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A new light on Black-Gloss Tiberine manufactures: the Colle Rosetta settlement (Latium, Italy). A preliminary study

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Abstract. – Within the framework of the studies regarding Black-Gloss Pottery, this paper focuses on the subject of Sabine Tiberine production. Some sherds of Black-Gloss Pottery found in the settlement of Colle Rosetta (Sabina Tiberina - Rieti) in the 1970s were analysed. Chronologically, the period of production of all the fragments found ranges from the latter half of the 4th century to the first half of the 1st century B.C. The period spanning from the 4th to the 3rd century B.C. appears to be the peak period for the production under study as regards quality of artefacts.

The geological investigation and the preliminary diffractometric, petrographic, chemical and SEM analyses carried out on the sherds and on the quarry samples taken from three different accessible clay-outcroppings near the archaeological site highlighted a probable local manufacture of the sherds. This finding is very important because it would be the first evidence of the existence of a ceramic workshop in the Tiberine area.

SEM analyses carried out on the Black-Gloss provided some details regarding the grade of vitrification and its composition. In particular, the total iron contents are very similar to those found in the gloss of Northern Etruria, of Ariminum and in Attic Black Figure Vases. So it is possible to imagine an imitation by Italic potters of the technological standardisation in providing this Fe-enrichment to obtain the Black-Gloss used by Greek craftsmen.

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Riassunto. – Questo articolo analizza il problema della produzione della Ceramica a Vernice Nera nella Sabina Tiberina. In relazione a ciò sono stati sottoposti ad analisi i frammenti di ceramica a vernice nera rinvenuti negli anni ’70 nel Lazio, sull’insediamento di Colle Rosetta (Rieti), nel territorio della Sabina Tiberina. Cronologicamente tali frammenti si collocano nel periodo compreso tra la seconda metà del IV e la prima metà del I sec. a.C. L’arco compreso tra la fine del IV ed il III sec. a.C. costituisce, sotto l’aspetto qualitativo, l’acme di tale produzione.

Le prime analisi diffrattometriche, petrografiche, chimiche ed al SEM eseguite sui campioni ceramici e su quelli di argilla prelevati dai tre differenti affioramenti di argilla accessibili e più vicini al luogo del ritrovamento delle ceramiche hanno posto in evidenza una probabile manifattura locale delle ceramiche. Tale informazione è di notevole rilievo poiché potrebbe costituire la prima prova della esistenza di un *atelier* di Ceramica a Vernice Nera in area tiberina.

Le analisi eseguite al SEM hanno, inoltre, fornito dati concernenti tessitura e struttura nonché la composizione chimica della patina esterna (gloss) delle ceramiche. In particolare, i contenuti totali di ferro appaiono molto simili a quelli riscontrati non solo nella patina esterna di ceramiche a vernice nera rinvenute in Etruria settentrionale e ad *Ariminum,* ma anche nella Ceramica Attica a Figure Nere. Pertanto è pos-

sibile immaginare che i ceramisti italici abbiano imitato il procedimento tecnico dell'arricchimento del ferro messo a punto dagli artigiani greci per la realizzazione della patina nera esterna.

KEY WORDS: *Black-Gloss Pottery, Colle Rosetta, production technology, archaeometry, raw material, gloss*

INTRODUCTION AND ARCHAEOLOGICAL ASPECTS

In the 1970s, as a result of deep ploughing, an extraordinary quantity of ceramic sherds were found in the Colle Rosetta area (Magliano Sabina - Rieti, Latium) (Figs. 1, 2). In Prehistoric times this site was a Middle Palaeolithic deposit. Later, it was a residential farming settlement inhabited from the end of the Orientalising Period (the mid-6th century B.C.) to the Imperial Age (the late 1st century A.D.). In the Archaic Period this land was part of the countryside of the Sabine settlement of Poggio Sommavilla up to the "Romanisation" of the Sabines (290 B.C.).

Colle Rosetta rises perpendicularly 80 metres above the river Tiber. Three important watercourses flow near the hill: the Colle Rosetta rivulet, which flows south of the hill; the river Tiber, which forms a wide loop of 700 metres that encloses this area, and the L'Aia tributary of Poggio Sommavilla, which flows into the river Tiber at Colle Tondo, directly south of where the sherds were found. The remains of a round cistern dug into the rock can be seen on the east side of the hill. On Colle Rosetta there are the remains of an important ancient road which, in the Archaic Period, connected the Poggio Sommavilla countryside with the settlement of *Falerii Veteres,* located on the opposite site of the river Tiber, by a landing-place, and in the Roman Period connected the town of *Forum Novum* with the Flaminian way. Ceramic sherds are scattered on the top of the hill and on its south-west slope for an area of 2000 metres (Verga, 2002, 2006). The 567 sherds of Black-Gloss Pottery analysed were casually found on the south side of the hill. Unfortunately, it was not possible to conduct archaeological excavations on this site because the landowner refused permission since his animal breeding was situated there. The sherds were taken to the Civic Archaeological Museum of Magliano Sabina (Rieti) by the Museum assistants, where they are presently kept.

Today, these ceramic fragments are one of the largest collections of Black-Gloss Pottery found in the Sabine area and are thus very important for the study of Sabine Black-Gloss Pottery production.

Black-Gloss Pottery was particularly widespread in the Mediterranean region in the late Republican period and reached its peak with the Roman production of the *Atelier des Petites Estampilles* (Morel, 1969). It imitates the Attic Black-Gloss Pottery of the late Classical Period (4th century B.C.) and was first produced in some ceramic workshops, particularly in Etruria, but also in Central and Southern Italy in the second half of the 4th century B.C. This production is known as "*Pre-Campana"* (Lamboglia, 1952).

On the basis of the casual discovery and of a

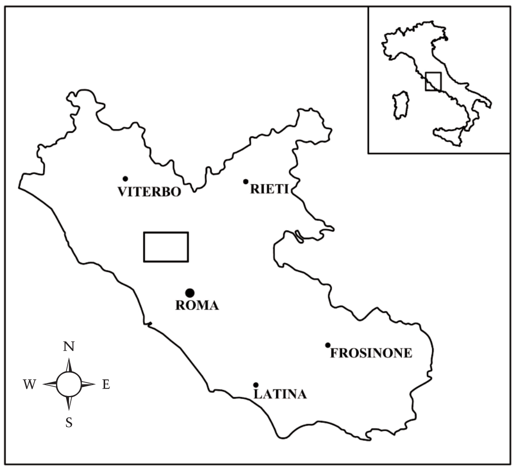

Fig. 1 – Schematic map of Latium (Italy). Location of Colle Rosetta settlement on a regional scale.

