipes' were identified, further clustered into 8 main fabric groups.

This approach demonstrates how, in addition to the choice of specific raw materials from different collecting sites in replicating their own technological traditions, artisans from distinct co-residential units and perhaps of different cultural affiliation shared knowledge regarding fabric preparation typical of their peculiar 'communities of practise'.

Keywords

Ceramics; technology, Bronze Age; Sardinia, social complexity.

Résumé

Complexité sociale dans la société de l'âge du bronze de la Sardaigne est étudié au moyen de 'Céramique Technologie'. 256 échantillons de céramique ont été étudiés à l'aide du microscope polarisant de sept établissements nuragiques dans la région Marmilla dans le sud-centre de la Sardaigne.

L'analyse pétrographique a souligné la grande variabilité dans la céramique: 42 «recettes de pâte» différents ont été identifiés, en outre regroupés en huit principaux groupes.

Mots-clés

Céramique; technologie; l'Âge du Bronze, Sardaigne; complexité sociale.

Introduction

Social complexity in the Bronze Age society of Sardinia is studied by means of 'Ceramics Technology', analysing under a petrographic microscope 256 vessels sampled during 2013 and 2014 from 7 different nuragic settlements in the Marmilla region in south-central Sardinia.

Sardinia is the second largest island in Italy, located in the central part of the Western Mediterra-

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nean basin. These settlements refer to the time span, locally called 'Nuragic Society', starting around the Middle Bronze Age (1700 - 1365 BC) and continuing through the Recent Bronze Age (1365 - 1200 BC) to the Final Bronze Age (1200 - 1000 BC).

In this research, a theoretical framework combining analytic techniques with social theory was developed. This is due to the fact that technology is an active process structured by the environment, resources and social roles, continually reproduced and modified during everyday life (Pfaffenberger, 1992; Michelaki, 2006). Indeed, ceramic fabric variability among selected common nuragic vessel forms, closely connected with domestic architecture, was analysed. This represents an innovation with respect to previous studies of pottery in Sardinia, which have principally focused on stylistic attributes and their use in assessing chronological typology. Methodological studies point out that it is almost impossible to fit ceramics into clearly defined homogeneous taxa that change their characteristics in an orderly way over space and time (Michelaki, 2007, p. 147). There are always 'intermediate categories', and as a result, archaeologists keep creating more types and questioning whether they are real or not and what their relation is to other types, all of which remain constructs (Michelaki, 2007, p. 147-148). Typology fails to account for ceramic variability, which should be studied by analysing complete 'operational sequences', starting from the way raw materials are selected, prepared and then shaped into vessels, to their surface finishing, firing, use, and discarding.

In particular, starting from these pre-existing Sardinian typologies, I tested them using the concept of 'technological style' and challenged their interpretation in terms of social organisation and chronological significance.

The present analysis focuses on pottery found within domestic structures. Households, representing the most basic components of human organization and the primary unit of consumption in prehistoric societies, largely reflect conservative and highly culture-specific behaviour (Aldenderfer, 1993; Bourdieu, 1977, 1990; Giddens, 1984; Madella *et al.,* 2013; Rapoport, 1990; Stark, Clark, and Elson, 1998). Moreover, although domestic units normally produced a large percentage of the resources they consumed, they were never completely self-sufficient (Halstead and O'Shea, 1989) and had to engage in various reciprocal exchange arrangements for labour, goods and food procurement (Hagstrum, 2001).

