

A MULTI ANALYTICAL APPROACH FOR THE CHARACTERIZATION OF THE CERAMIC FINDINGS FROM THE AIANO-TORRACCIA DI CHIUSI (SIENA-ITALY) ARCHAEOLOGICAL SITE.

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In the archaeological site of Aiano-Torraccia di Chiusi (Siena-Italy) the remains of a Roman *Villa*, dated from the beginning of 4th century to the end of the 5th century or the beginning of the 6th A.D., were discovered. The complex, abandoned in the 6th century A.D. was occupied by a group of barbaric artisans (Lombards or Ostrogoths) in the period between the 6th and the 7th century A.D. Numerous ceramic findings (*simil africanae*, *ingobbiata*, *acrome grezze*) dated back to 5- 7th century were discovered in the archaeological site. These findings were analyzed using different analytical methodologies (OM, XRD, XRF, SEM-EDS, ATR FTIR and micro-Raman) in order to characterize the paste and the cover of the *ingobbiata* (INGR) and *simil africanae* (TCC), the paste and the tempera of the *acrome grezze* (AG) and to determine the compositional relationship among different kinds of ceramics.



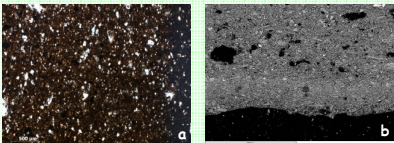
Aerial photograph of the valley of Torrente Foci placed in the border among Poggibonsi, Colle di Val d'Elsa and San Gimignano (Siena).



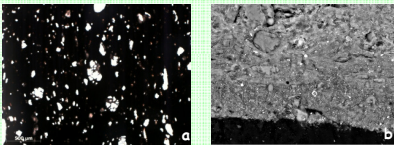
Aerial photograph of the Roman Villa (summer 2009).

THE RED COVERED CERAMICS

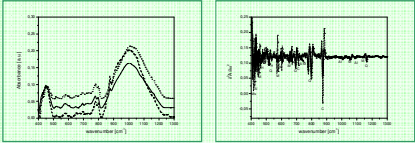
Red covered ceramics represents an imitation, often on a regional basis, of the late African Red Slip ware, already starting from the 2nd-4th century A.D. until the 7th century A.D. In particular, from the 7th century A.D. the typologies produced in Tuscany start a process of transformation that will give, after a progressive diversification from the typologies attested in other parts of Italy, specific and autonomous characters during the 7th century A.D..



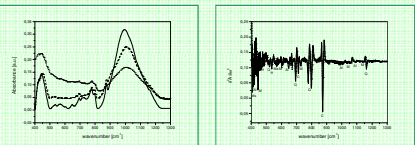
a) Thin section (nicols //, 5 X) and b) SEM image of INGR 27 sample.



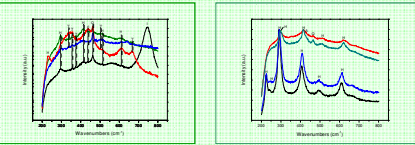
a) Thin section (nicols //, 5 X) and b) SEM image of TCC2136 sample.



Infrared spectra of the ceramic paste of 3 samples of INGR. a) absorption spectrum; b) second derivative profile. Al, albite; C, calcite; H, hematite; M, microcline; Q, quartz; Ms, muscovite.



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Raman spectra of four different points on the red covering of sample INGR 27. H = hematite, $\epsilon = \epsilon\text{-Fe}_2\text{O}_3$, $\gamma = \gamma\text{-Fe}_2\text{O}_3$, Q = quartz, I = illite.