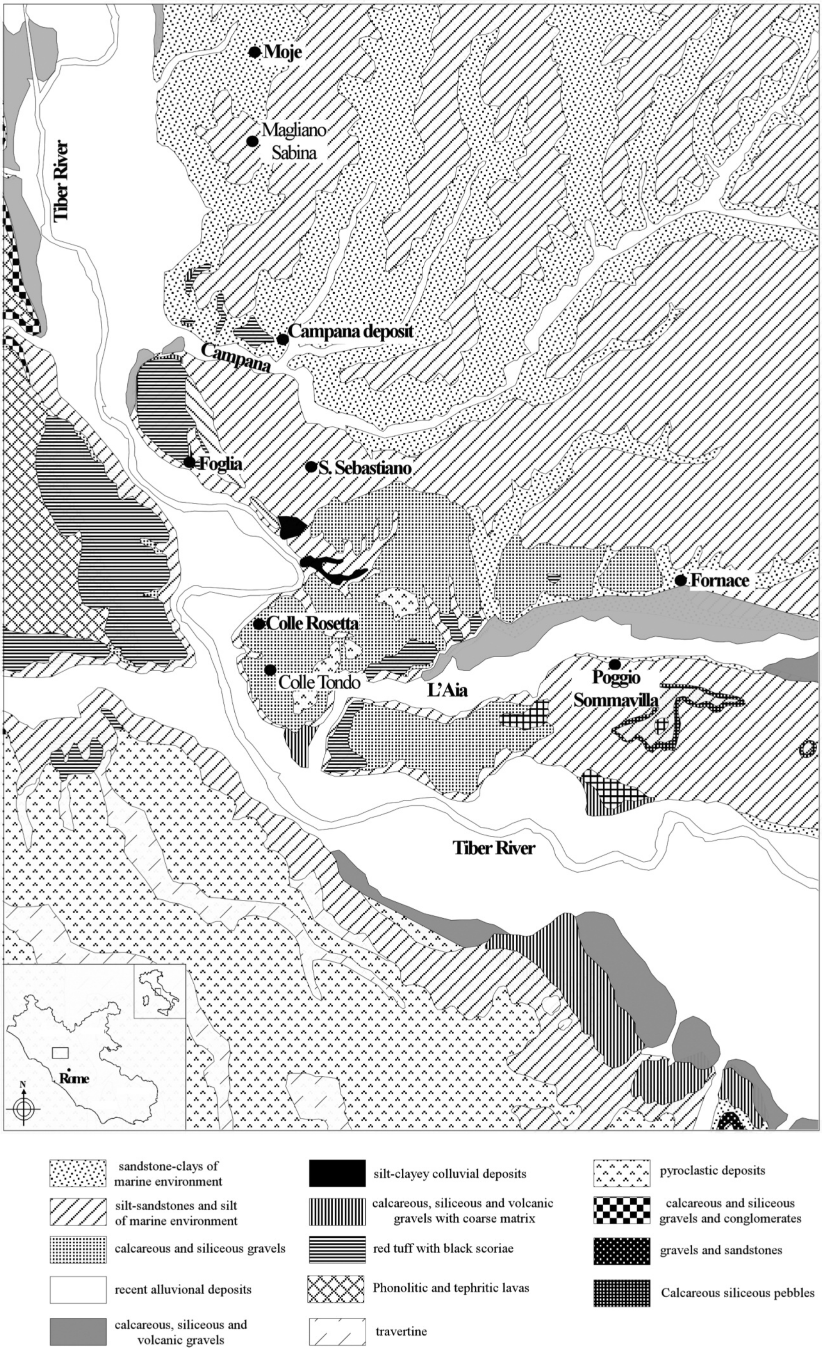

Fig. 2 – Geological map of the area studied (from Mancini *et al*., 2004; modified). The investigated archaeological sites and clay deposits are reported.

preliminary topographic survey, it was initially assumed that the sherds in question were buried approximately 30 cm below ground because of a change in lifestyle of the settlement's inhabitants or in the fashion of ceramics throughout the Peninsula during the second half of the 1st B.C.

Although no ceramic spacers or kiln wastes have been found so far, from the quantity of fragments (567 pieces) it seems unlikely that production was limited to local use.

The shape prototypes mainly consist of bowls, dishes, *skyphoi* and *oinochoai*, characteristic shapes of Northern and Southern Etruria and of the central hinterland of the Peninsula, i.e. the Sabine and Abruzzi regions.

There are also a many miniatures of bowls, *skyphoi* and *paterae* (107 pieces) (Fig. 3), which account for one fifth of the production.

Fig. 3 – Black-Gloss Pottery: a) *skyphos*, Morel form 4374a1, and b) dish, Morel form 1121d2. Both ceramic remains are currently housed in the Civic Archaeological Museum of Magliano Sabina (Rieti).

In the period ranging from the second half of the 3rd century to the first half of the 2nd century B.C., few ceramics were imported from Northern and Southern Etruria (Taylor, 1957; Serra Ridgway, 1982) or from Rome (Olcese, 1998). The latter fact points to an attempt to break away from Roman production (Morel, 1988). To reduce transport costs, it is likely that the ceramics were imported by river, owing to the proximity of the Tiber (Di Giuseppe, 2005).

The period ranging from the second half of the 4th century to the early 3rd century B.C. also marks a peak from the quality standpoint, when production was capable of imitating objects of the Partial Gloss Pottery of Attic Ceramics. The presence of a remarkable number of variations with respect to the classical characteristics established by Morel (Morel, 1981) indicates a commercial strategy aimed at expanding the market.

Although all forms of pottery are found in this period, between the late 2nd and early 1st century B.C. the production was almost exclusively confined to bowls of the 2784d Morel series.

This local pottery lies within the Black-Gloss ceramic system deduced by E. Roth for the Hellenistic Period and referred to the ceramic production that "took place in the context of independent specialisation, by potters who were not at all employed in the production of Black-Gloss fine wares destined for export, or who were able to produce during their time off" (Roth, 2007). From this point of view, this production is closely related to the ceramic production discovered at La Civitucola of Capena (Camilli and Vitali Rosati, 1993; Roth, 2006), the Faliscan settlement located at about 4 km south-east of the modern town of Capena (Rome).

Charts regarding details of style and laboratory analyses were drawn up of all the findings (567 samples), which comprise mostly bowls, *skyphoi*, dishes, *olpai* similar to those produced in the workshop in the Etruria and Roman-Latial area of the same period. The pottery under study is mainly composed of bowls belonging to the Morel 2783/2784 series, which were widespread throughout the Sabine and Faliscan territories.

Sampling and Experimental Methods

Colle Rosetta rises on Pleistocene clastic sediments (Mancini *et al.,* 2004) consisting of calcareous, siliceous gravels (Fig. 2).