This study traces, spatially and temporally, continuity and change in ceramics technology, using: 1) *ceramic petrology,* which is the systematic description of pottery materials, their compositions and organization in hand specimens and prepared samples or thin-sections, using a polarising microscope*;* 2) the concept of '*chaine operatoire*', the sequence of technical and mental gestures performed by potters during vessel manufacture, use, repair and discarding; 3) *a raw materials provenance study* which, using analytical and geological approaches, helps in establishing whether the corpus of vessels under study was produced using clays and other naturally or intentionally added materials obtained from the area investigated or far away from it. These raw materials, once analysed, constitute a basis against which to interpret potters' choices and compare them with the archaeological material under study; 4) *experimental archaeology,* which provides opportunities to confirm potential hypotheses and conclusions with multiple trials and repeatable tests in a chemical/mineralogical laboratory and which are used, starting from the identified steps in the 'operational sequence', to reproduce nuragic ceramic pastes.

Understanding how and where nuragic people in Marmilla collected their raw materials can be linked to the ways they must have perceived their landscape and its resources, indirectly informing us about other possible activities taking place in the same area.

As suggested by the wide corpus of ethnographic and ethno-archaeological studies of ceramic technology at the local level, domestic pottery is one of the most sensitive material culture items, reflecting conscious and unconscious elements of technological choices tending to be stable throughout time (Stark, 2003; Stark *et al.,* 1998, p. 208-231). The alternatives selected by artisans in their choice of raw materials (or 'technological styles') reflect an internalized understanding

of manufacturing traditions, learned through an early '*motor habit'*, and passed on from one generation to the next. Once acquired, it is the most resistant part of the sequence to change (Arnold, 1994; Gosselain, 1988, 1999a, 1999b, 2000; Michelaki, 2006, 2007; Roux & Corbetta, 1990; van der Leeuw, 1993). This is because learning how to shape a pot requires a focused effort on the part of both the teacher and the apprentice, with the former always promptly correcting mistakes and guiding the apprentice's hands in the appropriate gestures and posture (Michelaki, 2007). Moreover, the various steps in the operational sequence of ceramics production, regulated by social rules guiding everything from the choice of raw materials to 'proper' bodily behaviour, by the way tradition dictates the 'correct' way to shape and use objects and by gender ideologies determining who could or could not make certain objects or use them (Dobres, 2010, p. 109) and taboos of various types, were fully embedded in the community's social and economic systems. For this reason, they can be useful in providing clues to social behaviour (Dobres, 2010; Gosselain, 1998, p. 87-91).

Prescriptions and taboos related to the proper clays to be used to make good vessels are well known in ethno-archaeological records, but cannot be clearly recognized during prehistoric pottery studies. Nonetheless, they should be acknowledged in analysis, as they can help to understand the potters' choices not explained by technological requirements.

Initial results of the study

Three corridor nuraghi, which are long low irregular stone platforms with an internal corridor and one or a few small chambers linked to it, and one single tower nuraghe, a truncated high round tower built of large blocks of local rock set without mortar in regular horizontal rows and roofed by corbelled vaults, both from the Middle Bronze Age (1700 - 1365 BC), were sampled. They were inhabited during that period and then permanently abandoned (Fig. 1). They are:

1) *Corridor Nuraghe Brunku Madugui (Gesturi plateau)*: 27 samples;

2) *Corridor Nuraghe Sa Fogaia (Siddi plateau)*: 16 samples;

3) *Corridor Nuraghe Conca 'e Sa Cresia (Siddi plateau)*: 28 samples;

4) *Single tower nuraghe Is Trobas (Lunamatrona)*: 16 samples.

These are the only Middle Bronze Age archaicuraghi partially excavated in the region (except for Nuraghe Su Mulinu at Villanovafranca, for which sampling permission was not granted by its excavator), and their pottery represents the first ceramic materials produced during the initial period of the Nuragic society in the area.

