Pottery production in Late Neolithic cult sites of Santa Barbara and Cala Scizzo (Apulia, southeast Italy)

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ABSTRACT In the present work archaeometric data of 54 pottery samples from the archaeological sites of Santa Barbara and Cala Scizzo (Apulia, southern Italy) are presented. From each site two Late Neolithic wares (household and fine classes) were sampled. Mineralogical examination on thin-sections and PXRD analysis allow the identification of three paste groups, with different dominant clastic constituents: calcite (onyx marble clasts, carbonate fossils, micro-crystalline calcite), quartz, Fe-oxides or hydroxides and feldspars. The presence of a high quantity of pyroxenes and gehlenite has been observed only in fine ware from Santa Barbara. Chemical analyses (XRF) evidenced SiO_2, Al_2O_3 and CaO as the main oxides and their different concentrations allow the dividing of the samples in the same subgroups. As far as the ecological and technological aspects are concerned, archaeometric data suggest the use of two different (calcareous and non-calcareous) clays for pottery production in both sites. Mineralogical and chemical data show that all samples were fired at a temperature not exceeding 600-800°C. Only fine ware from Santa Barbara was fired in a range of 850°-1050°C.

1. The archaeological context

One of the most remarkable features of Late Neolithic of peninsular Italy is the presence of ritual sites, comprising natural caves or rock-cut structures. Burials and ritual activities (faunal remains of wild animals, stone enclosures, human figurines and red painted pebbles) are the major sources of cult evidence (Whitehouse, 1992). In the present work archaeometric data of 54 pottery samples from the cult sites of Manfredi hypogeum, within the Santa Barbara settlement, and Cala Scizzo cave (Bari province), located on the Adriatic coast of the Murge plateau (Fig. 1), are presented (Geniola, 1998). From the Manfredi hypogeum, dated to Serra d'Alto *facies* (BM-2256R÷2258R: 5500÷4400 cal. BC 2σ), two archaeological classes were sampled: 17 samples (SB01÷17) belong to very fine smoothed and dark brown painted pottery with complex geometrical motives, as well as 17 samples (SB18÷34) to black household pottery. From the Cala Scizzo cave, dated to Diana - Bellavista *facies* (BM-2253R: 4600÷3300 cal. BC 2σ), black (10 samples, CS01÷10) and plain (10 samples, CS11020) household pottery were sampled.

2. Analytical methods

Mineralogical, petrographic and chemical analyses were performed at Dipartimento Geomineralogico of the Bari University. Mineralogical studies were carried out by X-ray powder analysis (PXRD) using a Philips diffractometer (PW 1710) with Ni-filtered CuKα radiation

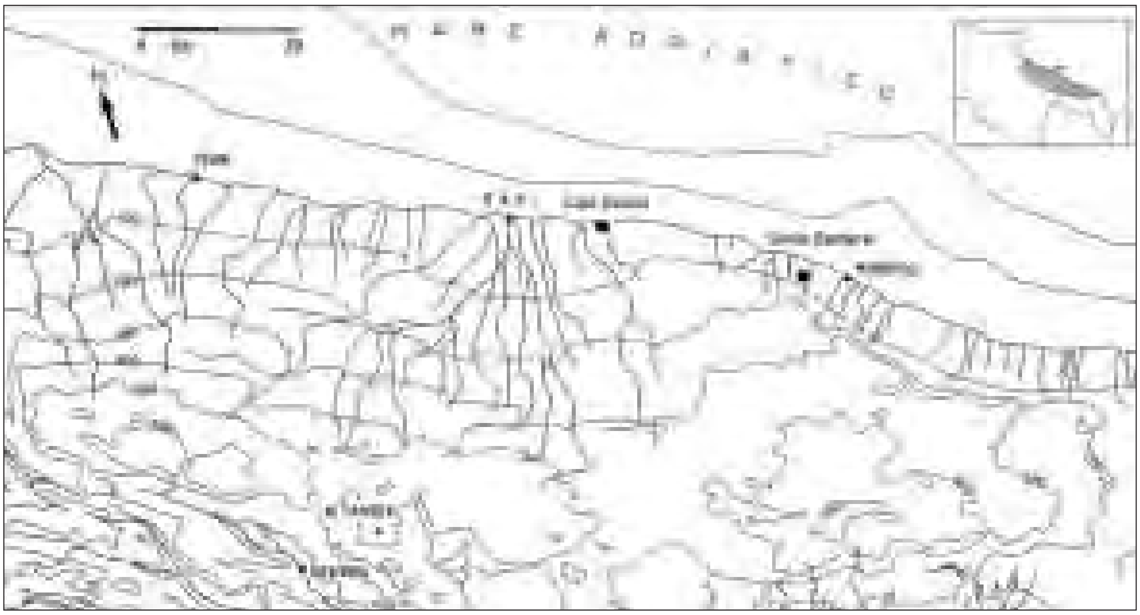

FIG. 1 – Location of the archaeological site of Cala Scizzo and Santa Barbara (Bari) on the Adriatic coast of the Murge plateau.

and employing NaF as internal standard. They have been completed by microscopic observation on thin sections, with a polarised light microscope. Modal analysis was carried out through a Swift & S. Point Counter, undertaking from 2500 to 4500 points for each sample (according to their wall thickness), with a line distance of 0,05 mm and a lateral step of 0,2 mm. Major and trace elements determination was performed by XRF, using a Philips PW 1480/10 spectrometer (Cr anticathode for major and minor elements, Rh anticathode for Rb, Sr, Y, Zr, Nb and W anticathode for Ce, La, Ba, Ni, Cr, V), following analytical techniques outlined by Franzini et al. (1972, 1975) and Leoni and Saitta (1976). Two reference standards (AGV-1 of USGS-USA and NIM-G of NIM-South Africa) were used to check the accuracy of the analytical data. Loss on ignition was determined by heating the samples at 1000°C for 12 hours. PXRD patterns of previously heated samples (1000°C), for the identification of mineralogical changes, were recorded at room temperature.