Table 1

List of both archaeological and clay studied samples. Inventory number, Morel forms, chronology and provenance of the samples are listed. LP = lower portion of the deposit; UP = upper portion of the deposit. The SEM analysed samples of the gloss study are in italics.

Sample	Inventory	Morel form	Chronology	Provenance
1	687	Dish 1121d2	Second half of IV BC	Colle Rosetta
2	375	Dish 1271a1	Beginning of III BC	Colle Rosetta
3	Poggio Sommavilla	Skyphos 4374a1	End of IV-beginning of III BC	Poggio Sommavilla
4	430	Jug 5213a1	End of IV-beginning of III BC	Colle Rosetta
6	705	Dish 1124a3	First half of III BC	Colle Rosetta
7	501	Bowl 2523c1	First half of III BC	Colle Rosetta
11	1023	Bowl 2783g	First half of III BC	Colle Rosetta
12	1083	Bowl 2783g	First half of III BC	Colle Rosetta
13	1473	Bowl 2783h	First half of III BC	Colle Rosetta
14	1078	Bowl 2783g	First half of III BC	Colle Rosetta
15	650	Bowl 2783g	First half of III BC	Colle Rosetta
16	827	Skyphos 4384a1	First half of III BC	Colle Rosetta
19	Foglia	Bowl 2784d1	End of II-beginning of I BC	Foglia
20	S. Sebastiano	Bowl 2765b	First half of III BC	S. Sebastiano
21	645	Skyphos 4373b	End of IV BC	Colle Rosetta
207	*207*	*Bowl 2783c*	*First decades III BC*	*Colle Rosetta*
259	*259*	*Bowl 2783*	*First half III BC*	*Colle Rosetta*
799	*799*	*Jug 5242*	*First half II BC*	*Colle Rosetta*
Fornace 1 LP	-	-	-	Fornace
Fornace 2	-	-	-	Fornace
Fornace 3	-	-	-	Fornace
Fornace 4	-	-	-	Fornace
Fornace 5 UP	-	-	-	Fornace
Moje 1 LP	-	-	-	Moje
Moje 2	-	-	-	Moje
Moje 3 UP	-	-	-	Moje
Campana 1 LP	-	-	-	Along tributary Campana
Campana 2	-	-	-	Along tributary Campana
Campana 3 UP	-	-	-	Along tributary Campana

Most of the ceramic fragments came from the archaeological site of Colle Rosetta (Table 1), but sampling also took into consideration three sherds coming from the archaeological sites of Foglia and San Sebastiano, which are located in the area of Magliano Sabina (Rieti) and Poggio Sommavilla in the area of Collevecchio (Rieti).

The pieces were selected for analysis according to their shape, age and place of discovery in order to determine any possible compositional variability.

The fragments most frequently found – bowls, *skyphoi,* dishes – show the Black-Gloss coating and they were chosen in a quantity proportional to the output at the various times of production (Table 1).

However, no compositional differences were expected in the various ceramic fragments on autoptical examination, carried out previously, and in their typology (Black-Gloss Pottery).

Macroscopically, no external deposits or paste pulverisation phenomena, owing to soluble salts and their deposition in the pores, could be seen. These observations were confirmed by optical microscopy analyses, which gave no evidence of crystallisation of newly formed phases in the pores of the paste and by the P_2O_5 content which was always < 0.29 wt %. In addition, in carrying out the archaeometric study besides the characterization of the sherds of the study, all the outcroppings of clay deposits in the area were also sampled and characterised by petrographic, chemical and diffractometric analyses.

The aim of this study was: i) to verify the possibility of a local production of the ceramic; ii) to study some quarries near the archaeological site of Colle Rosetta for a comparison of the ceramic samples; iii) to assess whether there had been a change from one quarry to another over time. In particular, the recognised clay deposits are located, respectively, near the Campana tributary (3.3 km from the Colle Rosetta site), in the locality of Moje (9 km away) and in the quarry on the Fornace site (4.6 km from Colle Rosetta and along the L'Aia tributary). Only the deposit of Moje is historically acknowledged as a quarry, from the Bronze Age to the Orientalising Period (Rosselli, 2000). There is also a clay deposit outcrop in the neighbourhood of Colle Rosetta, but it is inaccessible due to the vegetation and location perpendicularly above the river Tiber.

The quarry samples (5 from the Fornace site, which is the greatest outcropping, 3 from Moje, and 3 from the outcropping near the Campana tributary, at km 20,750 of the SS 657 highway, referred to in this paper as the "Campana samples") consist of silt-sandstones and sandstone-clays of marine environment (Mancini *et al*., 2004).

The following analyses were carried out on the pottery and clay samples. Fragments of the sherds of about 2x2 cm were taken and ground in an agate mortar for qualitative and chemical analyses. A further fragment from each sherd was used for a thin section cut perpendicularly to the pot surface. In the case of clay samples, thin sections of the bulk samples were carried out as well. Thin sections were analysed using a Zeiss polarising microscope.

Qualitative mineralogical analyses were also carried out by a PHILIPS PW 1830 diffractometer with Ni filtered CuKα radiation (40 kV, 20 mA) in order to determine the firing temperature of the vessels. The data were recorded in the 3°-70° 2Θ range, with a scanning speed of 1°/min and a time per step of 2 s/step, 1° divergence slit, 0.1 mm receiving slit, and 2° antiscatter slit. Diffractometric analyses on raw materials were carried out on both bulk and ethylene glycol pre-treated samples in order to identify clay minerals.

Major, minor and trace element contents were determined by a XRF (Siemens spectrometer, Cr anticathode tube) according to the method of Franzini *et al.* (1972, 1975) and Leoni and Saitta (1976); precision in the case of major elements was usually estimated less than 3%. Analytical precision was better than 10% for trace elements.

Determination of loss of ignition (LOI) was carried out at 1050°C.

For a better characterisation of the samples, including surface treatment, scanning electron microscope (SEM) backscattering images and spot analyses of the gloss were carried out at the Sem Laboratoty of Istituto per lo Studio dei Materiali Nanostrutturati-C.N.R. (Rome) using a Cambridge 360 scanning electron microscope equipped with a LaB_6 filament, a four-sector back scattered electron detector and an Oxford EXL II EDS analytical system; beam diameter was 160 ÷ 320 nm.

Textural and morphological analyses (by SEM) were carried out on freshly fractured sherds to evaluate the degree of vitrification of the paste as well as the firing temperature (Maniatis and Tite, 1981).

Results

Petrographic data

Pottery - All the studied samples were characterised by a fine paste, serial texture, low degree of sintering, and a scarce and mainly sub-rounded porosity, which ranges from 1 to 5 vol %.