Three complex nuraghi (corridor nuraghi or simple tower nuraghi progressively enlarged with the addition of multi-tower complexes and hut villages) were sampled as well, selecting the Middle Bronze Age, when present, and then moving on to the Recent (1365 BC - 1200 BC) and Final Bronze Age (1200 BC - 1000 BC). They are:

5) *Nuraghe Genna Maria (Villanovaforru)*, from which 18 Middle Bronze Age samples were taken;

6) *Nuraghe Ortu Comidu (Sardara)*, for which 52 thin-sections were kindly provided by Dr Paul Nicholson, Department of Archaeology of the University of Cardiff (UK), part of the team studying ceramics from the excavations directed by Prof. Miriam Balmuth, Tufts University (USA) during 1975, 1976 and 1978. These ceramics come from the northern area, radiocarbon dated to the Recent-Final Bronze Age and from the south tower of the complex nuraghe, radiocarbon dated to the Final Bronze Age--First Iron Age (Phillips, Nicholson, and Patterson, 1986).

7) *Nuraghe Arrubiu (Orroli),* which is not part of the Marmilla region but was chosen as an element for comparison with the region under study for three principal reasons: the first is that it is one of the largest and best excavated nuraghi on the island; the second is its geographical setting on a basaltic plateau similar to those of Gesturi and Siddi, located approximately 25 kilometres further east; the third is the presence of a huge quantity of ceramics of all types and ages from which to select

