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The First Specialised Potters of the Adriatic Region: The Makers of Neolithic *Figulina* Ware

Michela Spataro

Figulina *ware is widely distributed in different Early and Middle Neolithic material cultural assemblages along the eastern and western Adriatic coastlines. Scientific analyses in thin section and by Scanning Electron Microscopy, used in combination with Energy Dispersive Spectrometry (SEM-EDS), show that this type of pottery was probably produced on a regional scale, in contrast to everyday pottery types, which were produced for local needs only.* Figulina *ware was manufactured through a specific process with a well-defined choice of raw material, and fired at temperatures which required the use of kilns, whereas everyday ceramics were fired at lower temperatures and may have been produced at a household level. This suggests that specialised artisans produced the* figulina *ware, which implies that an economic and social shift took place at the end of the Early and at the beginning of the Middle Neolithic.*

Keywords: Adriatic coastlines, Danilo, figulina*, Hvar, Impressed Ware, Neolithic, petrography, SEM/EDS, Square-Mouthed Pottery culture*

Introduction

The aim of this paper is to discuss the role of *figulina* ware in the Early and Middle Neolithic of the Adriatic region, on the basis of the results of scientific analyses carried out by the author in the last few years.

These analyses considered 59 samples from 10 sites distributed along the eastern and western Adriatic coastlines and attributed to different archaeological cultures, such as the Impressed Ware (IW), the Square-Mouthed Pottery (SMP), the Serra d'Alto, the Danilo, and the Hvar cultures (Figure 1, Table 1).

Research context

The term '*figulina* ware' was introduced in 1934 by U. Rellini, when he excavated the Middle Neolithic site of Ripoli in Val Vibrata in central-eastern Italy (Teramo province, in Abruzzo) (Rellini 1934). Today, this term is commonly used to indicate a class of painted or unpainted yellowish, whitish, light buff, light greyish or pinkish pottery, mainly powdery in texture, and with almost invisible inclusions. Painted examples are decorated with red, brown, and dark linear and dynamic geometric motifs.

This type of pottery is widespread along the Adriatic coastlines, where it appeared around the middle of the sixth millennium cal. BC, in the Early Neolithic Impressed Ware Culture, until the late fifth millennium cal. BC in the Middle Neolithic Serra d'Alto Culture (Whitehouse 1969; Malone 1985), whose vessels are almost exclusively made of *figulina* pottery. It is distributed also along the eastern Adriatic coastline in assemblages of the Middle Neolithic Danilo and Hvar cultures (Batović 1960; Korošec 1964).

The situation in Central Italy is more complicated. Here both Early Neolithic sites of the middle sixth millennium cal. BC, such as Catignano in the Abruzzi (Tozzi and Zamagni 2003), and Middle Neolithic sites of the Ripoli Culture (Cremonesi 1965) made abundant use of *figulina* pottery, even though both the vessel shapes and painted patterns strongly differ according to their cultural and chronological attribution.

The term *figulina* is sometimes utilised inappropriately by archaeologists. Whereas real *figulina* pottery has the

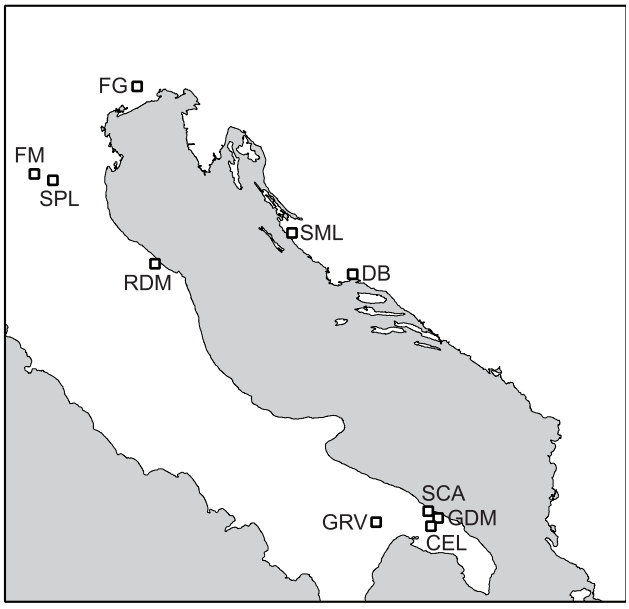

Figure 1. Sites from which figulina *ware was analysed by the author. Key: CEL = Caverna Elia, SPL = Spilamberto, RDM = Ripabianca di Monterado, SCA = Scamuso, DB = Danilo Bitinj, SML = Smilčić, FM = Fiorano Modenese, FG = Fagnigola, GDM = Grotta delle Mura, GRV = Gravina.*

Table 1. List of the sites from which figulina *samples were analysed.*

Site	Location	Culture	Sample(s) analysed	Technique(s) of analysis
Fagnigola	Italy	Fagnigola Group	1	Thin section
Fiorano Modenese	Italy	Square-Mouthed Pottery	1	Thin section
Ripabianca di Monterado	Italy	Middle Adriatic Impressed Ware	11	Thin section; SEM-EDS
Gravina di Puglia	Italy		3	Thin section
Grotta delle Mura	Italy	Impressed Ware	7	Thin section
Smilčić	Croatia	Danilo	4	Thin section; SEM-EDS
Smilčić	Croatia	Hvar	2	Thin section; SEM-EDS
Danilo Bitinj	Croatia	Danilo	6	Thin section; SEM-EDS
Caverna Elia	Italy	Serra d'Alto	2	Thin section; SEM-EDS
Scamuso	Italy	Serra d'Alto	4	Thin section; SEM-EDS
Spilamberto	Italy	Square-Mouthed Pottery	18	Thin section; SEM-EDS

characteristic traits described above, other ceramics, rich in visible filler, with a hard outer surface of buff colour, or whitish, rough pottery, are often attributed to this class, although they are also referred to as *pseudofigulina*.

In northern Italy *figulina* flasks painted with typical red and black, Ripoli geometric patterns, occur in the Early Neolithic layers of the Caverna delle Arene Candide in Liguria (Bernabò Brea 1946) while the finds from the Fiorano and Vhò group settlements of the Po Valley (Bagolini and Barfield 1991) are almost contemporary or slightly older. A similar phenomenon can be observed in the Friuli Plain, where the middle sixth millennium cal. BC sites of Fagnigola and Sammardenchia di Pozzuolo yielded a few fragments of unpainted *figulina* ware (Biagi 1975; Ferrari and Pessina 1996). There is no doubt that these *figulina* potsherds indicate that trade activities had already been established with some central Italian production centres: the problem, in most cases, is to define where these centres were located. The general impression is that the trade and circulation of *figulina* vessels was already active during the second half of the sixth millennium cal. BC. It involved the export of two well-defined vessel types: four-handled flasks with four small pierced bosses on the upper neck, just below the rim, and open, hemispherical bowls, most probably with one handle. In any case, it seems that *pseudofigulina* wares were also produced, most probably locally, as some of the finds from the Early Neolithic settlements of the eastern Po Plain Vhò Culture indicate (Bagolini and Biagi 1975).

The picture seems to be rather similar during the Middle Neolithic (fifth millennium cal. BC), when the SMP culture flourished in northern Italy (Barfield 1972). In this culture, *figulina* vessels seem to have been in use only during the first half of the millennium. Many discoveries made in north-eastern Italy (Rocca di Manerba, Gaione, Quinzano Veronese, Fimon Molino Casarotto, La Vela di Trento and others) (Barfield 1981; Bernabò Brea *et al*. 1990) have demonstrated that the SMP culture maintained strong relationships with that of Serra d'Alto in Apulia and Basilicata (Lo Porto 1989). Typical Serra d'Alto *figulina* handles often recur, although as isolated finds, at some SMP Culture complexes. For example, a typical, small Serra d'Alto flask was placed in a fifth millennium cal. BC grave at La Vela di Trento, in the Adige Valley. The Serra d'Alto flask is supposed to be a local imitation of the typical Apulian prototypes (Mottes 1997). *Spondylus* beads and shoe-last greenstone chisels of Central European type also appear at the same cemetery, indicating the importance of the Adige Valley axis in the commercial routes established between south and central Europe and vice-versa (Mottes *et al*. 2002). Other important SMP sites are Campegine and Chiozza di Scandiano in Emilia (Bagolini and Barfield 1971), which have been known since the end of the nineteenth century. At Chiozza, an important cemetery of the same period was also found, with burials of individuals crouched on their left side (Laviosa Zambotti and Messerschmidt 1941-1942).