Some argillaceous rock fragments (ARFs) (Whitebread, 1986) are present. Their skeleton (≈15-20 vol%), up to 0.2 mm in size, contains the following minerals in order of decreasing abundance: sub-rounded quartz grains, K-feldspars and plagioclase crystals, muscovite and, subordinate, biotite laths, frequent clinopyroxene (augitic in nature), scarce calcite individuals as a primary phase and opaque minerals. Rare polycrystalline quartz and vesiculated glass fragments are also present. Rare *chamotte* is evident in sample 16. All the samples have a discontinuous surface separating the ceramic body from a thin, very fine grain size, gloss layer that is sometimes very well preserved and continuous and sometimes less preserved, both as regards thickness and degree of conservation.

Raw material - The clayey outcroppings in the area under study are of marine origin (Mancini *et al.,* 2004) and are grey-greenish in colour. The sediments from Fornace and Moje are very similar from a mineralogical point of view, but the former shows a skeleton ranging from 20 to 25 vol% with a medium-fine grain-size (up to 0.2 mm) whereas the latter displays a lesser amount of skeleton (10-15 vol%) generally associated with a finer grain-size (up to 0.1 mm) with some coarser lenses and/or veins (thin layers) mainly filled with quartz and K-feldspar grains (up to 0.3 mm).

Their mineralogical component consists of, in order of decreasing quantity, sub-rounded quartz and K-feldspars grains, plagioclase, muscovite and subordinate biotite laths, scarce primary calcite crystals, rare clinopyroxene (augite, only in the Fornace sediments) and opaques. The lithic component represented by polycrystalline quartz and glassy fragments (only in the Fornace sediments) are rare.

The Campana sediments show a skeleton that is mineralogically similar to the previous ones but with some exceptions. Its skeleton ranges from 15-20 vol% showing a medium-fine grain-size (up to 0.2 mm). It consists of sub-rounded quartz and feldspar grains, plagioclase, abundant primary calcite, muscovite and subordinate biotite laths and opaques. A fossiliferous component was observed. Rare lithic fragments are represented by polycrystalline quartz.

Diffractometric Data

Pottery - The mineralogical component of the samples under study is mainly related to three important factors: i) the nature of the raw material used for the pastes; ii) the maximum temperature reached during ceramic firing; iii) the oxygen fugacity during the same firing (firing environment, Bimson, 1969; Philpotts and Wilson, 1994). Regarding ii), it must be noted that some mineralogical phases can be considered as thermal indicators, i.e. their presence or absence indicating the maximum temperatures reached during firing**.** From this standpoint, the recognised parageneses can yield further fundamental information about the technologies used in ceramic production. The qualitative composition of the pottery under study, in accordance with the petrographic data, yielded evidence of the presence of quartz, K-feldspars, plagioclase, muscovite and biotite, pyroxene, calcite and hematite.

Raw material - Diffractometric analyses of 11 samples of sediments revealed the presence of the following phases present in all the samples: illite, montmorillonite, muscovite, biotite, quartz, calcite, K-feldspar, hematite and - only in the Fornace samples - pyroxene.

Chemical Data

The chemical results are reported in TABLE 2. Firstly, the P_2O_5 content (average value 0.25 wt%), which varies slightly but is always less than 0.29 wt%, must be taken into account since it is considered a good indicator in establishing the contamination of ceramics (Lemoine *et al.,* 1981; Lemoine and Picon, 1982; Walter and Besnus, 1989; Freestone, 2001). This is in accordance with petrographic and SEM investigations which show no evidence of any contamination due to precipitation of newly formed phases into the pores or fractures.

Variation diagrams illustrating the chemical homogeneity of the archaeological sampling (Fig 4, 5).

Pottery - SiO_2 content ranges from 58.11 to 60.45 wt%, Al_2O_3 from 17.79 to 20.45 wt%; Fe_2O_3, MgO, MnO, and (Na_2O+K_2O) values are almost always constant, ranging from 5.56 to 6.75 wt%, 3.39 to 3.91 wt%, 0.12 to 0.15 wt% and 3.50 to 4.20 wt%, respectively.

The SiO_2 vs. CaO diagram shows that all the specimens consist of CaO rich or calcareous samples (CaO > 6 wt%; Maniatis and Tite, 1981).

Ca vs. Sr and Rb vs. Sr diagrams, displayed both for typology and periods, confirm the homogeneity of the archaeological sampling. The sherds, in fact, do not cluster together, clearly showing the potter's little concern for making different pastes for different uses, and it seems that the raw material was generally the same over time.

Raw material - The chemical composition of the bulk sediment samples reveals that these marine sediments are particularly rich in CaO and very similar to one another (Fig. 6) as we expected. In particular, Fornace and Moje show higher Al_2O_3 (ranging from 17.01 to 19.12 wt%) and Fe_2O_3 (3.99-6.19 wt%) contents than those of Campana; all three quarry samples display very similar amounts of alkali whereas the Fornace clays are characterised by the smallest amount of CaO (from 7.79 to 9.44 wt%).

Trace elements, as for the major ones, do not allow any discrimination on quarries (TABLE 2) as for the archaeological samples.

SEM investigation on pottery

Besides confirming the "freshness" of the study samples, SEM analyses provided some details regarding the grade of vitrification of the clay matrix (Maniatis and Tite, 1981; Kilikoglou, 1994) suggesting what was most likely the maximum temperature reached by the materials. Oxidised pottery samples show "filaments of glass" with a preserved laminar structure. This particular grade of vitrification was defined by Maniatis and Tite (1981) as *initial vitrification stage* (IV) and it is similar in the case of calcareous (CaO > 6 wt%) and non-calcareous clay (NC; Ca0 < 6 wt%). This morphology is typical of pottery fired at about 800°-850°C in an oxidising environment.

Surface treatment - The Black-Gloss (Fig. 7), typical of Attic production, was obtained from a

TABLE 2

Chemical data (XRF) of the studied samples normalised vs. LOI; oxide concentrations are in wt% ppm for trace elements. $Fe_2O_3 = Fe_{tot}$.