3. Mineralogical and chemical analyses

3.1 Thin sections analyses

Petrographic examination by point counting (Table 1) of 40 representative samples (SB01÷10, 18÷27 and CS01÷20) allows the identification of three paste groups, with different dominant clastic constituents. The first group, composed by black household pottery from Santa Barbara (SB01÷10), is tempered mainly by angular to sub-angular coarse-grained onyx marble clasts ($\bar{x}$ =26.58 vol.%). Quartz ($\bar{x}$ =12.59 vol.%), Fe-oxides or hydroxides aggregates ($\bar{x}$ =7.50 vol.%) and pisoliths were also observed as natural inclusions. Grog fragments are occasionally present in two samples (SB05 and SB07). In the second group, constituted by black household pottery from Cala Scizzo (CS01÷10), the silicate-rich matrix is dominant ($\bar{x}$ =82.16 vol.%) and non-plastic inclusions are coarse-grained quartz ($\bar{x}$ =11.71 vol.%) and feldspars ($\bar{x}$ =2.65 vol.%) clasts, with no calcareous rocks. The third group, composed by fine dark brown painted pottery from Santa Barbara (SB18÷27) and plain household pottery from Cala Scizzo (CS11÷20), shows an abundant sheet silicate matrix (SB: $\bar{x}$ =59.89; CS: $\bar{x}$ =69.97 vol.%), in which only the micas are recognisable. Non-plastic inclusions are homogeneous fine-grained minerals such as quartz (SB: $\bar{x}$ =11.85; CS: $\bar{x}$ =12.85 vol.%) and carbonate fossils (planktonic foraminifera); microcrystalline and secondary calcite was observed in all samples. Fragments of chert, zircon and tourmaline crystals were occasionally observed in the three groups.

TABLE 1
Modal analysis (vol. %) of pottery samples.

Samples	Matrix	Voids	Qtz	Ms	Bt	Feld	Px	Cal	Fe-ox/hydrox	Pisoliths	Fossils
SB01	51,55	12,20	7,77	0,33	0,45	0,42	0,08	23,25	3,80	0,15	0,00
SB02	40,51	15,93	7,83	0,13	0,00	0,60	0,00	28,83	6,16	0,00	0,00
SB03	39,76	13,00	16,68	0,25	0,74	0,96	0,00	18,93	9,36	0,33	0,00
SB04	28,26	9,01	12,75	0,28	0,22	0,57	0,00	40,93	7,69	0,28	0,00
SB05	33,83	10,59	18,05	0,16	0,38	1,03	0,00	26,44	8,67	0,85	0,00
SB06	39,65	9,87	15,77	0,36	0,99	0,93	0,42	21,24	10,76	0,00	0,00
SB07	29,64	12,71	7,95	0,66	0,48	0,39	0,00	40,61	7,00	0,00	0,56
SB08	56,29	3,80	11,14	0,35	0,00	0,69	0,00	22,18	5,49	0,06	0,00
SB09	51,56	6,78	10,85	0,17	0,40	0,21	0,00	22,18	7,78	0,07	0,00
SB10	46,86	5,22	17,06	0,48	0,30	0,48	0,00	21,18	8,25	0,11	0,06
$\bar{x}$	41,79	9,91	12,59	0,32	0,40	0,63	0,05	26,58	7,50	0,18	0,06
σ	9,61	3,79	4,07	0,16	0,31	0,27	0,13	7,99	2,00	0,26	0,18
SB18	60,89	1,35	15,16	0,40	0,13	0,61	0,00	19,70	1,42	0,00	0,34
SB19	52,56	9,96	11,87	0,31	0,47	0,89	0,00	16,83	6,59	0,00	0,52
SB20	70,95	6,30	6,33	0,00	0,00	0,30	0,00	9,90	5,48	0,00	0,74
SB21	63,78	7,24	8,65	0,29	0,00	0,35	0,00	10,34	9,17	0,00	0,17
SB22	50,12	9,52	13,25	0,62	0,22	0,66	0,00	19,41	5,23	0,00	0,97
SB23	54,99	7,86	13,67	0,63	0,47	0,87	0,00	17,45	3,30	0,00	0,75
SB24	65,15	8,73	15,11	0,00	0,31	0,58	0,00	7,55	2,57	0,00	0,00
SB25	64,39	4,38	12,72	0,60	0,43	0,53	0,00	8,21	7,07	0,00	1,67
SB26	54,40	12,61	10,15	0,67	0,51	0,62	0,00	14,87	5,56	0,00	0,61
SB27	61,71	8,39	11,62	0,19	0,47	0,79	0,00	11,36	5,27	0,00	0,20
$\bar{x}$	59,89	7,64	11,85	0,37	0,30	0,62	0,00	13,56	5,17	0,00	0,60
σ	6,61	3,12	2,81	0,26	0,20	0,20	0,00	4,63	2,27	0,00	0,48
t	**4,9081**	1,4666	0,4678	0,5614	0,8220	0,0652	1,1950	**4,4587**	**2,4394**	**2,2408**	**3,2922**
p-value	**0,0001**	0,1597	0,6455	0,5814	0,4218	0,9487	0,2476	**0,0003**	**0,0253**	**0,0379**	**0,0041**
CS01	82,63	0,34	15,38	0,00	0,00	1,02	0,35	0,00	0,25	0,04	0,00
CS02	83,66	0,65	12,17	0,00	0,00	2,50	0,31	0,16	0,16	0,39	0,00
CS03	83,56	0,28	11,92	0,22	0,00	3,09	0,38	0,00	0,50	0,06	0,00
CS04	81,96	0,37	11,02	0,00	0,00	2,65	0,27	2,10	0,59	1,05	0,00
CS05	83,45	1,13	10,61	0,19	0,00	2,55	0,19	1,75	0,00	0,12	0,00
CS06	85,24	0,22	10,05	0,01	0,00	4,01	0,01	0,13	0,19	0,13	0,00
CS07	81,54	0,45	9,72	0,21	0,00	2,18	0,19	5,44	0,27	0,00	0,00
CS08	74,55	0,37	14,14	0,00	0,00	3,46	0,00	7,24	0,01	0,00	0,22