It is difficult to understand why the production of *figulina* wares ceased in the second half of the fifth millennium cal. BC both in central and southern Italy, but the characteristic ceramics of the later cultures throughout the peninsula were quite different: the Diana culture, red-polished, undecorated wares in the south (Bernabò Brea and Cavalier 1956) and the black-burnished, also undecorated fine ceramics of the Chassey and Lagozza cultures in the north (Guerreschi 1967), which clearly indicate a radical change in the manufacturing technique, function and fashion.

Previous analyses of *figulina* fom the Italian and Croatian coastlines

As part of the author's PhD (1998-2001), 35 *figulina*

potsherds from both Adriatic coastlines were analysed using minero-petrographic and chemical analyses. The minero-petrographic work focused on the study of thin sections, in order to identify the minerals contained in the pottery fabric (Maggetti 1982), whereas Scanning-Electron Microscopy, used in combination with Energy Dispersive Spectrometry, (SEM-EDS) was employed to measure the concentration of major and minor elements in the clay (Spataro 2002, chapter 2). The SEM-EDS analysis was carried out at the Institute of Archaeology (UCL, London) with a JEOL JSM-35 CF with a standard peak resolution of 138 eV, and Window ATW2.

The samples analysed in thin section are from northern Italy (Fagnigola), central and central-eastern Italy (Fiorano Modenese and Ripabianca di Monterado), southern Italy (Gravina and Grotta delle Mura), and from the Croatian coastline (Smilčić and Danilo Bitinj) (Table 1; Figure 1). The SEM-EDS quantitative results were based on five bulk analyses on each sample at a magnification of x86 (each analysis representing a cross-sectional area of ca. 2 x 3mm). Both the results of individual bulk analyses and the average elemental concentrations (Schneider 1989) in each sherd were compared to the ceramic groups defined by minero-petrographic analysis.

Thin section analysis

The Italian sites

The results of the analyses in thin section show an articulated and varied picture. The fabrics of samples from the northern Italian sites of Fagnigola and Fiorano Modenese are rather similar, with a reddish, very fine-grained, slightly calcareous, vitrified, silty paste, with very rare inclusions, such as fine and well-sorted quartz (<5%; typical size 0.02 x 0.02mm), some iron oxides, and very fine muscovite mica. The sample from Fiorano Modenese shows also a pyroxene inclusion (Spataro 2002, 180-181).

In contrast to these very fine fabrics, the specimens from the Impressed Ware site of Ripabianca di Monterado are very different. Their fabrics are brown, calcareous, and fossiliferous, with rather well-sorted quartz (up to 20%; size range between 0.08 x 0.05 and 0.03 x 0.02mm), calcareous fragments, radiolarian chert, flint, opaques and iron oxides, feldspar, pyroxene, and abundant microfossils. A subgroup was also identified, characterised by a coarser paste with larger quartz inclusions and limestone fragments (Spataro 2002, 186). A soil sample, collected 0.5km from the site, was also analysed in thin section. Its fabric is very calcareous and fossiliferous, rich in quartz, radiolarian chert, flint and microfossils, such as that of the *figulina* ware (Spataro 2002, 153-160, figure 86/d).

The *figulina* potsherds from the south-eastern Italian sites of Gravina and Grotta delle Mura show similar fabrics: brown-reddish, fossiliferous and slightly vitrified, with well-sorted quartz, abundant microfossils, fine muscovite mica, iron oxides, rare feldspar, and pyroxene. The main difference between the two groups is in the occasional flint present in the samples from Grotta delle Mura and absent in those from Gravina. In particular, their pastes contain the same species of foraminifera (possible sea-urchin and *Nummulites*; Y. Goren, pers. comm. 2001). On the basis of these observations, it is possible to suggest that the samples analysed from these two sites come from very similar clay sources: calcareous, fossiliferous, with fine quartz and flint inclusions.

The samples from the northern Italian sites show much finer fabrics than those from central-eastern and south-eastern Italy. The latter all show calcareous and fossiliferous fabrics with much coarser and more abundant inclusions, though those from Ripabianca di Monterado contain radiolarian chert (absent in the southern Italian sites), more abundant flint and fewer microfossils. On the basis of the soil sample from Ripabianca, and the comparisons of the pottery fabrics, it is possible to suggest local production for the central Italian site and a possible regional manufacture for the Apulian sites (Spataro 2002, 162,190).

The Dalmatian sites

Six *figulina* samples were analysed from the Dalmatian site of Smilčić, near the city of Zadar, along the Adriatic coastline (Batović 1962; 1966). In addition to the *figulina* ware, the everyday pottery from this site was also analysed. The latter comes from three different occupation layers: Impressed Ware, Danilo, and Hvar Cultures (Spataro 2002, 75-93). A total of 63 potsherds were analysed in thin section and by SEM-EDS from the three cultural phases.

The everyday pottery from the three different cultural layers includes brown-reddish, calcareous fabrics, with abundant limestone, some quartz, occasional muscovite mica, iron oxides, opaques, and abundant added crushed calcite. The calcite crystals suggest that the pottery was fired at low temperatures, which never exceeded 750º C[1]. The ceramic technology does not change from the early up to the final phase of the Middle Neolithic: the potters exploited very similar, most probably local sources, as suggested by the continuity of use of the same sources and the thin section analysis of a soil sample collected 0.5km from the site (Spataro 2002, 91).

In contrast, the *figulina* ware analysed from the Danilo and Hvar layers (Table 1) shows a very different composition. The fabrics from the earlier Danilo layer were subdivided into two subgroups. The first is the so-called 'fine *figulina*', with a reddish, very fine-grained, slightly calcareous, ferruginous and vitrified fabric, with very fine and well-

[1] The pottery was fired under an oxidising atmosphere; therefore calcite disappears at firing temperatures above 750º C. In case of reducing atmosphere, calcite would disappear at about 800º C (Letsch and Noll 1983, 266).