	1	2	3	4	6	7	11	12	13	14	15	16	19	20	21
SiO_2	58.30	59.35	58.11	58.80	57.77	58.25	59.37	60.45	57.56	59.63	57.85	60.30	59.98	59.46	59.93
TiO_2	0.75	0.69	0.74	0.77	0.74	0.76	0.72	0.68	0.77	0.62	0.74	0.66	0.73	0.78	0.74
Al_2O_3	19.86	17.79	19.65	19.36	20.02	19.13	18.44	17.97	20.45	18.90	20.33	18.45	18.91	19.93	19.01
P_2O_5	0.23	0.25	0.29	0.27	0.29	0.26	0.23	0.21	0.25	0.23	0.24	0.22	0.22	0.26	0.28
Fe_2O_3	6.41	5.81	6.46	6.75	6.40	6.25	6.23	6.09	6.76	6.30	6.41	5.56	6.13	6.20	6.16
MgO	3.85	3.91	3.83	3.60	3.83	3.63	3.67	3.79	3.54	3.41	3.78	3.39	3.57	3.48	3.61
MnO	0.13	0.12	0.13	0.15	0.12	0.13	0.14	0.13	0.13	0.13	0.13	0.14	0.12	0.12	0.15
CaO	6.81	8.44	7.16	6.42	7.23	7.67	7.29	6.56	7.03	6.97	6.98	7.08	6.67	6.22	6.05
Na_2O	1.16	1.24	1.20	1.19	1.14	1.43	1.37	1.62	1.09	1.32	1.09	1.58	1.39	1.17	1.49
K_2O	2.51	2.39	2.44	2.70	2.46	2.50	2.54	2.50	2.41	2.48	2.44	2.62	2.28	2.39	2.58
LOI	1.49	2.82	2.13	5.46	1.33	1.29	5.76	4.46	0.7	36.03	1.49	7.00	3.37	4.41	6.76
Cu	59	53	67	58	64	62	55	57	69	65	56	52	58	68	59
Zn	193	185	199	177	205	171	165	165	191	137	209	163	153	155	163
Rb	123	107	139	126	136	116	111	123	158	78	127	113	125	154	146
Sr	529	567	560	365	555	464	389	468	583	331	519	397	436	367	431
Zr	244	236	281	185	266	217	190	229	298	124	255	187	221	176	213
Ba	264	246	335	228	286	263	221	239	358	190	300	213	264	287	310
Co	38	32	60	55	39	41	27	26	54	22	30	30	45	82	36
Pb	55	55	87	76	96	61	55	47	111	45	98	68	57	90	81
Ce	193	147	190	135	223	160	118	109	257	115	228	118	144	175	112
Nb	16	16	17	13	16	14	11	13	21	8	15	10	15	16	17
La	54	39	55	42	54	49	29	34	68	39	57	36	48	56	33

TABLE 2

Continued...

	Fornace 1	Fornace 2	Fornace 3	Fornace 4	Fornace 5	Moje 1	Moje 2	Moje 3	Campana 1	Campana 2	Campana 3
SiO_2	58.77	58.13	59.66	57.92	58.03	53.98	54.49	55.10	56.28	57.91	59.96
TiO_2	0.65	0.61	0.71	0.74	0.63	0.55	0.60	0.56	1.37	0.95	0.44
$Al2O_3$	18.49	18.97	19.12	18.02	18.47	17.31	17.01	17.21	13.28	13.62	13.43
$P2O_5$	0.18	0.18	0.18	0.18	0.23	0.16	0.16	0.17	0.10	0.12	0.12
$Fe2O_3$	6.19	5.97	3.99	5.32	4.98	4.47	3.92	4.81	3.55	3.46	3.00
MgO	3.48	3.83	3.12	3.96	4.07	4.87	5.23	5.46	4.49	4.68	5.46
MnO	0.10	0.11	0.10	0.10	0.11	0.11	0.10	0.11	0.20	0.11	0.10
CaO	8.11	7.79	9.05	9.44	9.15	14.96	14.75	12.90	17.15	15.08	14.16
Na_2O	1.42	1.73	1.59	1.71	1.67	1.05	1.15	1.13	1.44	1.88	1.55
K2O	2.61	2.68	2.48	2.61	2.66	2.54	2.59	2.56	2.13	2.19	1.79
LOI	17.84	16.65	16.09	16.65	22.13	21.10	17.79	17.49	19.23	14.70	17.71
Cu	17	30	26	30	66	33	40	33	17	21	17
Zn	69	116	102	109	129	121	139	124	69	83	68
Rb	57	79	76	78	81	71	87	61	74	98	71
Sr	353	411	372	360	400	382	437	333	353	349	359
Zr	256	206	204	187	152	151	188	119	256	248	263
Ba	268	251	262	219	270	264	221	253	219	220	218
Co	7	10	10	30	10	9	12	11	7	9	5
Pb	34	58	53	55	62	53	52	52	34	59	66
Ce	83	83	58	94	72	94	81	91	83	102	80
Nb	9	15	12	12	13	11	15	7	9	14	10
La	23	28	20	29	21	25	22	22	23	20	24