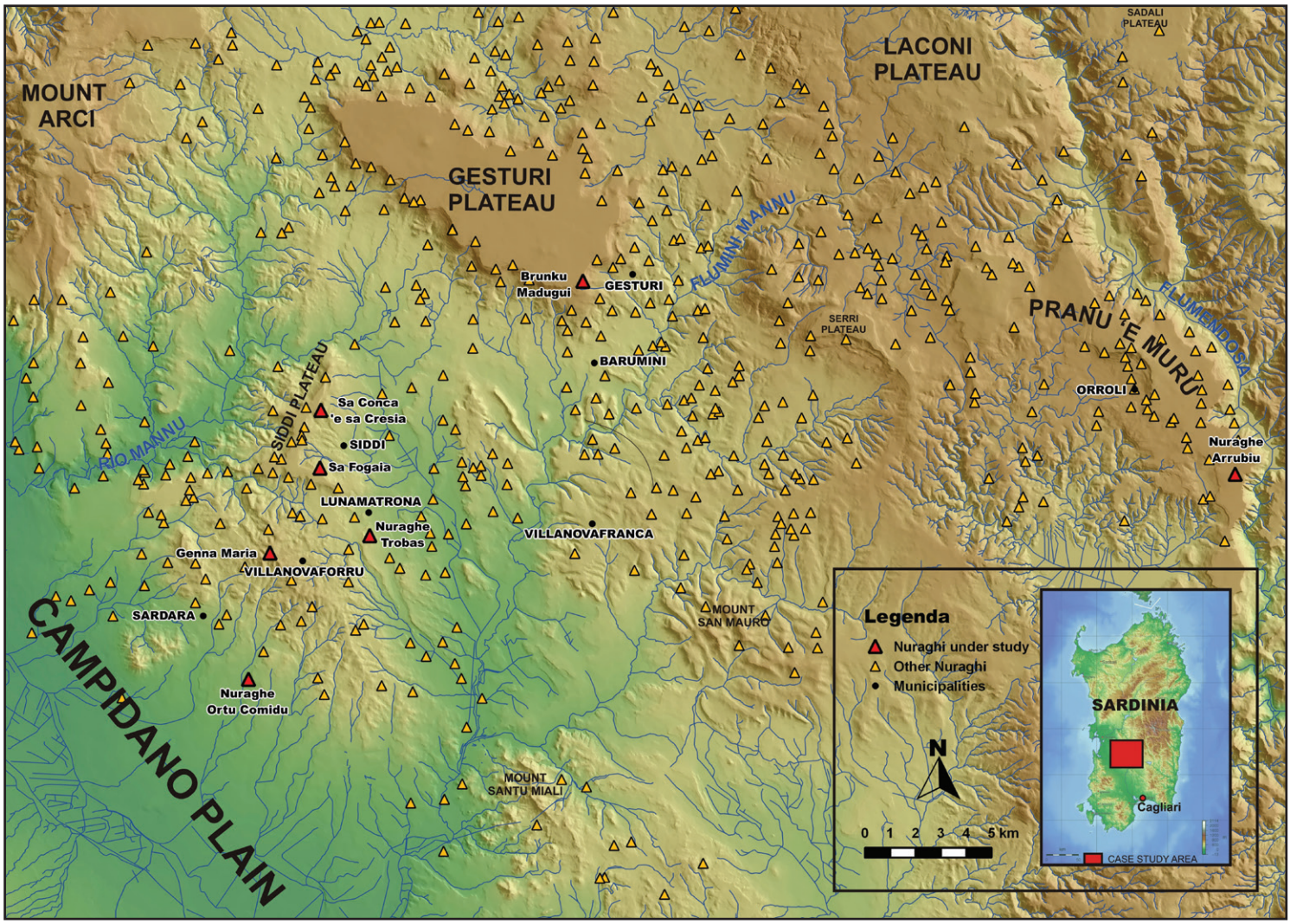

Fig. 1 - The area under study. From Lilliu C., 1985; www.tharros.info. Drawings: V. G. Anardu and M. G. Gradoli.

samples to be studied. This permitted me to shed light on possible exchange networks not only within the Marmilla region but also between the latter region and the nearby Sarcidano area. Twenty-nine samples were selected from ceramics coming from courtyard B (Middle Bronze Age), while sixty samples were taken from Tower A (Recent Bronze Age).

To better contextualise the beginning of Nuragic culture during the Middle Bronze Age in the area, twenty Pre-Nuragic samples (Final Neolithic, Eneolithic, and Early Bronze Age), coming from the same region and currently on display at the Archaeological Museum in Villanovaforru, were sampled as well. No settlement was excavated in the region during this period: they come from one rock-cut tomb ('Domus de Janas') and several surface finds. They were sampled to determine whether or not there was continuity in fabric manufacture between the two different periods.

Petrographic analysis was carried out on 0.030 mm thick thin-sections taken from the sherds in their original state, using a Brunel SP-300-P polarising microscope equipped with a Canon 1100D camera. The method and terminology applied were those proposed by Whitbread (1989, 2001). A descriptive vocabulary was used to better maintain ob-

jectivity during data recording and separate interpretation from description.

One of the most striking characteristics of these ceramics is the great variability in their fabrics: 42 different 'paste recipes' were identified, clustered into 8 main fabric groups (Fig. 2). They are:

1) FABRIC GROUP 1. PLUTONIC. Includes 134 samples divided into 15 subgroups;

2) FABRIC GROUP 2. VOLCANIC. Includes 86 samples divided into 5 subgroups;

3) FABRIC GROUP 3. METAMORPHIC. Includes 20 samples divided into 9 subgroups;

4) FABRIC GROUP 4. SHELL TEMPERED. Includes 8 samples divided into 4 subgroups;

5) FABRIC GROUP 5. MIXED SANDS. Includes 11 samples divided into 6 subgroups;

6) FABRIC GROUP 6. BURNT ORGANIC MATERIAL. Includes 3 samples.

7) FABRIC GROUP 7. VERY FINE ORANGE CLAYS (with very rare quartz micro-inclusions). Includes 1 sample;

8) FABRIC GROUP 8. FINE SANDS WITH VOIDS (in a red matrix). Includes 1 sample.

Two main fabric groups (the Plutonic and Volcanic ones) are the most representative of pottery manufacturing in the area. In particular, the Plutonic one shows how local potters used the same raw materials having a great variety of micro-morphological characteristics and inclusion dimensions, while the uniformity of the volcanic subgroups implies a well-rooted shared manufacturing tradition within the region. These two fabrics groups are present, at the same time and during the whole Bronze Age, among the seven settlements considered and were used to produce different categories of domestic vessels, such as pans, saucepans, large and small storage jars, as well as large and small bowls and cups, made by producing a finer fabric. It is also interesting to note that these two fabric groups were the most common among those present in the area during the Pre-Nuragic period as well, confirming a manufacturing continuity of several millennia in the tradition of the area studied, regardless of their varying use context (habitation or burial), shape and presence of peculiar decorations.