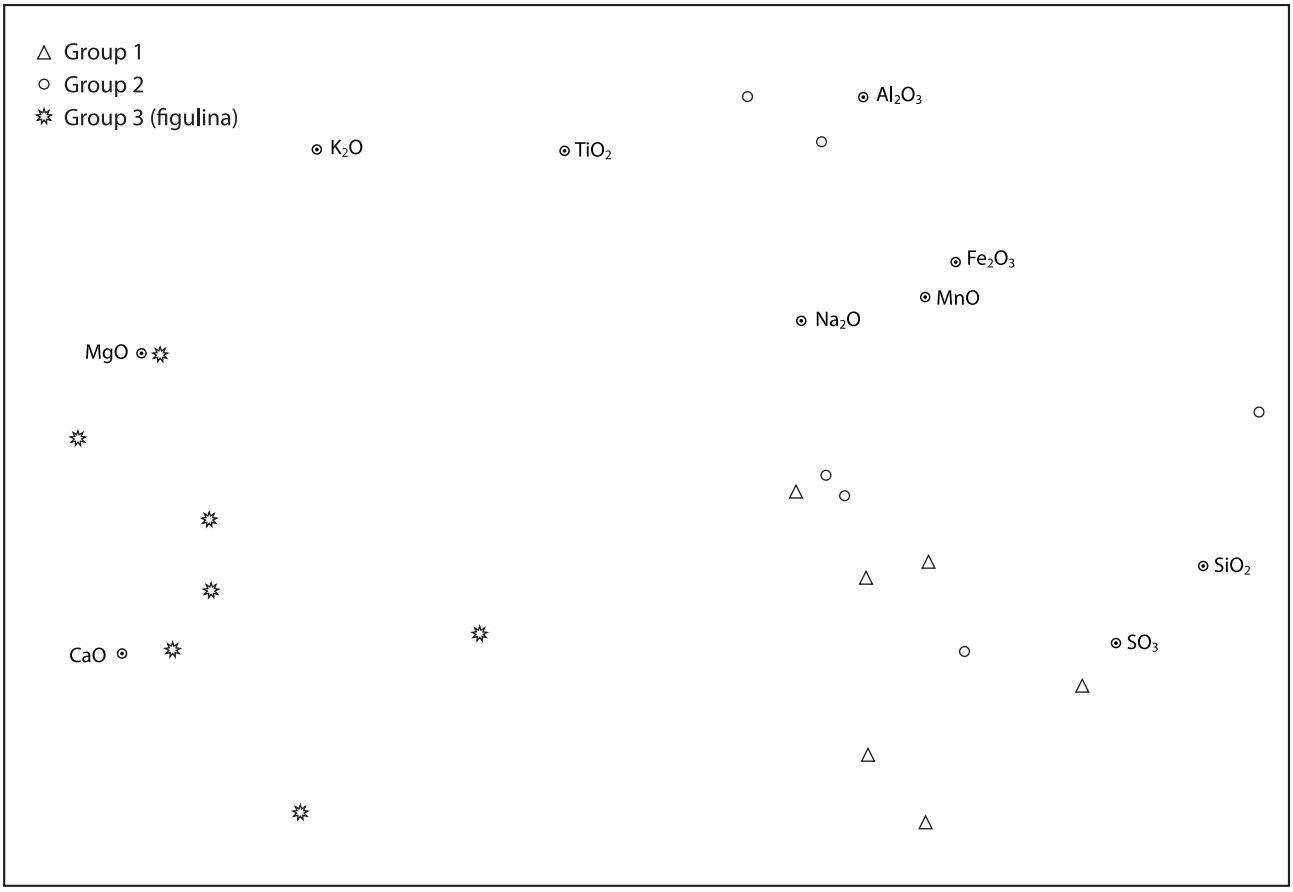

Figure 2. PCA (components 1 and 2) of SEM-EDS results from everyday pottery and figulina *ware found at Ripabianca di Monterado. Each point represents the mean of 5 bulk analyses of a single sherd. Points are labelled according to the fabric group defined by optical microscopy.*

sorted quartz (<5%; typical size 0.02 x 0.01mm), muscovite mica with very fine lamellae, iron oxides, and rare pyroxene. The second group is the 'coarse *figulina*', with a coarser and more micaceous fabric. The fabrics of *figulina* sherds from the overlying Hvar culture are almost identical to that of the 'fine' group from the Danilo phase.

Six *figulina* samples were studied from the site of Danilo Bitinj, located 18km east of Šibenik (Korošec 1958). In addition, 19 potsherds of ordinary ware were also analysed in thin section and by SEM-EDS. The thin sections of the latter show dark brown, calcareous and iron-rich fabrics with abundant and mainly poorly-sorted quartz, some muscovite, polycrystalline limestone, heavily tempered with crushed calcite. On the basis of the analysis of a soil sample collected near the site, it is possible to suggest local production for these ceramics.

As in the case at Smilčić, the analyses of *figulina* show a rather different composition. The thin sections of the six samples have been subdivided into 3 subgroups: 'fine', 'medium' and 'coarse' *figulina*. The first subgroup is very similar to the 'fine' fabric from Smilčić. It shows a reddish, very fine, vitrified, ferruginous and very slightly calcareous fabric with very well-sorted quartz (<5%; typical size 0.02 x 0.01mm), fine muscovite, iron oxides, and very rare pyroxene. The medium and the coarse groups are more calcareous with coarser and more abundant inclusions (Spataro 2002, 116). The fabric of the fine *figulina* at both Danilo Bitinj and Smilčić is isotropic, which suggests that it was fired at temperatures exceeding 850º C.

SEM-EDS analysis

The SEM-EDS results show an interesting picture, when we compare the everyday pottery and the *figulina* data.

The Italian site

The SEM-EDS results from Ripabianca confirm that there are distinct differences between the everyday pottery and the *figulina* ware, as already noticed in thin section (Spataro 2002, 153-163). On the basis of the 30 samples analysed from this site, the clay utilised for the everyday pottery was subdivided into two types: calcareous and non-calcareous. The first group (13 samples) shows abundant quartz, some limestone breccia, polycrystalline quartz, muscovite, rare pyroxene and microcline, and it was heavily tempered with flint. The second group (6 samples) was more micaceous, with more abundant quartz and limestone, some flint but

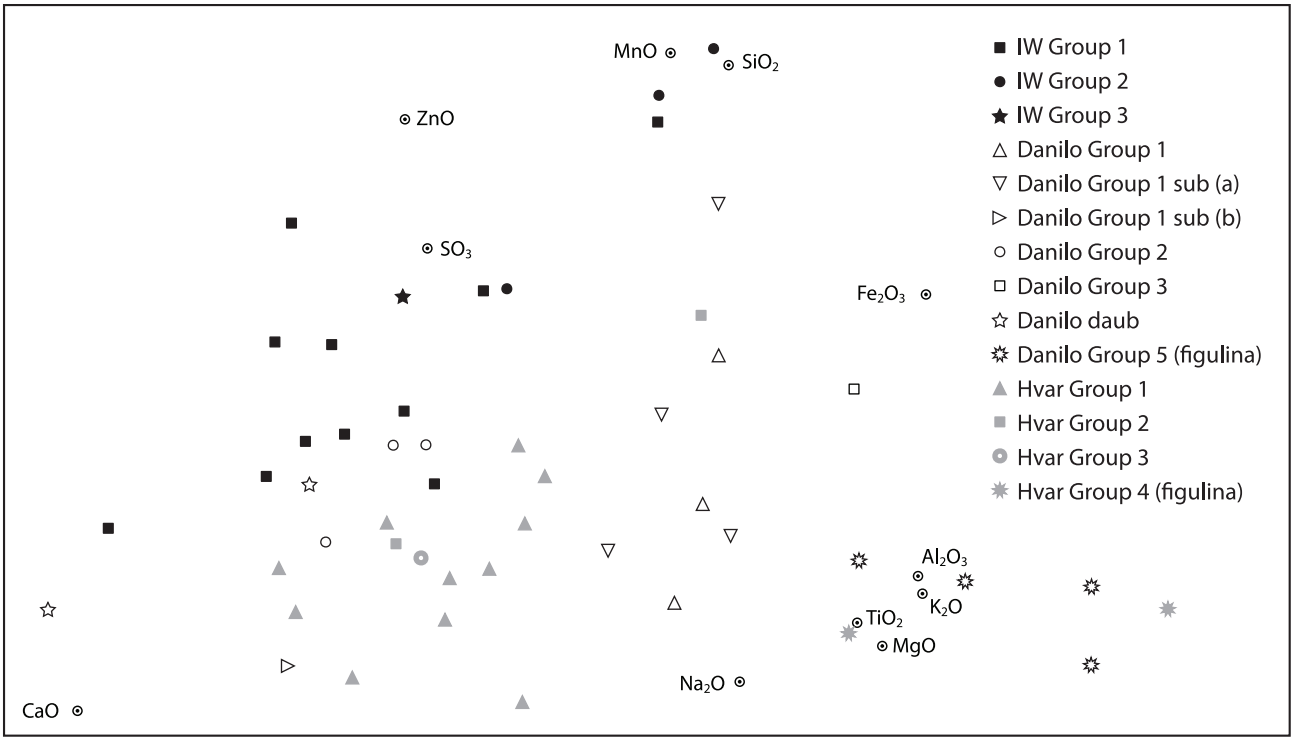

Figure 3. PCA (components 1 and 2) the SEM-EDS results from everyday and figulina *pottery found at Smilčić. Each point represents the mean of 5 bulk analyses of a single sherd. Points are labelled according to the fabric group defined by optical microscopy, and by occupational phase (IW = Impressed Ware).*

also rare granitic rock fragments. A third group, composed of 11 samples of *figulina* ware (see above), shows a calcareous, fossiliferous and vitrified fabric, with abundant quartz, radiolarian chert, flint, muscovite, and rare feldspar and pyroxene. A subgroup of 2 samples was also identified; it is much coarser with larger-sized quartz and flint (Spataro 2002, 159). Principal Components Analysis (PCA) of the SEM-EDS results divides the samples into two groups, one representing *figulina* ware and the other everyday pottery (Figure 2). The elements associated with *figulina* ware are calcium, potash and magnesium, which are related to the calcareous fabric.