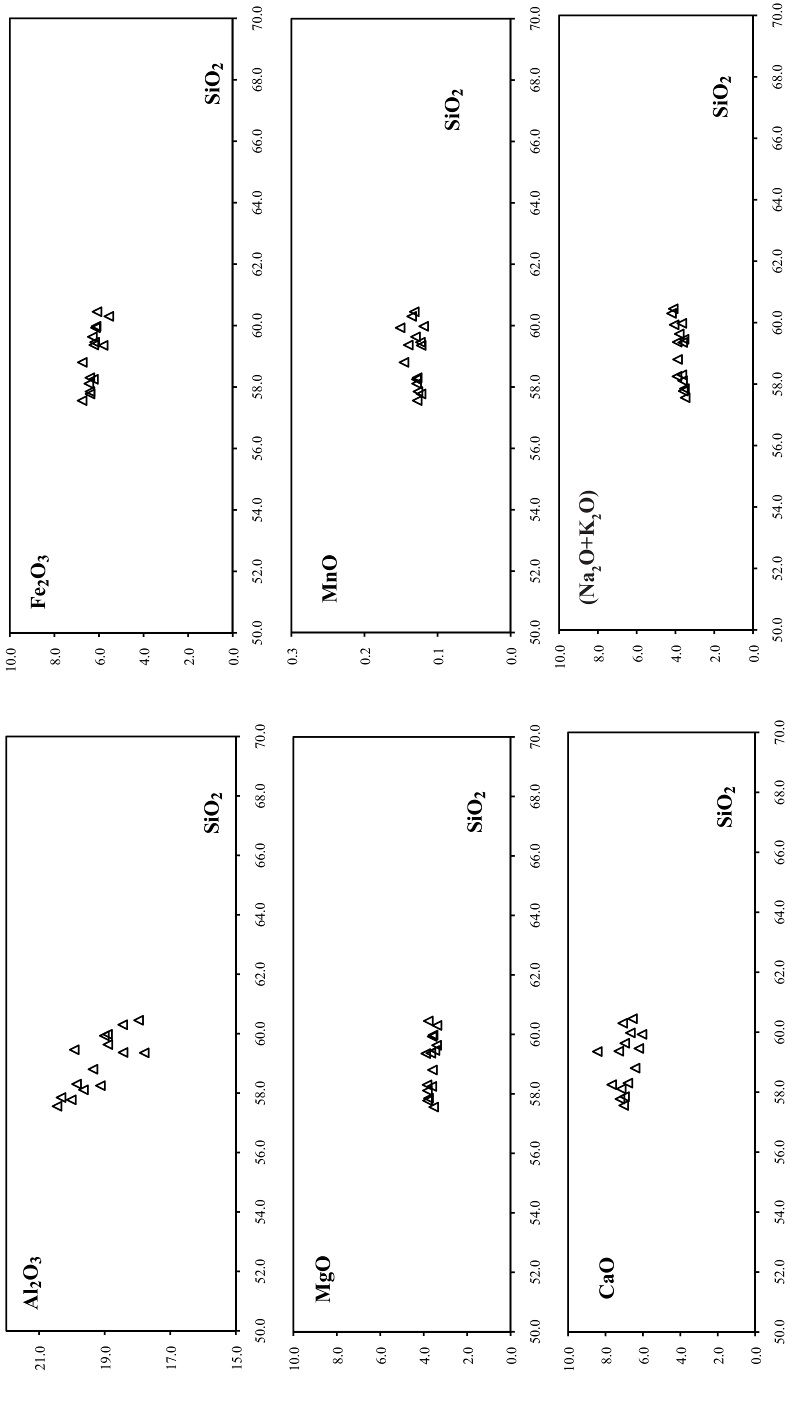

Fig. 4 – Variation diagrams of the archaeological samples.

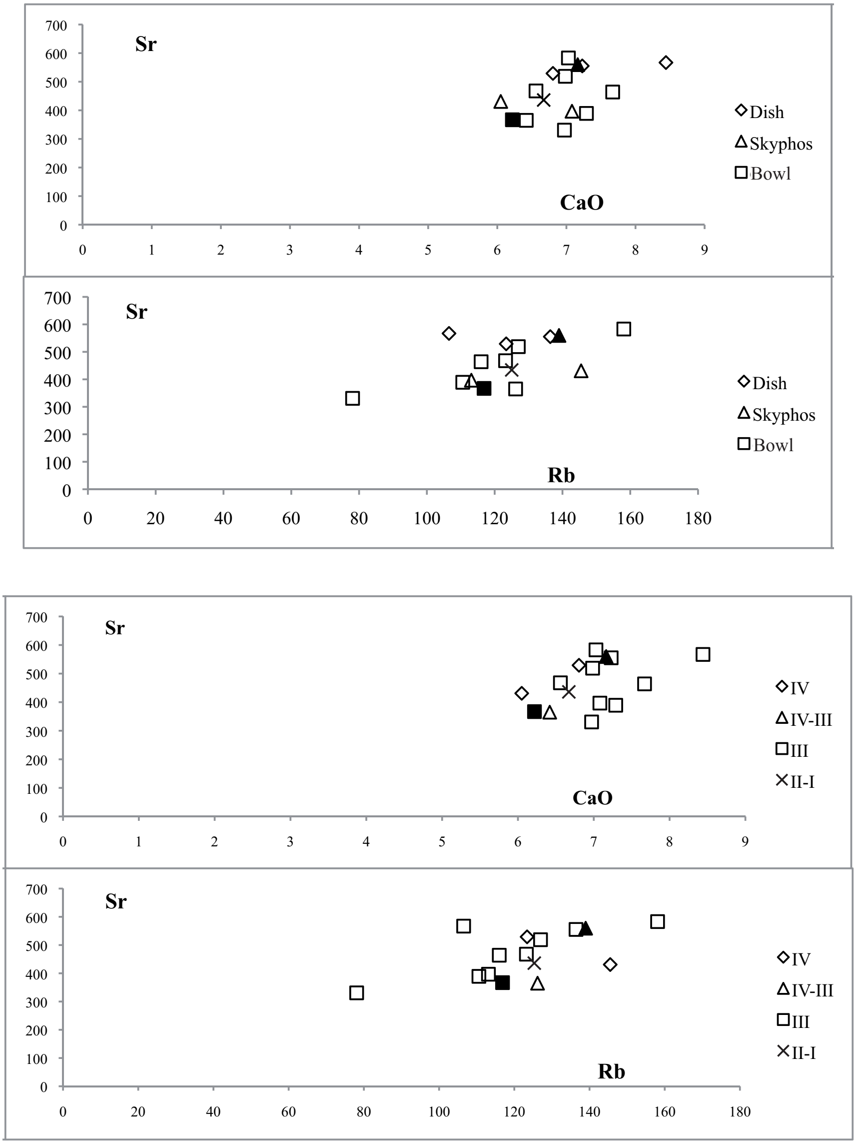

Fig. 5 – Variation diagrams of the archaeological samples both for typology and periods. Filled triangle = sample from Poggio Sommavilla archaeological site; filled square = sample from San Sebastiano archaeological site; cross = sample from Foglia archaeological site (Bowl).