Several vessel-building techniques were observed in the macro samples studied:

a) '*Pinching*', especially for small cups and bowls and for the rounded bases of small vessels.

b) '*Coiling*', of different thickness and shape. Sometimes, coil presence seems to have been obliterated by use of the turntable.

c) '*Slab-building*', mainly for large vessels;

d) '*Paddle and anvil*'.

Looking in detail at the way pottery was made in the Marmilla region, I can say that potters used more than one defined technique in shaping their vessels. Different parts of the same vessel were often prepared separately (such as handles and lugs or the rims of large storage vessels) and then added to the body of the vessel being manufactured. This fact, indeed, increases ceramic variability among the different domestic structures of the region.

Surface treatment and finishing techniques also vary, as follows:

a) '*Textured or rough*': vessels used on the fire, such as pans and saucepans, have corrugated or textured exterior surfaces, believed to be better transmitters of heat; their internal surfaces are smooth in the attempt to reduce surface permeability. Jars and storage vessels have corrugated or smooth external surfaces to be easily grasped and moved, and smooth internal ones.

b) '*Brushing*': this kind of surface treatment was sometimes observed in jars and the exterior part of cooking vessels;

c) '*Plain*', both interior and exterior surfaces;

d) '*Burnishing*': different stages of the process were noted among the vessels. Vessels may be lightly burnished, well burnished or highly burnished;

e) '*Smudging*': this type of surface treatment involved those vessels called by local authors '*Ceramica Nera Lustrata*' ('Black Lustrous Ceramics');

f) '*Slipped*': sometimes, a black, reddish or light beige slip, made of very fine clay, was hand-applied to one or both of the vessel surfaces, masking their original colours due to firing conditions.

Decoration on external or internal surfaces, while rarely present and only during the Middle Bronze Age/ First part of the Recent Bronze Age (11 samples of 256 examined), consists of impressed vertical lines, a single row of dots, dots or impressions filling the internal