The Dalmatian sites

If we now look at the results from the Dalmatian coastline, we can immediately spot that the clays exploited for the production of the daily-used pottery and that of the *figulina* are very different. At the site of Smilčić, during the Danilo culture[2], the everyday pottery was produced using probably local clays, mainly calcareous, which was mainly tempered with crushed calcite. 17 samples were subdivided into 4 fabrics: 15 samples out of 17 were tempered with calcite; see for details Spataro 2002, 80-83).

The *figulina* ware is subdivided into 2 subgroups - 'fine' and 'coarse'. The 'fine' group is very fine-grained, slightly calcareous, vitrified, ferruginous and micaceous, with rare and tiny inclusions (quartz, muscovite and pyroxene). The 'coarse' group is much richer in coarser minerals, in particular quartz, polycrystalline limestone and flint (Spataro 2002, 84). At the same site, some 500 years later, during the Hvar culture, the *figulina* production is again very different from the everyday pottery. The latter (19 samples out of 20) was heavily tempered with crushed calcite, as in the previous cultural layer, but the *figulina* samples are extremely similar to the 'fine' *figulina* from the previous layer.

Looking at the SEM-EDS results of the ordinary pottery from Smilčić Impressed Ware, Danilo and Hvar phases and the *figulina* ware from the same cultural layers, we can immediately notice that the *figulina* sherds are distinguished from the everyday ones, mainly in relation to the lower percentages of CaO and the higher percentages of the following oxides: iron, magnesium, titanium, potash and aluminium (Figure 3). The high percentage of CaO in the everyday pottery is due to the fact that they were heavily tempered with calcite, whereas iron, aluminium, titanium, potash and magnesium are related to the different clay source exploited for the *figulina* manufacture. The composition of a daub sample from Smilčić is similar to that of the everyday pottery found at this site, reinforcing the idea that the pottery was produced locally.

If we look at the SEM-EDS data from everyday pottery and

[2] Although there are few absolute dates for the Danilo culture, it seems to start around the middle of the sixth millennium cal. BC (Chapman 1988).

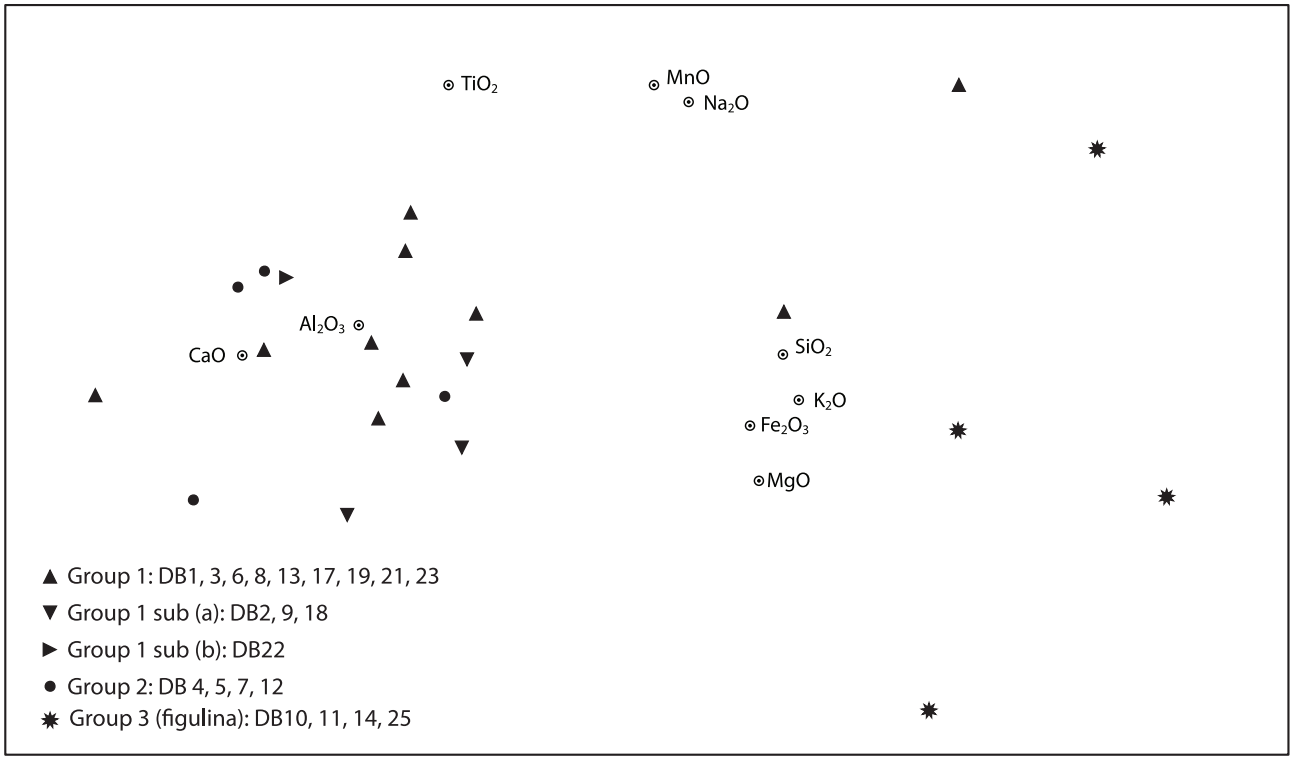

Figure 4. PCA (components 1 and 2) of the SEM-EDS results from everyday and figulina pottery found at Danilo Bitinj. Each point represents the mean of 5 bulk analyses of a single sherd. Points are labelled according to the fabric group defined by optical microscopy.

figulina ware of the Danilo Bitinj site (Danilo phase) we can see a similar pattern (Figure 4). The everyday pottery (particularly Group 2) appears to contain more calcite than any of the *figulina* samples, which are chemically quite distinct, with higher concentrations of silica, magnesia and/or potash.

If the compositional data from the two Croatian sites are compared by PCA (Figure 5), we can see a reasonably clear separation between everyday pottery from Danilo Bitinj and Smilčić, suggesting that most, if not all, of these ceramics were locally made at each site (although the clay sources exploited during the different phases of occupation at Smilčić may not have been identical). By contrast, *figulina* pottery from each site is quite similar in composition, as well as being distinctly different to the everyday pottery. It is feasible that the *figulina* material has a single production centre, which has yet to be identified.

New analyses of the *figulina* from Early and Middle Neolithic Italian sites

In 2007, minero-petrographic analysis in thin section and by SEM-EDS (a Philips XL30 ESEM was used in combination with INCA Oxford Instruments) were also carried out on *figulina* samples from the southern Italian sites of Scamuso (Biancofiore and Coppola 1997) and Caverna Elia (Coppola 2003, 112-118) in Apulia, and the SMP culture site of Spilamberto (Bagolini 1981) in northern Italy, near Modena.

Spilamberto: petrographic and chemical analyses

Eighteen *figulina* samples were analysed from Spilamberto and six fabrics were identified in thin section. Most of the fabrics are vitrified, except for F5, which was fired at lower temperature; Fabric 2 is highly vitrified. Fabrics 2, 3, and 4 are slightly calcareous, vitrified, fossiliferous, and micaceous, whereas Fabrics 5 and 6 are non-calcareous and very micaceous (see Table 2). They all show fine-size inclusions and most samples show post-depositional calcareous fragments.