TABLE 1 [cont.]

Samples	Matrix	Voids	Qtz	Ms	Bt	Feld	Px	Cal	Fe-ox/hydrox	Pisoliths	Fossils
CS09	83,06	1,55	8,80	0,06	0,00	1,84	0,25	3,91	0,53	0,00	0,00
CS10	81,93	0,30	13,28	0,14	0,00	3,16	0,95	0,24	0,00	0,00	0,00
$\bar{x}$	82,16	0,56	11,71	0,08	0,00	2,65	0,29	2,10	0,25	0,18	0,02
σ	2,88	0,44	2,08	0,10	0,00	0,85	0,26	2,60	0,22	0,33	0,07
CS11	62,12	4,13	16,87	1,21	0,00	3,22	0,18	9,94	0,00	0,00	2,34
CS12	74,68	5,02	11,54	0,51	0,00	1,29	0,38	4,60	0,10	0,00	1,87
CS13	90,61	2,97	4,49	0,40	0,00	0,36	0,16	0,32	0,00	0,00	0,68
CS14	68,96	0,09	16,45	1,93	0,00	2,93	0,22	4,97	2,30	0,00	2,14
CS15	65,87	3,03	18,04	0,93	0,00	2,54	0,00	5,92	0,31	0,35	3,03
CS16	73,43	5,52	11,98	1,74	0,00	1,14	0,07	3,74	0,21	0,35	1,81
CS17	54,31	0,43	23,07	1,99	0,00	3,97	0,80	8,08	0,00	0,28	7,07
CS18	46,94	1,36	7,85	0,56	0,18	0,76	0,00	41,59	0,00	0,30	0,45
CS19	82,62	0,35	8,39	0,62	0,00	1,11	0,17	5,05	0,00	0,49	1,20
CS20	80,20	1,48	9,86	0,19	0,24	1,43	0,16	4,03	0,00	0,55	1,86
$\bar{x}$	69,97	2,44	12,85	1,01	0,04	1,87	0,22	8,82	0,29	0,23	2,25
σ	13,25	1,99	5,64	0,67	0,09	1,20	0,23	11,79	0,71	0,21	1,86
t	**2,8410**	**2,9082**	0,6028	**4,3324**	1,4807	1,6649	0,6704	1,7615	0,1749	0,4158	**3,7759**
p-value	**0,0108**	**0,0094**	0,5542	**0,0004**	0,1560	0,1132	0,5111	0,0951	0,8631	0,6825	**0,0014**

Qtz = quartz; Ms = muscovite ; Bt = biotite; Feld = k-feldspar and plagioclase; Px = pyroxene; Cal = calcite; Fe-ox/hydrox = Fe-oxides or hydroxides aggregates (symbols as in Kretz, 1983). Student *t*-test between the two archaeological classes of each site; in bold: significant at level of probability ≤0.04.

3.2. Powder X-ray diffraction (PXRD) analyses

PXRD analyses (Table 2) show the presence of predominant quartz and feldspars, accompanied by variable amounts of calcite, and confirm the differences between Cal-rich (SB01÷17) and Qtz-rich (CS01÷10) black household pottery samples. Weak peaks of clay minerals (illite and minor quantities of smectite) have been observed in both these two groups. A high quantity of diopsidic pyroxenes and gehlenite has been detected only in some fine pottery samples from Santa Barbara (SB18÷27). The high peaks of calcite in almost all samples can be derived from secondary calcite within the matrix (as observed in thin sections) in primary porosity and drying shrinkage. PXRD analyses of heat-treated representative samples at 1000°C (Table 3) confirm that pyroxene and gehlenite synthesis is dependent on calcite and clay minerals abundance (Maggetti, 1982): the presence of a high quantity of neoformed pyroxenes and gehlenite was detected mainly in SB18÷34 (where their concentration increases) and in CS11÷20 samples (where they were absent). In Qtz-rich (CS01÷10) samples, characterised by very low quantities of calcite, only hematite is the secondary product of firing. The co-occurrence of diopside, gehlenite and hematite was observed only in the Cal-rich samples (SB01÷17). CaO was also detected (mainly in SB08, 11, 13-14 samples), probably due to the prevailing quantities of $CaCO_3$ in the paste (onyx marble clasts).

TABLE 2
Mineralogical composition, by PXRD analysis, of pottery samples.