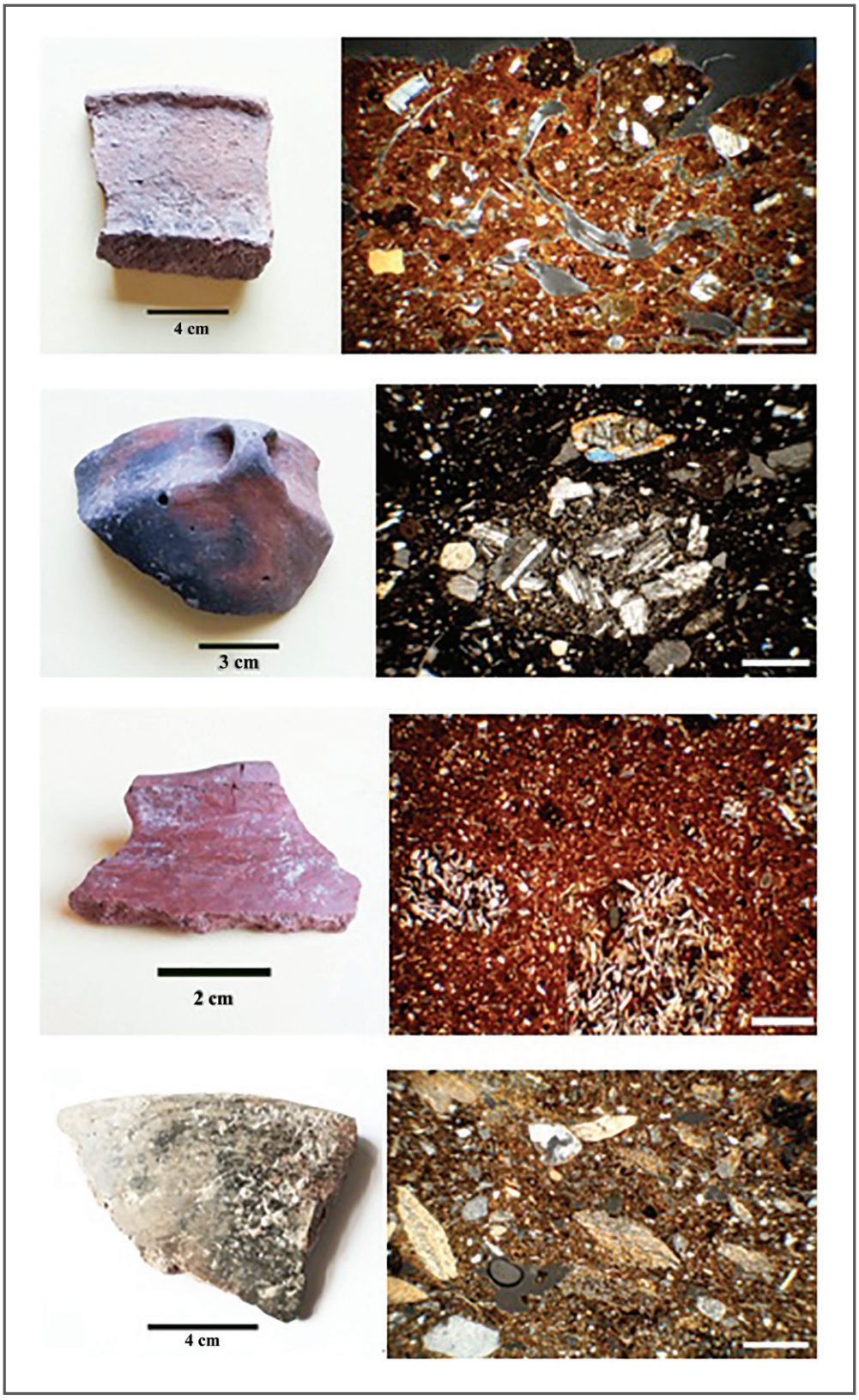

Fig. 2 - Middle and Recent Bronze Age pottery from the studied area. White scale bar 500µm. Macro and photomicrographs: M. G. Gradoli.

part of an impressed triangle shape and, in one rare case, horizontal thin brown painted lines.

External and internal surface colours, when not slipped, reflect different firing conditions: red-reddish or orange, grey and black, light beige or brown denoting oxidising or reducing atmospheres or, more frequently, mixed firing conditions. Nonetheless, the use of a slip of a different colour could also reflect potters' decision to create vessels with specific colours not produced technologically, perhaps due to the fact that oxidising or reducing conditions could not be kept stable for long periods. This fact indirectly provides information on the structures used to fire them (open or pit fires).

During the Recent Bronze Age, pottery assemblage is similar to that of the previous Middle Bronze Age, except for the appearance of some well-burnished necked jars and bowls locally called 'Nuragic Grey Ware'. Its main characteristic is its external colour (light grey) and thin walls (approximately 4 mm).

Under the polarising microscope, it can be classified within the '*Metamorphic fabric group*' but in a new sub-group, due to its fine grained aplastic inclusions.

Thin-walled vessels of this type can be obtained by manipulating raw materials during their preparation with the addition of fine temper or using clays that are naturally rich in these inclusions. The fact that, at least for the samples analysed to date, the temper is made of very small grains of metamorphic rock, similar in composition to those used for the other vessels but less rounded, may lead to the conclusion that the same fluvial metamorphic raw material was intentionally refined. This permitted the creation of thin-walled vessels that were then fired at high temperatures in a reducing atmosphere. According to Rice, such conditions increase strength during firing which, in turn, produces lightweight, very durable containers particularly suited for liquid storage (Rice,1987, p. 228). This type of surface finish is achieved in the presence of insufficient oxygen, when the carbonaceous matter in the clay cannot be completely oxidized: the gases present reduce iron oxides to a lower oxidation state, producing this typical grey colour (Michelaki, 2006, p. 97).