Fabric 1 is micaceous, vitrified and very slightly calcareous, with very well-sorted and fine sub-angular quartz (15%; typical size 0.03 x 0.03mm), occasional polycrystalline quartz, very rare flint, red clay fragments, abundant fine muscovite and some biotite micas, one grog fragment, and some iron oxides and opaques (Figure 6).

Fabric 2 has some well-sorted sub-angular quartz (10%; typical size 0.03 x 0.03mm), abundant micas, iron oxides and opaques, rare microfossils, and rounded calcareous fragments (probably post-depositional). Its subgroup is similar but with more abundant quartz sand (Figure 7).

Fabric 3 shows abundant and well-sorted sub-angular quartz (>20%; typical size 0.03 x 0.03mm), muscovite and biotite micas, abundant iron oxides and clay fragments, and occasional feldspar and pyroxene.

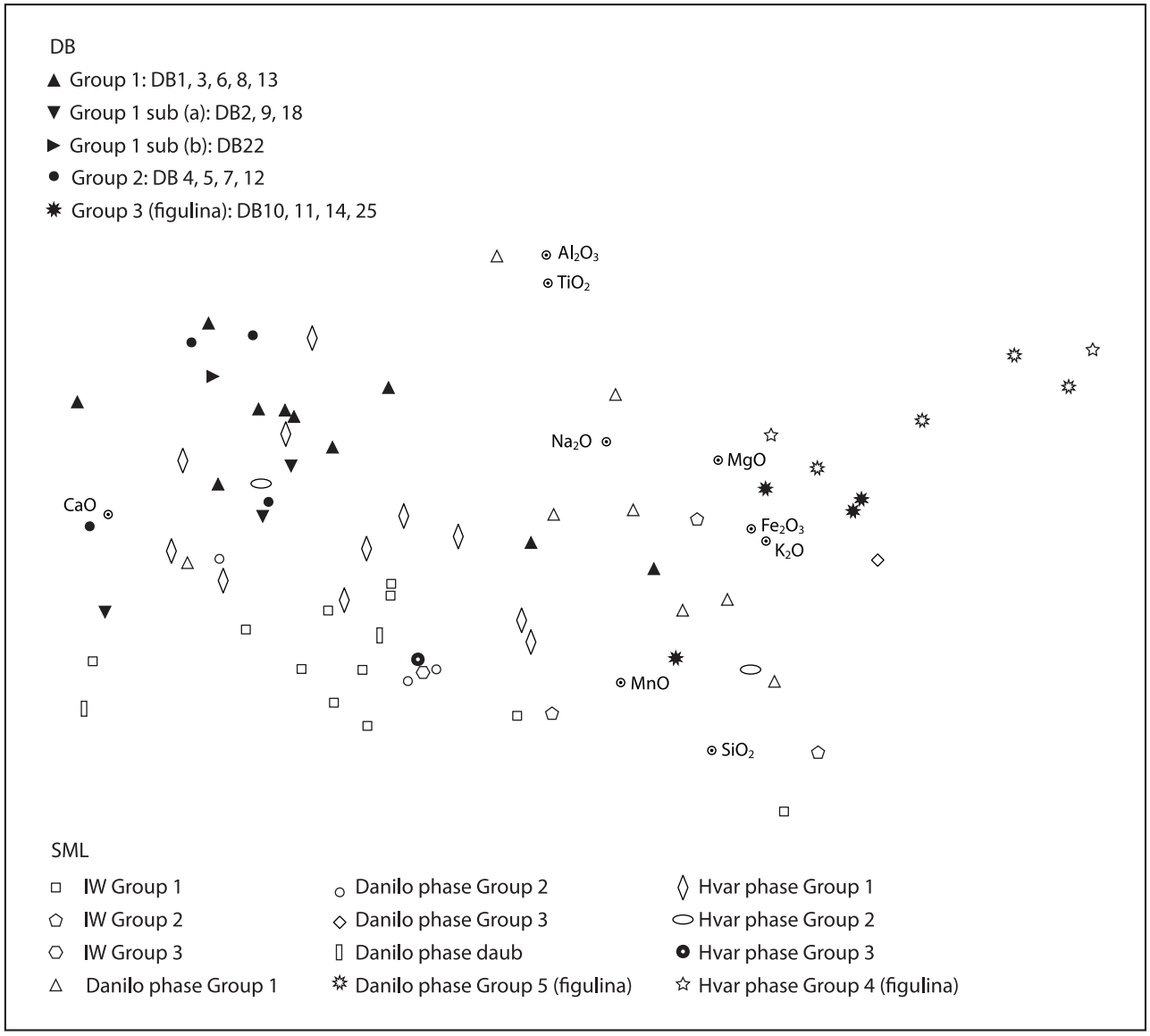

Figure 5. PCA (components 1 and 2) of the combined SEM-EDS results from everyday and figulina *pottery found at Danilo Bitinj (DB) and Smilčić (SML). Each point represents the mean of 5 bulk analyses of a single sherd. Points are labelled according to the fabric group defined by optical microscopy, and, at Smilčić, by occupational phase (IW = Impressed Ware).*

Fabric 4 is very slightly calcareous, with abundant and well-sorted sub-angular quartz (>15%; typical size 0.04 x 0.03mm), muscovite, and very rare zircon and red clay fragments.

Fabric 5 is very micaceous, with abundant and well-sorted sub-angular quartz (20%; typical size is 0.04 x 0.03mm), abundant muscovite and some biotite, occasional feldspar, pyroxene and amphibole, some microfossils, abundant red clay fragments, and iron oxides and opaques.

Finally, Fabric 6 contains some well-sorted quartz (10%; typical size is 0.04 x 0.03mm), rare feldspar, some fine muscovite mica, and some iron oxides.

In summary, Fabric 1 is very micaceous, non-fossiliferous and contains some packed mica; F2 contains fewer inclusions than the others. Fabrics 3 and 4 are similar, but the former is less micaceous and iron-rich; on the other hand, F4 is less calcareous than groups 2 and 3 and it has more abundant red clay fragments than Fabrics 1-3. Fabric 5 is more micaceous than the others, and it has more abundant inclusions (e.g. pyroxene and feldspar), opaques and heavy minerals than F6. Fabrics 3, 4, 5 and 6 show more abundant inclusions than F1 and 2, but always fine-grained.

Mannoni (1994) studied the mineralogical composition of 12 samples of everyday pottery from the site of Spilamberto S. Cesario, 4 samples from the SMP phase, 5 samples from the Late Neolithic and 3 samples from the Eneolithic. The fabrics of the SMP samples contain quartz, rare polycrystalline quartz, very rare grains of plagioclase and siltite (in two samples), muscovite, and abundant iron oxides. In the later samples, siltite is also present, and in the

Table 2. Spilamberto: description of the fabrics identified in thin section.

Fabric	Samples	Matrix	Minerals
F1	4 (SPL 1, 2, 10, 17)	Micaceous, vitrified and very slightly calcareous	Abundant: quartz Common: muscovite mica, biotite, iron oxides, opaques Rare: polycrystalline quartz, flint (SPL 2, 10), red clay fragments, feldspar Very rare: a grog fragment (SPL2)
F2	3 (SPL 9, 12, 13)	Micaceous, vitrified, slightly fossiliferous and calcareous	Abundant: iron oxides, opaques Common: quartz, muscovite, biotite, red clay fragments Rare: microfossils, rounded calcareous fragments, probably post-depositional (e.g. SPL 9)
F2 *sub. a*	2 (SPL 11, 18)	Micaceous, vitrified, slightly calcareous and fossiliferous	Abundant: quartz Common: muscovite, biotite Rare: microfossils, rounded calcareous fragments
F3	2 (SPL 5, 6)	Micaceous, vitrified, slightly calcareous and fossiliferous	Abundant: well-sorted sub-angular quartz, iron oxides, clay fragments, muscovite, biotite Common: microfossils Rare: feldspar, pyroxene Some post-depositional factors are visible on the edges of the samples
F4	5 (SPL 3, 4, 7, 8, 19)	Micaceous, very slightly calcareous, fossiliferous, slightly vitrified 4 out of 5 samples have a slip, 0.5-1mm thick, made of the same minerals as the rest of the fabric. It is probably a surface treatment such as burnishing.	Abundant: well-sorted sub-angular quartz, muscovite mica Common: some microfossils, red clay fragments Very rare: zircon
F5	1 (SPL 14)	Very micaceous, fossiliferous and non-calcareous Slip made of the same material as the rest of the sherd	Abundant: well-sorted sub-angular quartz, muscovite Common: biotite, red clay fragments, iron oxides Rare: feldspar, polycrystalline quartz, pyroxene, amphibole, zircon, epidote, microfossils, opaques
F6	1 (SPL 15)	Very micaceous, fossiliferous and non-calcareous Sort of slip	Common: well-sorted quartz, fine muscovite mica, iron oxides Rare: microfossils (slightly coarser than in the other groups), feldspar, pyroxene

Eneolithic the pottery was tempered with crushed calcite (Mannoni 1994: 72). The author suggests that the raw material for the production of the SMP samples could come from local alluvial fans, alluvial post-Würmian deposits with *terra rossa*, and from the nearby Emilian Apennines (Mannoni 1994: 73-74).