Samples	C.M.	Ms	Qtz	Feld	Cal	Px	Gh
SB01	X	X	XXXXX	X	XXXXX		
SB02	XX	XX	XXXX	X	XXXXX		
SB03	XX	XX	XXX	X	XXX		
SB04		X	XXXX	X	XXXXX		
SB05	X	X	XXXXX	X	XXXXX		
SB06	X	X	XXXXX	XX	XXXXX		
SB07	X	X	XXX	XX	XXXXX		
SB08	XX	X	XXXXX	X	XXXX		
SB09	XX	X	XXX	XX	XXXXX		
SB10	X	X	XXXXX	X	XXXXX		
SB11	XX	XX	XXXX	XXX	XXXXX		
SB12	XX	X	XXX	X	XXXXX		
SB13	XX	X	XXX	X	XXXXX		
SB14	XXX	X	XXXX	XXX	XXXX		
SB15	XX	X	XXXX	XX	XXXX		
SB16	X	X	XXXXX	XXX		X	
SB17	XX	X	XXXXX	XX	XXX		
SB18		X	XXXXX	XXX	XXX	XX	XX
SB19			XXXX	XXX	XXX	XX	XX
SB20			XXXX	XXX	XXX	XXX	XX
SB21	X		XXXXX	XX	XXX	tr.	XX
SB22			XXXXX	XXX	XXX	X	XX
SB23			XXXXX	XX	XXX	tr.	tr.
SB24			XXXXX	XXX	XX	XX	XX
SB25			XXXXX	XXX	XXX	XX	XX
SB26			XXXXX	XXX	XXX	XXX	XX
SB27			XXXXX	XX	XX	XX	XX
SB28	X	X	XXXXX	XX	XXXXX		
SB29	X	XXX	XXXXX	XX	XXXXX		
SB30	X	XXX	XXXXX	XX	XXXX	X	X
SB31	X	XX	XXXXX	XXX	XXXX		X
SB32			XXXXX	XXX	XXXX		
SB33			XXXXX	XXX	XX	XX	XX
SB34	X	X	XXXXX	XX	XXXX		
CS01	XX	X	XXXXX	X	tr	tr	
CS02	X	X	XXXXX	X		X	
CS03	XX	tr	XXXXX	X		X	tr
CS05	X	tr	XXXXX	XX	X	tr	
CS06	XXX	X	XXXXX	XXX	tr	X	tr
CS07	X		XXXXX	X	X	X	
CS08	X	tr	XXXXX	X	XX		

TABLE 2 [cont.]

Samples	C.M.	Ms	Qtz	Feld	Cal	Px	Gh
CS09	X	tr	XXXXX	X	X		tr
CS10		tr	XXXXX	XXX			
CS11	tr	tr	XXXXX	XX	XXXX		
CS12	X		XXXXX	X	XXXXX		
CS13	X		XXXXX	X	XXXXX	tr	tr
CS14		tr	XXXXX	XX	XXXX	tr	tr
CS15	tr	tr	XXXXX	XX	XXXX		X
CS16	tr		XXXXX	X	XXXX		tr
CS17	X	tr	XXXXX	XX	XXXX		
CS18	X	tr	XXXXX	XX	XXXX		tr
CS19	tr		XXXXX	X	XXXX		X
CS20		tr	XXXXX	XX	XXXX		tr

C.M. = clay minerals; Ms = muscovite; Qtz = quartz; Feld = k-feldspar and plagioclase; Cal = calcite; Px = pyroxene; Gh = gehlenite (symbols as in Kretz, 1983). Number of (x) is in relationship with mineralogical phase abundance.

TABLE 3
Mineralogical composition, by PXRD analysis, of heated (1000°C) representative pottery samples.

Samples	Qtz	Feld	Px	Gh	Hem
SB01	XXXXX	XXX	X	X	XX
SB02	XXXXX	XX	X	X	X
SB04	XXXXX	XXX	X	X	X
SB05	XXXXX	XXX	X	X	X
SB08	XXXXX	XXX	X	X	X
SB11	XXXXX	XX	XX	X	XX
SB13	XXXXX	XX		X	XX
SB14	XXXXX	XXX		X	XX
SB15	XXXXX	XX		X	XX
SB19	XXXXX	XXXX	XXX	XX	X
SB20	XXXXX	XXXX	XXXXX	XXX	tr.
SB23	XXXXX	XXX	X	X	tr.
SB25	XXXXX	XXXX	XXX	XXX	tr.
SB27	XXXXX	XXX	XXX	XXX	tr.
SB28	XXXXX	XXX	XX	XXX	X
SB29	XXXXX	XXX	XXX	XX	X
SB30	XXXXX	XXX	XXX	XX	
SB31	XXXXX	XXX	XXX	XX	
CS01	XXXXX	XX	X		XX
CS02	XXXXX	XX	X	tr	XX
CS03	XXXXX	XX	tr		XX
CS05	XXXXX	XXX		tr	XX
CS06	XXXXX	XXX	X		XX

TABLE 3

Samples	Qtz	Feld	Px	Gh	Hem
CS07	XXXXX	XXX	X		XX
CS08	XXXXX	XXX	X	X	XX
CS09	XXXXX	X			X
CS10	XXXXX	XXXXX			XX
CS11	XXXXX	XXX	XXX	XXXX	
CS12	XXXXX	XXX	XXX	XX	tr
CS13	XXXXX	XXXX	XXX	XX	X
CS14	XXXXX	XXX	XXX	XXXX	tr
CS15	XXXXX	XXX	XXX	XXXX	tr
CS16	XXXXX	XXX	XXX	XXX	tr
CS17	XXXXX	XXX	XXX	XXX	
CS18	XXXXX	XX	XXX	tr	tr
CS19	XXXXX	XXX	XXX	XXXX	
CS20	XXXXX	XX	XX	XXXX	tr

Qtz = quartz; Feld = k-feldspar and plagioclase; Px = pyroxene; Gh = gehlenite; Hem = hematite (symbols as in Kretz, 1983). Number of (x) is in relationship with mineralogical phase abundance.