Fig. 3 - Round pebble from Nuraghe Arrubiu at Orroli. Scale bar: 2 cm. Photo: M. G. Gradoli

At the moment, no information regarding possible firing temperatures and the type of firing structures used is known, as no open pits or remains of kilns were found during excavations in the area. Thus, the potters' clear intention of producing thin-walled resistant vessels, fired in a reducing atmosphere, seems one possible hypothesis. Some 'nuragic grey ware' jars often have 'plain' internal walls (without surface treatment), perhaps due to the necessity of having a 'porous surface' which, for relatively short water storage, could help to keep the liquid cool (Rice, 1987, p. 231). Nonetheless, the inner part of their necks is always burnished. Associated with these pottery vessels, some round fluvial pebbles were found during sampling, perhaps representing one of the possible tools used to burnish their surfaces (Fig. 3).

Other necked jars or vessels having a different shape and the same temper composition but thicker walls (from 4 to 6-7 cm), seem to have been smudged instead. This is particularly clear under the polarising microscope and even to the naked eye: a thin

black deposit, due to the presence of carbon in colloidal form settled on the pottery as soot, penetrated the pores and turned the surface a permanent, lustrous black (Michelaki, 2007, p. 97).

Smudging is generally carried out at the end of the firing process by covering both the burning fuel and pottery with a smoke-producing substance, such as manure, green branches or leaves (Kaiser, 1984, p. 249-250 cited by Michelaki).

Regarding the study of the Final Bronze Age in the area, it may be useful to anticipate the results of the re-examination of 52 pottery thin-sections coming from the Nuraghe Ortu Comidu (Sardara). Considering their typology and microscopic character, the excavators and experts studying the ceramics described two different mineralogical homogenous fabric groups found in two different archaeological settings: the North Area from the Recent/Final Bronze Age and the South Tower from the Final Bronze Age/First Iron Age (Phillips, Nicholson & Patterson, 1986, p. 225). In the Plutonic Fabric Group and subgroups I defined, ceramics coming from the 'North Area' are all made of coarse or fine sand tempered with plutonic rock pieces, while ceramics coming from the 'South Tower', were manufactured using coarse or well-sorted loose plutonic sand without plutonic rock pieces in their fabrics. On the whole, it may be inferred that during the Recent-Final Bronze Age, pottery fabrics found in the 'North Area' were intentionally tempered with plutonic rock pieces, while during the later period, corresponding to the use of the South Tower, pottery was tempered using loose plutonic sand, probably collected from a different part of the landscape. The use of analytical methodology other than pottery petrology, for instance chemical analysis, would not have permitted this differentiation, as ceramics coming from both areas would have shown the same chemical and mineralogical composition, even if the 'temper' used had a different material consistency.

These two subgroups of plutonic origin are well represented in the Marmilla region in all the nuraghi analysed since the Middle Bronze Age, and even during the Pre-Nuragic period, confirming the conservative millenarian tendency of local pottery communities to continue using the same raw materials, easily available in that part of the landscape, even if shape and decoration changed in the course of time.

Conclusions

The great fabric variability observed under the petrographic microscope - 42 different 'paste recipes' clustered into 8 main fabric groups - reflects deliberate choices, early in the manufacturing process, which are not easily explained by possible raw materials physical constraints. Comparing petrographic and typological categories in all seven settlements considered, each fabric group encompasses a range of different shapes and, even when a new type of ware (such as '*nuragic grey ware*') appears, it does not involve changes in technology practises. The first conclusion drawn from these observations is that '*fabric diversity associated with homogeneity in vessel external characteristics*' seems to result from the activity of different extended familiar groups inhabiting the same region. Moreover, it indicates recurrent small-scale pottery production, secondary to other housekeeping tasks, in the absence of an overriding system of control able to impose technological homogeneity.