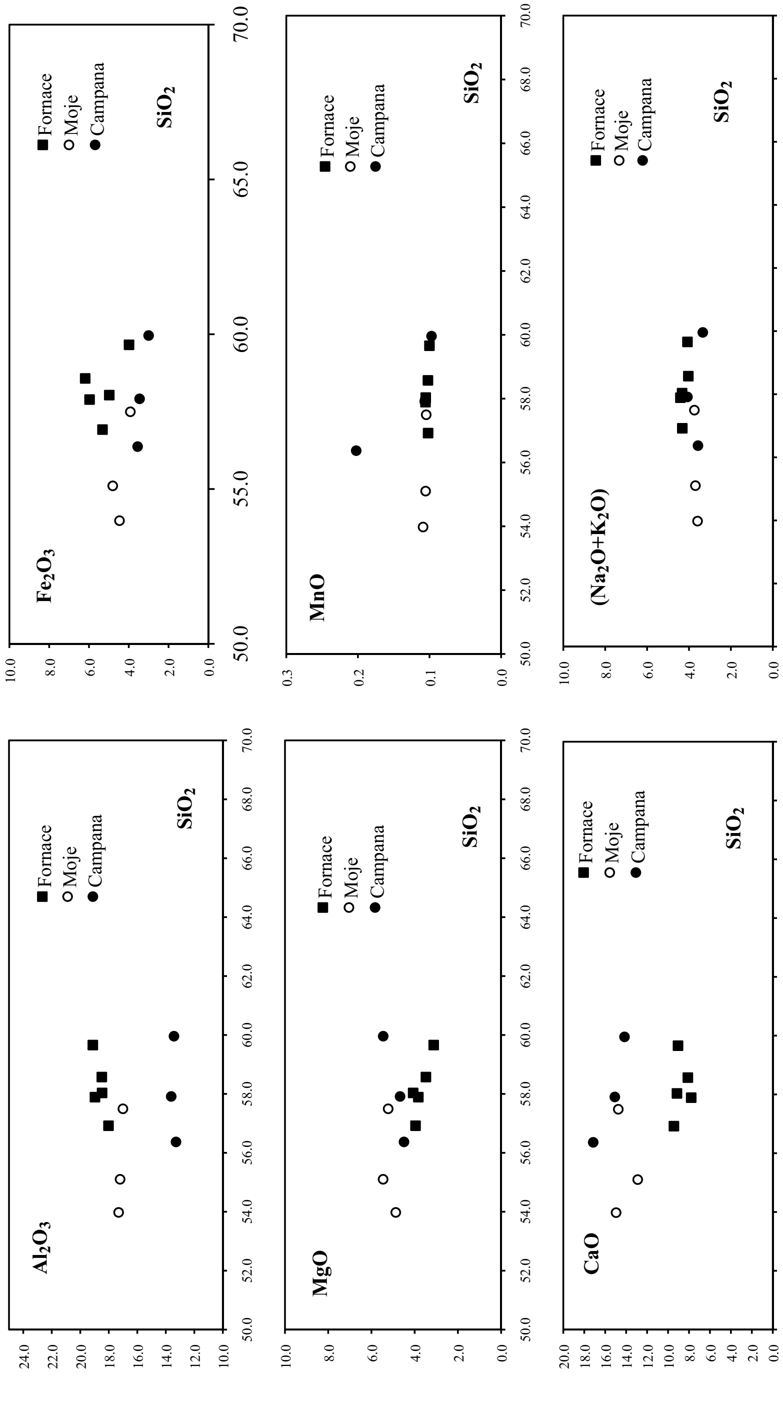

Fig. 6 – Variation diagrams of the clay samples from the three locations.

TABLE 3

Chemical analyses carried out by SEM-EDS on Black-Gloss coating and ceramic body. Major and minor elements are expressed in wt% and normalised to 100%. Beam size is about 200 nm.; m *= average value calculated on the basis of three analyses; σ = standard deviation; c = coating; cb= ceramic body; FeO = Fe tot; nd = not detected.*

sample	SiO_2		TiO_2		Al_2O_3		FeO		MgO		CaO		Na_2O		K_2O		Tot
	m	*σ*	*m*	*σ*	*m*	*σ*	*m*	*σ*	*m*	*σ*	*m*	*σ*	*m*	*σ*	*m*	*σ*	
207c	42.72	0.22	0.85	0.07	32.04	0.22	13.76	0.20	2.42	0.14	1.48	0.07	1.59	0.20	5.14	0.10	100.00
207c	45.36	0.26	0.73	0.08	29.98	0.25	13.65	0.23	2.10	0.15	1.31	0.08	0.93	0.22	5.93	0.13	100.00
207c	43.99	0.25	0.86	0.08	29.37	0.24	14.26	0.23	2.38	0.15	1.77	0.09	1.15	0.23	6.23	0.13	100.00
207c	42.53	0.24	0.60	0.08	30.86	0.24	13.96	0.22	2.23	0.16	2.16	0.09	1.60	0.24	6.06	0.12	100.00
207cb	58.89	0.22	1.14	0.07	17.05	0.14	7.03	0.15	3.09	0.13	8.87	0.11	1.15	0.18	2.78	0.08	100.00
207cb	59.04	0.22	1.11	0.07	17.07	0.16	6.66	0.14	3.08	0.13	8.95	0.11	1.21	0.19	2.88	0.08	100.00
259c	38.21	0.25	0.90	0.09	34.20	0.27	16.94	0.26	3.40	0.19	1.10	0.08	nd	-	5.25	0.13	100.00
259c	34.79	0.25	1.01	0.09	34.80	0.28	17.94	0.26	3.31	0.18	1.83	0.09	1.56	0.24	4.75	0.12	100.00
259c	36.17	0.25	0.86	0.09	34.85	0.28	17.86	0.26	3.55	0.19	1.43	0.09	nd	-	5.28	0.13	100.00
259c	34.53	0.25	0.90	0.09	34.39	0.28	17.70	0.27	4.08	0.19	3.17	0.10	nd	-	5.22	0.13	100.00
259cb	54.72	0.22	0.79	0.07	18.97	0.17	5.95	0.14	3.28	0.14	12.30	0.13	1.05	0.19	2.95	0.08	100.00
259cb	53.58	0.22	0.70	0.07	18.84	0.17	6.17	0.14	3.24	0.14	13.78	0.13	1.13	0.19	2.56	0.08	100.00
799c	36.29	0.30	0.53	0.10	35.70	0.33	17.78	0.31	4.04	0.23	1.47	0.10	nd	-	4.19	0.14	100.00
799c	37.81	0.17	0.53	0.05	34.85	0.18	17.01	0.17	3.35	0.12	1.13	0.05	1.04	0.17	4.28	0.08	100.00
799c	38.56	0.18	0.65	0.06	33.83	0.20	16.54	0.18	3.36	0.13	1.69	0.06	1.12	0.18	4.25	0.08	100.00
799cb	51.87	0.21	0.61	0.06	24.14	0.18	9.18	0.16	2.36	0.13	8.02	0.10	nd	-	3.83	0.09	100.00
799cb	52.74	0.20	0.98	0.07	18.44	0.16	8.57	0.16	3.09	0.13	13.14	0.12	0.87	0.18	2.18	0.07	100.00

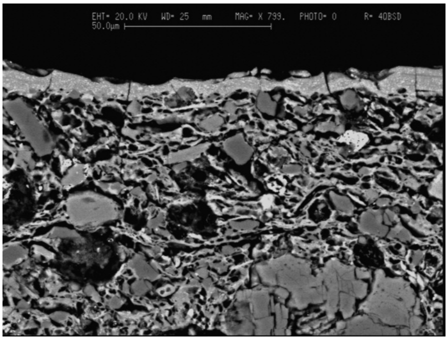

Fig. 7 – SEM backscattering electron microphotograph of gloss pottery; sample 207. Gloss thickness is 29 µm in this area.

fine-grained illitic non-calcareous clay (Bimson, 1956; Winter, 1959; Hofmann, 1962, 1966; Noll *et al.,* 1973 Winter, 1978; Tite *et al.,* 1982)) that was applied with a brush or by dipping, as in this case (fingerprints and glossy drops on the ceramic bases are evident in many vases), on the surface of the ceramic body and fired using air and carbon monoxide as working atmospheres in an oxidising-reducing-oxidising single firing cycle which transformed iron oxides and sintered the matrix (Maggetti *et al.,* 1981; Maniatis *et al.,* 1993; Ingo *et al.,* 2000; Gliozzo *et al.,* 2004; Cuomo di Caprio, 2007).