Most of the *figulina* sherds studied here show fossiliferous fabrics (16 samples out of 18), with microfossils, and abundant muscovite and biotite micas. As already seen at Ripabianca di Monterado, it appears that the potters used very different clay sources for the manufacture of everyday and *figulina* pottery.

The SEM-EDS results show that the different bulk analyses of individual sherds tend to be extremely similar (Figure 8). The clustering apparent in the figure is consistent with the petrographic grouping, and there are no additional clusters indicating clay sources other than those identified by thin sectioning. Fabric group 1 samples form a clear cluster, which is distinctly different to all other samples. Fabric 2 and 2(a) samples also form a distinct cluster. Only sample SPL19 produced individual bulk analyses which appear to belong to 2 different clusters, those associated with Groups 2 and 4 (the sherd was attributed to Group 4 on the basis of petrography). Sample SPL9 appears to be associated with G2 *sub. a* rather than G2, in which it was placed petrographically, but this might be due to the post-depositional formation of secondary calcite, already noticed in thin section.

The SEM-EDS results do not clearly separate Fabric 3 from Fabric 4, or Fabric 5 from Fabric 6, perhaps because not enough samples from these groups have been analysed. Fabrics 3 and 4 are similar in thin section (see above) but Fabric 3 is less micaceous and has finer-grained quartz than F4. Fabrics 5 and 6, which in thin section are both non-calcareous, as their position in the PCA plot suggests, and differences between them (see above) may be obscured by the variability within the assemblage as a whole.

Overall, these samples were produced from very similar clays, as the petrographic analyses demonstrate, probably indicating the deliberate selection of a particular type of clay for the production of *figulina* ware. Nevertheless, it is possible to distinguish different clay sources, which may reflect different production centres.

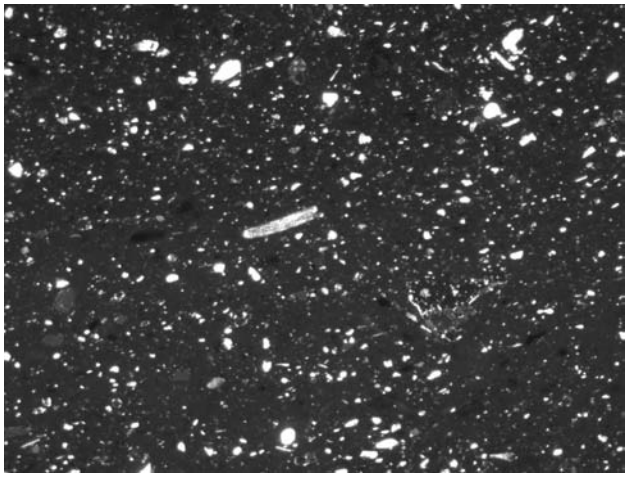

Figure 6. Thin section of figulina *from Spilamberto (sample SPL2) showing a vitrified and micaceous fabric with very well-sorted and fine quartz, very fine lamellae of muscovite, and a grog fragment (photo by the author, XPL, 15mm width of field).*

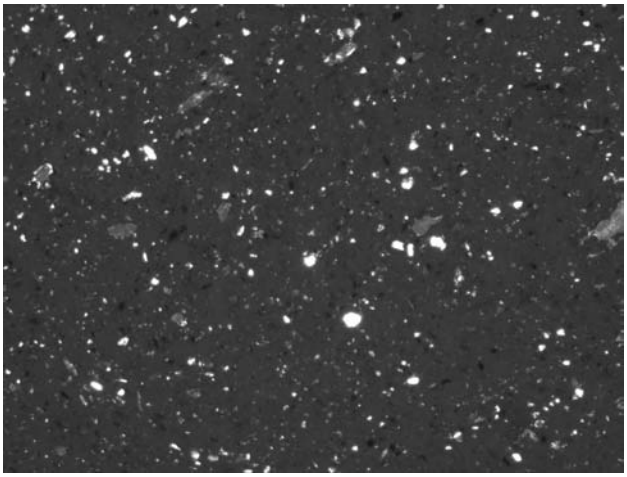

Figure 7. Thin section of figulina *from Spilamberto (sample SPL9) showing a very fine vitrified and micaceous fabric with some fine quartz, iron oxides and opaques (photo by the author, XPL, 15mm width of field).*