3.3 Chemical analyses (XRF)

XRF analyses (Table 4) evidenced that SiO_2, Al_2O_3 and CaO were the main oxides and their different concentrations allow the dividing of the samples in the same three subgroups. The ternary diagram SiO_2, Al_2O_3 and CaO+MgO (Fig. 2) shows the clear diversification of Qtz-rich samples (CS01÷10) from Cala Scizzo and SB01÷17 samples from Santa Barbara characterised by higher, but more variable ($\bar{x}$ =15.08; σ=6.90), quantities of CaO; the former are also distinguished by highest Al_2O_3 values, related to clay matrix abundance. In the central part of the diagram we can show a complete overlapping of samples belonging to fine painted pottery from Santa Barbara (SB18÷34) and to plain household pottery from Cala Scizzo (CS11÷20), both characterised by similar amount of the three main oxides and by highest concentrations of MgO (probably due to the main quantities of diopsidic pyroxenes). Only two samples (CS18 e SB16) can be considered as outliers for the lowest quantities of CaO in their groups.

As regards trace elements (Table 5), Rare Earth Elements (REE), such as Lanthanum (La) and Cerium (Ce), clearly show only two clusters (Fig. 3). The first cluster contains fine painted pottery from Santa Barbara (SB18÷34) and plain household pottery from Cala Scizzo (CS11÷20). The second one contains black household samples from both sites, except for four outliers (SB02, SB04, SB07 and SB12) with lower value of Ce and La. This chemical affinity, between wares with different non-plastic inclusions, may suggest the use of the same type of clay (in which REE are adsorbed), with the addition of a calcareous temper in black household pots made at Santa Barbara.

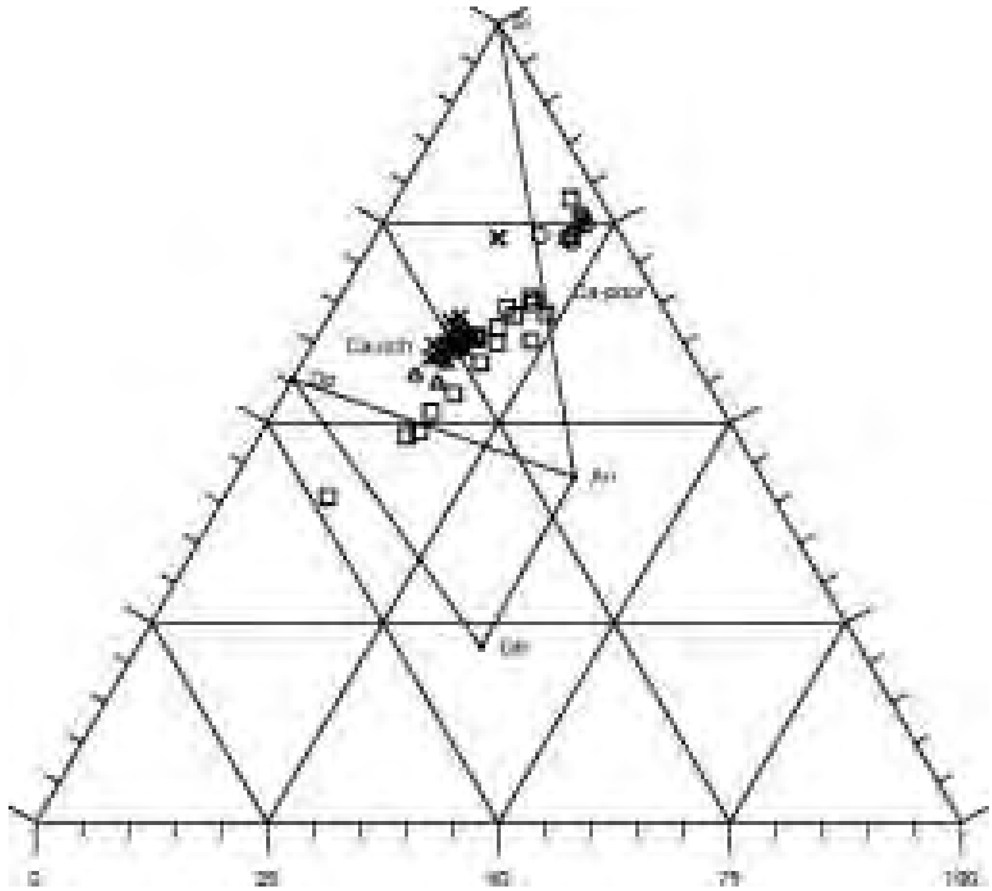

FIG. 2 – Ceramic triangular diagram $(CaO+MgO)/Al_2O_3/SiO_2$; Di = diopside; Gh = gehlenite; An = anortite.