In particular, considering architectural settlement type and distribution, the Marmilla region during the Middle Bronze Age seems to have been inhabited by small groups of people sharing basic rules of pottery manufacturing, raw material choices and accessibility, along with similar external vessel shapes. No precious or 'prestige vessel' or any kind of craft specialisation or standardisation was observed in their domestic assemblages, leading to the preliminary conclusion that the same landscape was occupied by small, independent households with a high degree of mobility, sharing and exchanging technological knowledge, from distinct co-residential units through extensive 'cultural networks'. The same pattern seems to be confirmed for the other 135 ceramic samples of the Recent/Final Bronze Age studied to date.

Such a new scenario of the Middle and Recent Bronze Age way of living in the Marmilla region challenges previous interpretations of 'Nuragic social complexity' and the overestimated power held by

local 'elites'. The well-known assertion of the emergence of '*new elites*' proposed for Nuragic Society for several decades, fails to account for such 'petrographic fabric variability'.

Social complexity, not only in Sardinia, has always been equated with hierarchy and power centralisation, which I believe do exist, but must be evident on several analytical scales. Undue emphasis is often at the basis of vertical political differentiation assuming the existence of institutionalised, hereditary leadership, even when it is possible that the data available could be interpreted in terms of different forms of social organization and control (Kienlin, 2012, p. 18). Indeed, this domestic pottery production shows very little evidence of 'social inequality' on a local scale. Kienlin and Kohring, among others, suggest the use of a 'bottom-up' approach to understanding social complexity and begin analysing complexity not from the elite viewpoint but using the notions of 'equality' or 'inequality' (Kienlin, 2012, p. 19; Kohring, 2011, p. 148, 2012). Equality is, actually, a utopian idea: in all human groups, people will differentiate between their fellow men and_women on the grounds of performance or other types of qualities, as equality or inequality is socially constructed. Hierarchy should not be equated with complexity, as a group may be complex even without institutionalised ranking (Rowlands, 1995; Wynne-Jones & Kohring, 2007; Souvatzi, 2007), and authority and political power may operate at different levels, from households to kinship groups, through collective forms of decision-making in everyday life and in small-scale integrative units or via clans, lineages or larger entities such as the tribe (Kienlin, 2012).

In this research, I concentrated on the analysis of ceramics from single households or different parts of the same household, exploring the links between social knowledge systems and technology among 'communities of practise' from the same region. A community of practise is a group of people learning and sharing the same techniques of pottery manufacture and the same way of structuring their general meanings and understanding of the world (Wenger, 1998). Such groups, to which people belong and into which they are incorporated, should be regarded as the arena in which daily encounters occur and individuals share practical and cosmological knowledge, recalling Bourdieu's consideration that the practises surrounding material culture establish social relationships. Indeed, communities of practise frame encounters mediating between shared structuring principles and the individual-embodied '*chaine operatoire*'. In addition, they create a sense of shared identity by affirming links within and between communities (Kohring, 2011, p. 156). This approach demonstrates how, in addition to the choice of specific raw materials from different collecting sites in replicating their own technological traditions, artisans from distinct co-residential units and perhaps of different cultural affiliation shared knowledge about fabric preparation typical of their peculiar 'communities of practise'.

Acknowledgements

I would like to thank the Soprintendenza Archeologica di Cagliari and Sassari, and in particular Chiara Pilo and Nadia Canu, for granting me permission to sample the ceramics; the Nuraghe Arrubiu excavation directors, Fulvia Lo Schiavo and Mauro Perra; and Mauro Perra for his assistence during sampling.

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