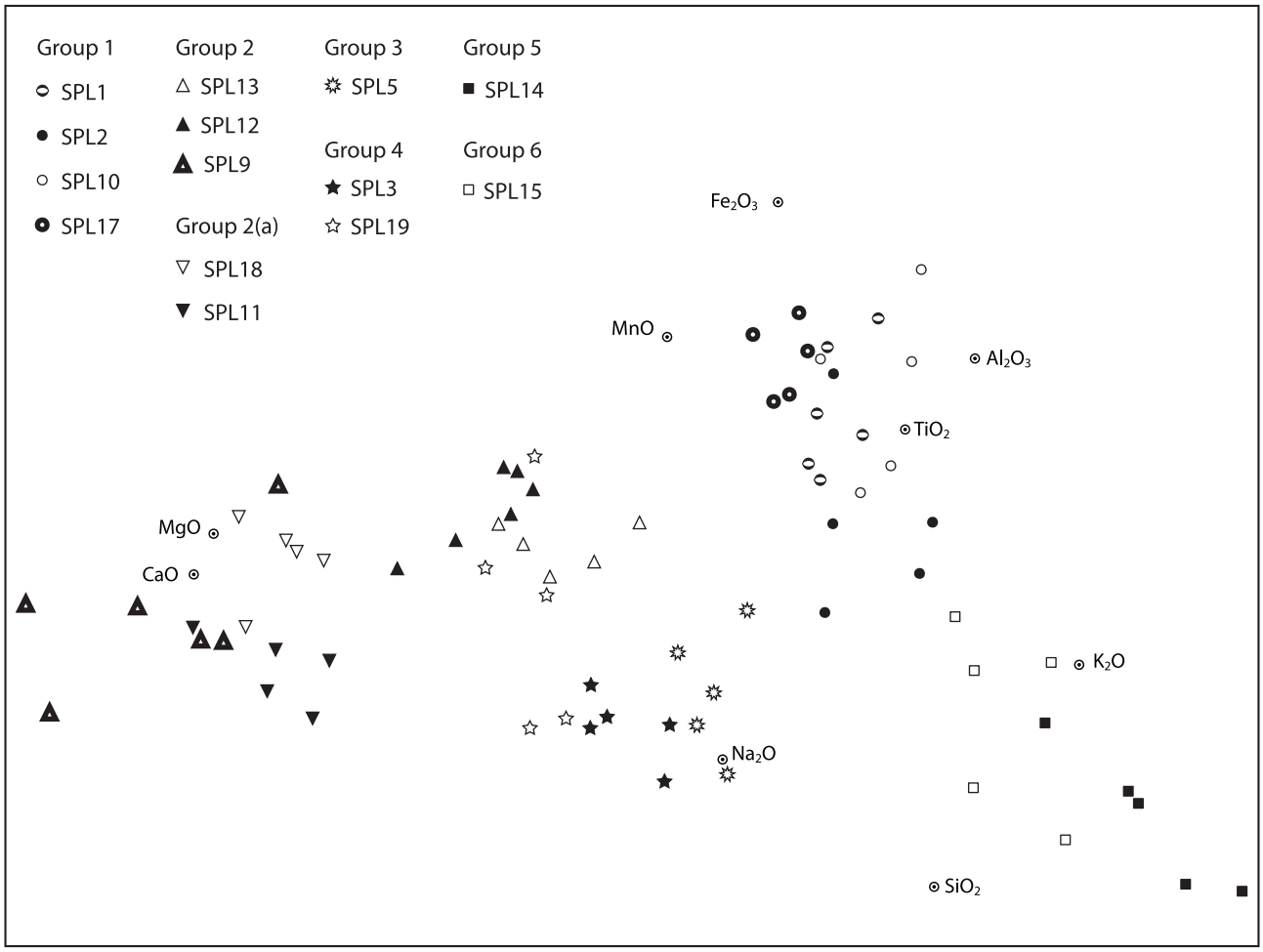

Figure 8. PCA (components 1 and 2) the SEM-EDS results from figulina *pottery found at Spilamberto. Each point represents one of the five bulk analyses of each sherd. Points are labelled according to sherd.*

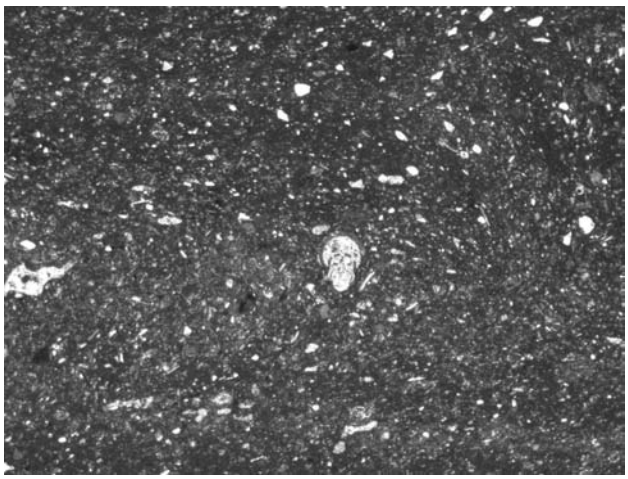

Figure 9. Thin section of figulina *from Caverna Elia (sample CEL2), showing a calcareous and fossiliferous fabric with well-sorted quartz, fine mica, a microfossil and red clay fragments (photo by the author, XPL, 15mm width of field).*

Caverna Elia and Scamuso: petrographic and chemical analyses

Two *figulina* potsherds were studied from the painted red bands *figulina* phase of Caverna Elia (samples CEL1 and CEL2), at Ceglie Messapica, in Brindisi province. Both potsherds are reddish, very calcareous and fossiliferous, with very fine muscovite, some well-sorted sub-angular fine quartz (<7%; 0.03 x 0.03mm), rare pyroxene, very rare feldspar and red clay fragments, and occasional shell fragments. Sample CEL2 is more calcareous than CEL1 (Figure 9, Table 3).

In addition, four *figulina* samples were analysed from the site of Scamuso (Scamuso phase II[3]; this phase is contemporary to that of Caverna Elia with red painted *figulina*, Serra d'Alto phase) (Coppola 2003, 118), Three fabrics were identified in thin section, all calcareous, fossiliferous, and vitrified (Table 3).

Fabric 1 has some well-sorted and fine sub-angular quartz (15%; 0.03 x 0.03mm), abundant fine rounded fragments of calcareous pellets, some fine microfossils and fine muscovite, abundant iron oxides and opaques, and occasional red clay fragments.

Fabric 2 shows abundant well-sorted quartz (20%; 0.04 x 0.03mm), fine rounded fragments of polycrystalline limestone, some microfossils, fine muscovite, and rare red clay fragments.

Fabric 3 is slightly calcareous with some well-sorted fine quartz (7%; 0.03 x 0.03mm), microfossils, iron oxides, very rare feldspar, opaques and a shell fragment, very fine muscovite, and rounded fragments of polycrystalline limestone.

Fabric 1 is coarser than Fabric 3, with more abundant quartz, fine rounded fragments of limestone, and iron oxides. Both Fabrics 1 and 2 are fossiliferous, vitrified and calcareous with some fine muscovite.

Discussion of the SEM-EDS analyses

Figure 10 shows strong homogeneity in the samples from Spilamberto, and a clear clustering was showed according to the sites where the pots where found. Ripabianca, Scamuso and Caverna Elia seem to be all made with calcium rich clays. We also get a cluster of sites Ripabianca, Scamuso, and Caverna Elia, which are very distinct from the samples from Spilamberto. There is a separation between Danilo Bitinj and Smilčić, but it is not completely clear.

Looking at Figure 5, we can see that the chemical composition of the everyday pottery from Danilo Bitinj is rather homogeneous and different from that of the three phases at Smilčić. The latter seems to cover a wide range, probably due to the long time depth that we are considering, from the Early Neolithic (IW) until the latest phases of the Middle Neolithic (Hvar culture). An interesting aspect coming out from the PCA analyses is that two (samples 6 and 8) sherds from Danilo of the everyday pottery fall in the main cluster of Smilčić everyday pottery. This might address the possibility of some imports from Smilčić during the Danilo culture.

In particular, the *figulina* ware clusters on its own, indicating the exploitation of a different source. At Smilčić, there is an overlap of the *figulina* from Danilo and Hvar phases, suggesting that a similar or the same source was used during both cutures. Furthermore, the *figulina* found at Danilo and that from Smilčić seem very similar, suggesting that they might have a common source.

***Figulina* ware in context, specialised artisans: economic shift between the Early and Middle Neolithic?**

The samples analysed by the author and discussed in this paper can be attributed to different geographical areas and cultures, spanning the time from the Early to the Middle/ Late Neolithic.

Figulina ware crossed geographical, chronological, and cultural boundaries. It was manufactured and found in different settlements for more than a millennium, in areas of possible cultural contact (SMP and Danilo/Hvar cultures; IW of the middle Adriatic and Serra d'Alto; and possible links between the Apulian and the Croatian coastlines), but each culture had its own identity, defined by specific material cultural artefacts and traits.

[3] Scamuso II (cuts 3-9) are the layers with Impressed, Graffito and painted with red bands pottery. The radiocarbon dates are between 6890±70 BP (Gif-6742) and 6530±70 BP (Gif-6722) (Biancofiore and Coppola 1997), equivalent to the first half of the sixth millennium cal. BC.

Table 3. Caverna Elia and Scamuso: description of the fabrics identified in thin section.

Site	Fabric	Samples	Matrix	Minerals
Caverna Elia	1	2 (CEL 1,2)	very calcareous and fossiliferous	Common: fine quartz, muscovite Rare: pyroxene, feldspar, red clay fragments, shell fragments (CEL2 is more calcareous than CEL1)
Scamuso	1	2 (SCA22, 24)	very calcareous fossiliferous vitrified	Abundant: fine rounded calcareous fragments Common: quartz, microfossils, fine mica, iron oxides, opaques Rare: red clay fragments
Scamuso	2	1 (SCA23)	very calcareous fossiliferous vitrified	Abundant: quartz Common: fine rounded calcareous fragments, microfossils, fine muscovite Rare: red clay fragments
Scamuso	3	1 (SCA25)	vitrified slightly calcareous fossiliferous	Common: well-sorted fine quartz, microfossils, iron oxides, fine muscovite, rounded calcareous fragments Very rare: feldspar, opaques, a shell fragment