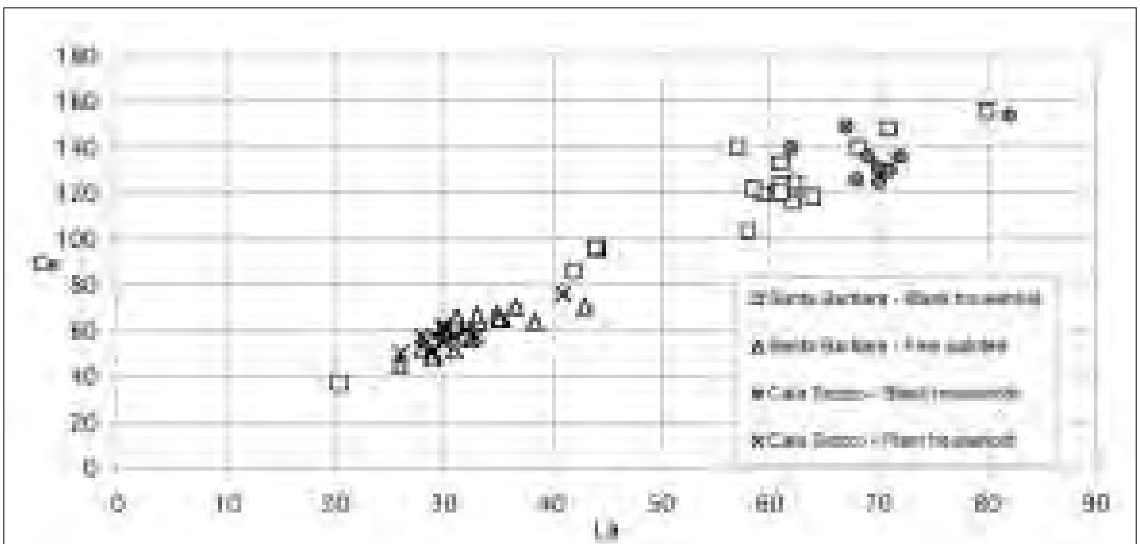

FIG. 3 – Ce *vs.* La plot (*ppm*).

TABLE 4
Chemical composition (wt%) of pottery samples by XRF analysis.

Samples	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI
SB01	48,66	0,75	15,38	6,64	0,13	1,02	11,61	1,25	2,20	0,14	12,21
SB02	36,51	0,52	12,06	5,50	0,05	1,81	20,57	0,97	1,71	0,21	20,10
SB03	49,99	0,69	16,35	6,93	0,10	1,02	9,57	1,35	1,76	0,12	12,13
SB04	34,00	0,52	11,14	5,06	0,09	0,82	24,30	0,95	1,24	0,19	21,70
SB05	46,54	0,61	13,00	6,00	0,16	1,07	15,72	1,10	1,71	0,13	13,97
SB06	51,64	0,72	16,26	6,81	0,13	0,72	10,07	0,76	1,68	0,14	11,07
SB07	27,02	0,38	7,45	3,22	0,04	1,24	30,73	0,57	0,92	0,28	28,16
SB08	50,22	0,68	14,55	6,18	0,12	1,00	12,13	1,13	1,54	0,10	12,35
SB09	45,10	0,62	14,89	6,36	0,11	0,83	14,29	1,05	1,52	0,16	15,08
SB10	46,96	0,62	14,33	6,23	0,09	1,02	13,50	0,78	1,36	0,15	14,95
SB11	44,17	0,80	17,10	7,97	0,15	0,95	11,01	0,51	1,30	0,17	15,87
SB12	34,17	0,57	11,85	5,41	0,11	0,72	23,14	0,41	1,23	0,08	22,31
SB13	38,23	0,85	13,05	6,49	0,09	0,93	19,05	0,39	1,30	0,14	19,48
SB14	41,54	0,86	13,92	7,28	0,21	0,97	15,78	0,43	1,31	0,21	17,50
SB15	44,92	0,64	13,02	6,01	0,09	1,35	14,94	0,65	1,46	0,08	16,84
SB16	61,83	0,65	14,85	5,19	0,20	0,75	1,78	1,03	1,92	0,15	11,66
SB17	47,14	0,74	17,28	7,09	0,13	1,54	8,13	0,63	2,25	0,21	14,85
$\bar{x}$	44,04	0,66	13,91	6,14	0,12	1,04	15,08	0,82	1,55	0,16	16,48
σ	8,22	0,12	2,46	1,08	0,05	0,29	6,90	0,31	0,35	0,05	4,62
SB18	50,30	0,59	12,36	5,24	0,08	3,36	15,17	1,43	1,65	0,28	9,54
SB19	49,22	0,68	13,50	6,28	0,08	2,61	16,16	0,77	1,86	0,33	8,50
SB20	44,92	0,66	12,84	6,06	0,09	2,25	21,33	0,72	1,78	0,42	8,93
SB21	46,75	0,65	12,59	6,02	0,09	1,86	19,88	0,72	1,91	0,31	9,23
SB22	49,86	0,70	13,61	6,19	0,08	2,48	15,77	0,94	2,16	0,28	7,92
SB23	49,52	0,60	11,61	5,69	0,06	1,92	17,78	0,89	2,01	0,37	9,55
SB24	50,50	0,69	13,74	6,31	0,09	2,69	16,28	1,02	1,96	0,30	6,42
SB25	48,39	0,65	12,93	5,87	0,09	2,25	18,07	0,82	2,01	0,25	8,67
SB26	50,56	0,65	13,22	5,82	0,10	1,85	16,63	0,91	2,13	0,25	7,88
SB27	46,72	0,60	11,92	5,62	0,08	2,10	19,54	0,99	1,86	0,34	10,22
SB28	40,83	0,44	9,36	3,71	0,07	1,37	21,09	0,73	1,54	0,41	20,46
SB29	43,41	0,57	11,45	4,92	0,08	1,40	17,32	0,49	1,42	0,15	18,78
SB30	46,68	0,53	11,32	4,36	0,10	1,60	16,56	0,62	1,75	0,28	16,20
SB31	46,75	0,56	11,70	4,90	0,08	2,06	16,29	0,67	1,76	0,21	15,02
SB32	44,63	0,54	11,00	4,73	0,10	1,61	17,43	0,67	1,63	0,32	17,34
SB33	45,82	0,56	11,90	4,84	0,07	1,82	15,15	0,83	1,74	0,28	16,98
SB34	42,21	0,48	10,28	3,95	0,08	1,37	18,54	0,64	1,51	0,17	20,77
$\bar{x}$	46,89	0,60	12,08	5,32	0,08	2,04	17,59	0,82	1,80	0,29	12,50
σ	2,98	0,07	1,21	0,82	0,01	0,54	1,92	0,21	0,21	0,07	4,94
t	1,3440	1,7797	**2,7526**	**2,4767**	**3,0159**	**6,6801**	1,4446	0,0669	**2,5165**	**6,2585**	**2,4313**
p-value	0,1884	0,0846	**0,0097**	**0,0187**	**0,0050**	**0,0000**	0,1583	0,9470	**0,0171**	**0,0000**	**0,0208**
CS01	62,03	0,67	16,94	5,92	0,13	1,29	1,20	1,23	2,35	0,08	8,16