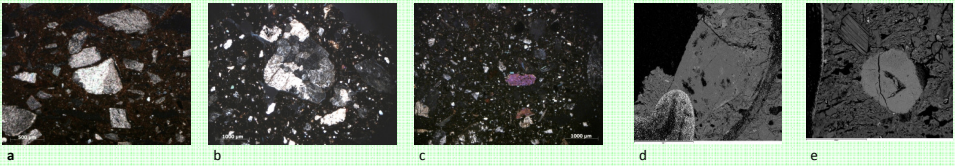
	Na2O	K2O	Al2O3	SiO2	B2O3	CaO	FeO	SO3	Sum
INGR 14 (paste)	0.0460	0.0464	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467
INGR 14 (paste)	0.0460	0.0464	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467
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INGR 14 (paste)	0.0460	0.0464	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467
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INGR 14 (paste)	0.0460	0.0464	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467
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INGR 14 (paste)	0.0460	0.0464	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467	0.0467
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Microchemical analyses (SEM- EDS) of the covering (*ingobbio*) and ceramic pastes. The measures are obtained as mean of 3 measured areas.

For the characterization of red covered ceramics the use of chemical or mineralogical techniques for the bulk are not very useful, because the data obtained on the powders show the mean composition of the samples, without any difference between paste and covering. The micro chemical and mineralogical analyses, such as FTIR, SEM-EDS and micro-Raman performed on small samples' fragments allow to discriminate the composition and texture of paste and covering. The red covered ceramics are clearly subdivided in two groups: **Samples TCC** were fired at a temperature >900°C, probably imported. The temper, observed with OM and SEM-EDS, is constituted by sorted and rounded quartz fragments (frequently found in African territory), besides the covering is characterized by a significant Fe-enrichment. **Samples INGR** that do not show clear chemical and mineralogical difference between *ingobbio* and paste (comparing SEM- EDS and ATR FTIR data), while the most relevant difference is linked to the grain size, that is small in the covering with respect to the paste. The covering seems to be obtained using well sorted clayey raw material. This ceramic has been produced using low firing temperatures. The *ingobbio* of the INGR samples contains the same constituents of the ceramic paste, with a small difference in the intensity of the peak of hematite (FTIR analyses).

THE ACROME GREZZE

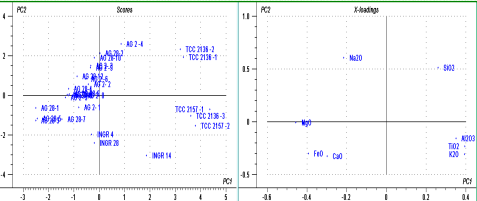
This kind of ceramic findings shows a complete summary of typologies, with a dowry constituted by olle, bowl-lids, casseroles, lids, jugs, small jugs, dated back to the second half of the 5th- end of the 6th century A.D. The *acrome grezze* were analyzed through XRD, OM, performed on the bulk and SEM-EDS on the temper and paste. These ceramics were realized re-employing the material coming from the mosaic *tesserae* of the Roman *Villa* (white and yellow marbles, *Lapis Laecedaemonius*, *Lapis porphyrites*, *Portasanta*, *Greco scritto*).



Thin sections images (nicols //):
(a) sample AG 4 realized with temper constituted only by calcite with a typical bimodal grain size distribution (5X);
(b) sample AG 4 realized with temper constituted by marble fragments, pyroxenes and plagioclases (2.5X);
(c) sample AG 34 realized with temper constituted by pyroxenes, plagioclases and micas (2.5X).
SEM images:
(d) sample AG 23: particular of an altered albitic plagioclase
(e) sample AG7: particular of a marble fragment and of a pyroxene.

STATISTICAL COMPARISON AMONG ACROME GREZZE - SIMIL AFRICANE - INGObBIATE DI ROSSO

The comparison among the analyses of red covered ceramic's paste has been performed with the areal data (investigated area 20X30 micron) obtained by SEM-EDS. A statistical approach was tried in order to emphasize the difference among the pastes.



The PC1 and PC2 supply the 94% of information of the samples variability. The graph of scores, compared to the loadings ones represents the variables in the new space formed by the principal component and reveals that samples' grouping along the first principal component is mainly due to the relative content in SiO₂, Al₂O₃, TiO₂, K₂O, while the second one is characterized by the Na₂O and SiO₂ content. From this comparison it's clear that the TCC ceramic findings are obtained using different raw material with respect to AG and INGR samples. Otherwise at the present moment it's not evident an unmistakable differentiation between AG and INGR samples.