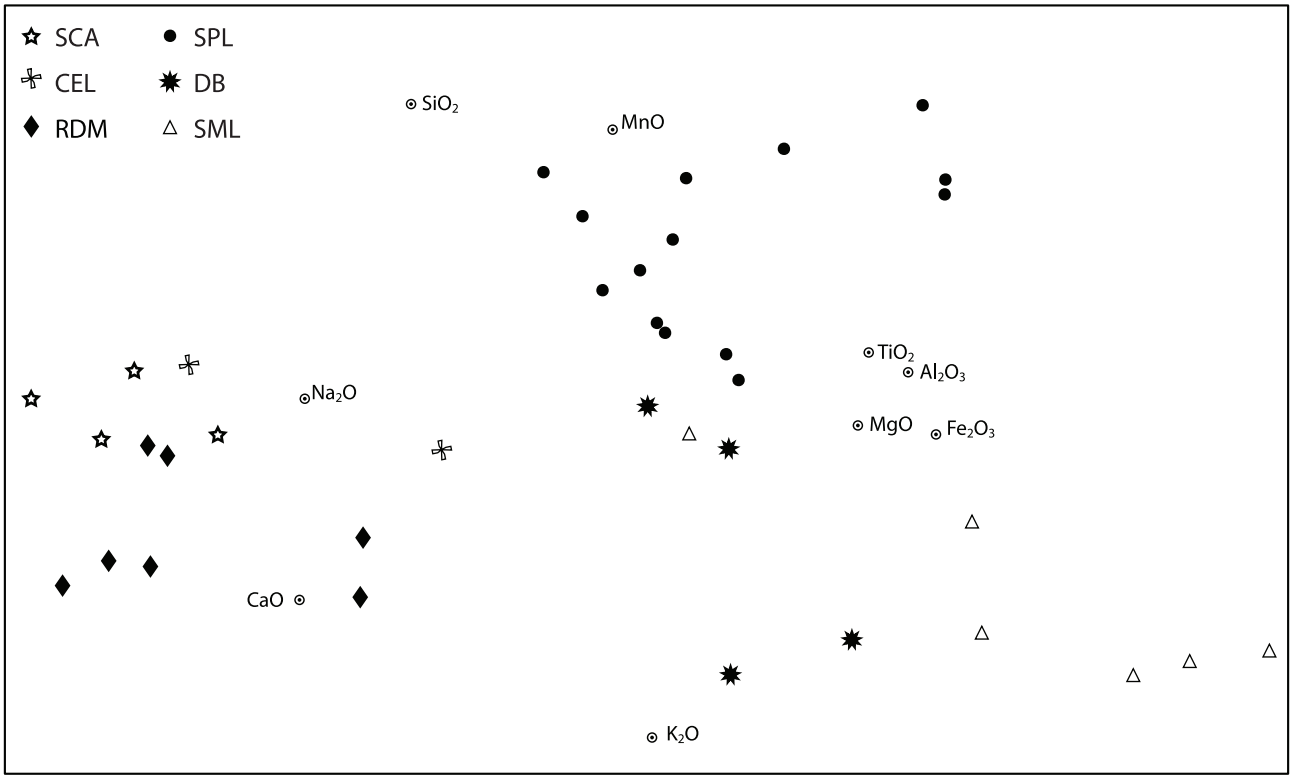

Figure 10. PCA (components 1 and 2) of SEM-EDS results from figulina *samples only. Each point represents the mean of 5 bulk analyses of a single sherd. Points are labelled according to the site at which the sherds were found (CEL = Caverna Elia, SPL = Spilamberto, RDM = Ripabianca di Monterado, SCA = Scamuso, DB = Danilo Bitinj, SML = Smilčić).*

Given the fact that *figulina* vessels were so widespread, we may ask whether they were produced locally for a particular purpose, such as the storage of specific, probably valuable, goods (Barfield 1981, 32), or whether they were distributed from one or more specialised production centres as prestige items, or even as containers for a commodity which was traded throughout the region. In order to answer this and other related questions, we would need to analyse the organic residues in the pottery using scientific techniques, such as Gas-Chromatography.

A rather complex pattern seems to come out from the analysis of the *figulina* ware. Analyses of 312 vessels of everyday pottery from 17 Early and Middle Neolithic sites distributed along the Adriatic coasts (Spataro 2002) suggest that pottery was produced using local clay sources, often extremely similar to the soil collected by the author in

the proximity of the Neolithic villages. These pots were mainly tempered with local minerals, and fired in bonfires (on the basis of the non-vitrified fabrics, and the presence of crystals of crushed sparry calcite in most samples, it was possible to suggest that the firing temperature never exceeded 750 °C; Spataro 2002). These results indicate small-scale production linked to household requirements, and that trade in everyday pottery was insignificant, in contrast to the clear evidence of long-distance trade in flint and obsidian artefacts (Tykot 1996; Barfield, pers. comm. 2001).

On the other hand, *figulina* ware was produced following a very different recipe. Despite the fact that it was always manufactured using a specific type of raw material, rich in iron, potash, and manganese, it appears to have been produced on a regional scale, in southern and central Italy and in Dalmatia. Before being shaped, the clay was probably levigated (dissolved in water by a mechanical process and then left to settle for a few days), in order to remove coarser particles. The choice of a clay rich in calcium, manganese and potash is difficult to explain: calcium-rich clays are not ideal for cooking ware because calcium oxide fragments at high temperatures. The high percentages of calcium, magnesium, and potash could suggest a well-defined choice since these elements can promote the vitrification of the ceramics at rather low firing temperatures (M. Bimson, pers. comm. 2008), but perhaps the clay was also chosen for the whitish colour effect produced by calcium oxide.

In contrast to the everyday vessels, the *figulina* was highly-fired, and to reach a stable temperature of about 850 °C, kilns were employed. The use of a specific formula based on the choice of well-defined clays, levigation, and firing at very high temperatures in kilns, suggests that a specialised potter was required. In contrast to the production of everyday pottery at household level, the *figulina* items suggest that production was for regional, if not wider, consumption.

It is suggested here that *figulina* was produced for distribution at no more than the regional scale. The potters who produced the *figulina* found at the Italian sites used fossiliferous, micritic, ferruginous, and micaceous sources, with fine-grained sand. The samples analysed from Caverna Elia, Gravina, Grotta delle Mura, Ripabianca di Monterado, Scamuso, and Spilamberto are distinctly different to the 'fine' *figulina* ware from the Dalmatian coastline. At the same time, there are strong similarities in the *figulina* ware from the southern and central Italian sites. In terms of chemical composition, however, the Spilamberto samples cannot come from the same source as the samples from Caverna Elia, Scamuso, and Ripabianca di Monterado (Figure 10); the latter also appear to represent at least two or three different clay sources. If there were specialised production centres for *figulina* ware, they may have produced copies of a prototype which first appeared in south-eastern Italy around the middle of the sixth millennium cal. BC for distribution within a relatively small region. The study of Mannoni (1994a; 1999) and Muntoni *et al.* (2006, 93-97) also propose a selection of local and regional clays, in the regions of Apulia and Basilicata, for the production of *figulina* with red bands of Passo di Corvo[4], and for the production of the Serra d'Alto *figulina* from Grotta Scanzano, Grotta della Tartaruga, Canne-Setteponti in the Murge region of Apulia.

These results suggest that an important social and economic change took place during the middle of the sixth millennium cal. BC. Alongside with the everyday vessels, such as cooking pots and liquid containers, a specialised manufacture of singular, probably prestige, items such as the *figulina* bowls and flasks appeared, and these must have been produced by specialised artisans. This change (as discussed in Spataro 2002, 203-4) apparently coincided with the spread of the *rhyton* cult vessel along the eastern Adriatic coastline (Perić 1996), the appearance of the Danilo culture on the Adriatic coast and its interaction with Linearband Keramik Korenovo culture sites in Slavonia (Dimitrijević 1961; Težak-Gregl 1993, 14), the appearance of the Kakanj culture in Albania (Benac 1973), and the more specialised art craft in Sardinian obsidian production between the Early Neolithic and Middle Neolithic at Monte Arci (Lugliè, pers. comm. 2008; Lugliè *et al.* 2008) .

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[4] Mannoni (1999) studied also a few *figulina* samples from the Arene Candide in Liguria.

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