TABLE 4 [cont.]

Samples	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI
CS02	58,44	0,68	17,05	6,02	0,14	1,41	0,98	1,80	2,64	0,18	10,66
CS03	60,61	0,69	17,85	6,23	0,10	1,58	0,99	2,01	2,70	0,07	7,17
CS05	58,54	0,72	16,94	6,24	0,12	1,56	2,77	1,70	2,61	0,17	8,63
CS06	59,04	0,59	16,59	5,94	0,09	1,46	0,98	1,75	2,45	0,14	10,97
CS07	56,39	0,63	16,02	5,68	0,11	1,49	3,19	1,66	2,37	0,11	12,35
CS08	57,18	0,53	13,79	5,15	0,09	0,99	5,84	0,98	2,01	0,10	13,34
CS09	56,17	0,73	16,65	6,29	0,14	1,32	3,12	1,61	2,31	0,11	11,55
CS10	60,24	0,68	17,25	5,70	0,12	1,71	2,64	1,57	2,20	0,07	7,82
$\bar{x}$	58,74	0,66	16,56	5,91	0,12	1,42	2,41	1,59	2,40	0,11	10,07
σ	1,98	0,06	1,15	0,36	0,02	0,21	1,61	0,31	0,22	0,04	2,19
CS11	47,68	0,44	10,18	4,01	0,06	3,30	14,77	1,61	1,89	0,23	15,83
CS12	44,50	0,57	12,33	5,18	0,08	4,21	12,57	1,27	1,86	0,19	17,22
CS13	43,83	0,61	12,66	5,37	0,08	2,19	15,60	0,69	1,72	0,21	17,04
CS14	44,01	0,44	9,62	3,95	0,06	2,23	17,70	1,31	1,73	0,13	18,82
CS15	43,87	0,47	10,47	4,26	0,07	2,04	17,02	1,37	1,74	0,37	18,32
CS16	43,83	0,54	11,19	4,57	0,09	2,07	17,10	1,01	1,79	0,23	17,58
CS17	47,56	0,49	10,71	4,34	0,06	3,78	13,13	1,82	1,81	0,09	16,20
CS18	55,80	0,49	10,16	3,88	0,05	2,53	7,78	1,74	1,84	0,07	15,66
CS19	44,84	0,47	11,00	4,30	0,06	3,42	15,46	1,63	1,71	0,25	16,86
CS20	42,86	0,45	9,97	4,14	0,06	2,88	17,91	1,52	1,72	0,15	18,34
$\bar{x}$	45,88	0,50	10,83	4,40	0,07	2,86	14,90	1,40	1,78	0,19	17,19
σ	3,84	0,06	1,00	0,51	0,01	0,78	3,10	0,35	0,07	0,09	1,09
t	**9,0145**	**5,7183**	**11,620**	**7,4506**	**6,6310**	**5,3830**	**10,840**	1,2687	**8,4638**	**2,4328**	**9,1073**
p-value	**0,0000**	**0,0000**	**0,0000**	**0,0000**	**0,0000**	**0,0000**	**0,0000**	0,2216	**0,0000**	**0,0263**	**0,0000**

Student *t*-test between the two archaeological classes of each site; in bold: significant at level of probability ≤0,03.

TABLE 5

Trace elements (*ppm*) of pottery samples by XRF analysis.

Samples	Ba	Rb	Sr	Y	Zr	Nb	V	Cr	Ni	La	Ce
SB01	647	166	126	22	243	24	108	83	53	59	120
SB02	477	132	101	7	138	15	105	84	56	42	86
SB03	598	174	131	23	262	29	113	82	53	61	124
SB04	590	126	103	12	177	17	81	62	46	44	95
SB05	663	138	137	23	196	18	95	77	51	64	118
SB06	523	159	133	25	275	29	121	85	53	68	140
SB07	267	73	123	6	66	5	78	66	33	20	37
SB08	634	145	135	26	257	26	96	82	52	62	125
SB09	579	157	157	21	245	25	108	79	53	59	122
SB10	499	142	230	23	230	21	117	103	57	62	116
SB11	771	148	392	32	296	31	155	134	69	80	156
SB12	733	145	149	16	211	21	83	82	49	44	96

TABLE 5 [cont.]