The Black-Gloss, which had already been observed by optical microscopy, was investigated also by SEM on three samples (207, 259 and 799) to study their morphological-textural features and their chemical composition. Coating thickness is very variable (also taking into account the modality of its application) within the sampling, as well as within the same sample from area to area. It shows a minimum-maximum range of about 6-30 µm with an average value of about 20 µm. Porosity is almost constant (taking into account both the frequency and the areas occupied by pores which show sub-rounded shapes and subordinate elongated shapes) and does not seem to correlate with coating thickness.

The gloss of every single sample shows a low or very low variation in its chemical composition (Table 3), even if a discrete variation in the quantity of each element exists from one to the other. This may be due to the technological process adopted to obtain a clay suspension suitably enriched in iron. As a rule, chemical composition of the gloss is characterised by a higher iron content (ranging from 13.65 wt%, of sample 207, to 17.94 wt%, of sample 259), and a lower CaO content (from 1.10 wt%, of sample 259, to 3.17 wt%, of sample 259) than the ceramic body ones (FeO: 5.95-9.18 wt%; CaO: 8.02-13.78 wt%). This is a common, or rather, a typical feature of Black-Gloss production (Ingo *et al.,* 2000; Gliozzo *et al.*, 2004) and is thus not a sufficient requisite for considering the ceramics as having a common origin (Gliozzo *et al.,* 2004).

Discussion and Conclusion

The results of this preliminary study based on archaeological, optical and scanning electron microscopy as well as diffractometric and chemical analyses show that all the samplings belong to a single archaeological class (Black-Gloss Pottery) even if they sometimes represent different typologies (Table 1) which could be considered local. As we expected from the previous autoptical investigation, the ceramic pastes are similar even if they come from different archaeological contexts. Moreover, our results show that potters in the area under study were not concerned with making different pastes for different ceramic typologies and so they did not want to achieve a good level of specialisation but a good level of standardisation in production.

Mineralogical and chemical variations within the ceramic class are very slight and the petrographic features of the samples, serial distribution of the grain-size and sub-rounded shape of the crystal, which have been highlighted for the quarry-samples too, suggest that the quality of the raw material used was such that it was unnecessary to add extraneous elements to the sediment to render the paste more pliable. Indeed, only in sample 16 was a *chamotte* inclusion observed; paste preparation was therefore extremely simple, needing little processing. The serial distribution of the grain-size of the ceramic paste does not allow us to consider any other process (such as water sedimentation or grinding) except the natural one producing it.

As for the quarry samples, on the basis of petrographic analyses (the chemical analyses were unable to discriminate these clay deposits; TABLE 2), the raw material of the Campana deposit, 3.3 km from Colle Rosetta, lacks pyroxene (which is frequently found in ceramic pastes) in its mineralogical composition, and it shows the lowest iron content (3.00 to 3.55 wt%) and the highest CaO content (from 14.16 to 17.15 wt%) which, besides the abundant calcite crystals, is also probably due to its fossiliferous component that is not present in the ceramic paste.

Like Campana, the clay deposit of Moje also lacks pyroxene. The Moje geological context almost entirely consists of marine sediments (Fig. 2). On the other hand, the Campana and Fornace deposits are located near some volcanic outcroppings (red tuffs with black scoriae and/or pyroclastic deposits; Mancini *et al.,* 2004; Fig. 2) containing pyroxene. However, this mineral is lacking in all the investigated Campana samples. Moreover, the petrographic investigation showed evidence of the presence of lenses in the Moje clay which gave this sediment a iatal grain-size distribution that is not observed in the ceramic paste.

On the basis of our results, the Fornace sediment seems to be petrographically very similar to archaeological pastes and shows the same mineralogical, lithic composition and grain-size. It must be noted that the mineralogical composition of both the clays and ceramics under study are very typical of much of the Tiber valley but, on the basis of archaeological observations – shapes classified**,** amount of sherds, miniatures - it may be hypothesised that the archaeological sherds are local and that the Fornace deposit, also supported by its strategic location, could be considered the raw material source. Indeed, the Fornace outcropping is located along the L'Aia, a tributary of the river Tiber. The Campana deposit is also near a tributary of the Tiber (the Campana one) but the lack of pyroxene in its clay excludes it as a possible source (Fig. 2).

Moreover, it may be hypothesised that the clay utilised was always supplied from the same quarry in all periods.

The analytical data also gave some insights into the production techniques such as firing temperature, seasoning and surface treatments. As regards the former, there are some features of this production, such as the presence of ARFs which indicate a scarce kneading of the paste and/or a brief or total absence of seasoning**.** The latter can greatly reduce or eliminate this kind of inclusion (Cuomo di Caprio, 2007).

Evidence based on the mineralogical composition of the pastes suggests that the maximum temperature reached during firing was 800°-850°C. In fact, at a higher temperature, calcite completely dissociates reacting with quartz forming more stable silicates. As for gloss, Vendrell-Saz *et al.* (1991) showed that a low reducing temperature and short firing time produced a small average grain size (>300nm) with a matt surface whereas higher temperatures and longer firing times produced well-developed crystals making the surface appear iridescent.

These results were also confirmed by SEM analyses which suggested the same temperature range.

The Black-Gloss was investigated from textural and chemical points of view. Coating thickness varies considerably from about 6 to 30 μm, with an average value of about 20 μm. Porosity does not seem to be correlated to the thickness of the black layer which shows chemical characteristics that are very common to the whole gloss production with higher iron contents and a lower CaO content with respect to the ceramic paste (Table 3).

From an archaeological point of view, the study confirmed that the process followed to obtain the Black-Gloss is the same as the one used for the Black-Gloss of Northern Etruria and the Ariminum vases (Mazzeo Saracino *et al.,* 2000; Gliozzo *et al.,* 2004), and also of the Black-Gloss on Attic Black-Figure of Vases (Ingo *et al.,* 2000). In all likelihood, owing to cultural trading relations, this technological process was first imported by italic potters of Campania and Etruria, and then shortly afterwards by italic craftsmen of the Sabine Tiberine and Faliscan areas.

On the basis of a local production hypothesis, the three analysed sherds from the sites of Foglia, San Sebastiano and Poggio Sommavilla, whose ceramic pastes are very similar to those of Colle Rosetta, point to the widespread distribution of this production also in the surrounding territory of the Sabine settlement of Poggio Sommavilla up to and beyond Sabine "Romanization" (290 B.C.).

Transportation of the finished objects in the case of Foglia and Poggio Sommavilla, given their geographic location, was obviously along the River Tiber and its tributary L'Aia, flowing through this territory.

On the basis of this study it appears that a workshop existed in the countryside of Poggio Sommavilla. This information is of great importance as it would be the first evidence of the existence of a ceramic workshop in the Sabine area.

Further detailed investigations will be carried out on the area's archaeological and quarry samples in order to make comparisons with the results obtained in the present study.

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