Samples	Ba	Rb	Sr	Y	Zr	Nb	V	Cr	Ni	La	Ce
SB13	401	144	150	34	258	23	102	125	58	58	103
SB14	611	160	215	38	271	24	124	126	61	61	120
SB15	663	236	416	29	344	28	126	137	83	61	133
SB16	673	225	314	26	362	39	81	83	37	57	140
SB17	877	272	179	33	402	45	131	150	101	71	148
$\bar{x}$	600	161	188	23	249	25	107	96	57	57	116
σ	142	46	97	9	81	9	21	27	16	13	28
SB18	402	86	257	19	150	11	106	106	64	30	59
SB19	478	113	278	22	141	11	111	115	53	37	70
SB20	392	118	269	19	132	11	113	116	53	35	64
SB21	460	115	249	19	139	11	143	110	49	33	64
SB22	361	117	258	21	137	12	123	119	51	38	63
SB23	288	120	233	19	144	10	103	90	43	33	56
SB24	301	109	331	23	143	12	91	117	59	35	67
SB25	337	123	322	19	139	11	93	126	78	35	65
SB26	369	110	210	13	115	9	98	103	47	33	67
SB27	403	108	270	19	133	10	126	104	43	31	66
SB28	336	98	214	14	116	8	74	82	33	26	45
SB29	594	138	261	19	126	11	92	109	40	28	52
SB30	327	125	236	20	158	11	85	101	40	31	51
SB31	457	121	342	22	153	11	92	113	50	29	50
SB32	689	127	305	13	133	10	106	137	63	43	70
SB33	336	107	263	16	130	10	76	119	53	29	56
SB34	358	102	250	17	132	9	83	84	34	29	48
$\bar{x}$	405	114	268	18	137	10	101	109	50	33	60
σ	105	12	38	3	12	1	18	14	11	4	8
t	**4,5542**	**4,0990**	**3,1601**	**2,1059**	**5,6624**	**7,1526**	0,9555	1,6750	1,3997	**7,1431**	**8,0735**
p-value	**0,0001**	**0,0003**	**0,0034**	**0,0431**	**0,0000**	**0,0000**	0,3465	0,1037	0,1712	**0,0000**	**0,0000**
CS01	379	134	178	32	322	36	92	87	38	67	149
CS02	743	146	199	32	296	32	100	85	39	70	131
CS03	489	144	177	30	313	33	93	80	38	72	136
CS05	812	149	264	38	318	31	97	87	41	69	136
CS06	427	146	181	29	278	29	92	81	38	68	126
CS07	625	139	199	28	281	29	86	76	38	71	130
CS08	508	137	160	28	239	20	91	85	37	70	125
CS09	549	140	158	33	312	30	106	96	47	62	140
CS10	488	163	163	40	350	33	89	83	38	82	154
$\bar{x}$	558	144	187	32	301	30	94	84	39	70	136
σ	143	9	33	4	32	4	6	6	3	5	10
CS11	470	134	255	18	148	9	67	66	34	31	57
CS12	375	146	281	21	163	14	100	93	41	41	76
CS13	302	110	252	18	119	10	101	101	43	30	55
CS14	451	91	275	16	135	8	71	74	34	29	50

TABLE 5 [cont.]

Samples	Ba	Rb	Sr	Y	Zr	Nb	V	Cr	Ni	La	Ce
CS15	443	98	293	19	138	8	74	83	35	30	62
CS16	468	102	291	20	136	9	81	89	42	28	57
CS17	313	86	277	20	141	8	76	60	37	32	60
CS18	445	78	166	10	115	7	63	60	34	26	50
CS19	405	87	279	19	140	9	79	87	35	33	57
CS20	362	90	277	19	142	9	74	74	35	30	60
$\bar{x}$	403	102	265	18	138	9	79	79	37	31	58
σ	62	22	37	3	14	2	13	14	4	4	7
t	**3,0990**	**5,3644**	**4,8382**	**8,3511**	**14,765**	**13,719**	**3,3068**	1,1379	1,5111	**18,175**	**19,575**
p-value	**0,0065**	**0,0001**	**0,0002**	**0,0000**	**0,0000**	**0,0000**	**0,0042**	0,2710	0,1491	**0,0000**	**0,0000**

Student *t*-test between the two archaeological classes of each site; in bold: significant at level of probability ≤0.04.

4. Discussion

Archaeometric data (for other analyses from some Neolithic sites in central Apulia see Muntoni, 2003; Laviano and Muntoni, in press) suggest the use of the same non-calcareous clay for black household pots made at Santa Barbara and Cala Scizzo. Only in Santa Barbara village potters probably added, as tempering material, large onyx marble clasts. "Terre rosse", silty-clayey continental sedimentary deposits very poor in carbonate (Dell'Anna et al., 1973; Scalese et al., 2001), largely outcrop on the Murge plateau, could be then used for pottery production in both the archaeological sites. Variations in accessory minerals frequency are due to locally different setting of "terre rosse". On the other hand the "Argille subappennine" (Rutigliano deposits: Moresi, 1990) marly clays outcropping not far away from the two considered sites (ca. 7 km south of Cala Scizzo and ca. 15 km west of Santa Barbara), consist with the sheet silicate clay matrix of fine painted samples from Santa Barbara and plain household pottery from Cala Scizzo. Mineralogical and chemical data show that all samples were fired at a temperature not exceeding 600-800°C; only some fine painted pottery samples (SB18÷27) from Santa Barbara were fired at a higher temperature (in a range of 850°-1050°C).

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