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Classification and provenance of soapstones and garnet chlorite schist artifacts from Medieval sites of Tuscany (Central Italy): insights into the Tyrrhenian and Adriatic trade

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ABSTRACT

Soapstones (talc-bearing schists) and garnet chlorite schist artifacts found in Medieval archaeological sites of Tuscany (Central Italy) were classified, in order to define provenance of the different lithotypes. In Italy and throughout the Central Europe, these greenschist facies metamorphic rocks are generally known, among the archaeologists, as the *pietra ollare* from the Alps. The investigated Tuscan archaeological sites are between 6 and 13th century AD and were strictly linked, in that period, to the well defined network trade running along Tyrrhenian coast. Samples come from little containers used for cooking and preserving food and showing traces of lathe manufacturing at their sidewalls. According to modal mineralogy, petrographic texture, XRD, SEM-EDS and whole rock chemistry we recognised, among the 18 studied findings, three different petrographic groups of the Alpine *pietra ollare*. (i) Fine grained magnesite talc schists (i.e. soapstones) from outcrops of the Central Alps located in the Valchiavenna area. (ii) Garnet chlorite schists from the Valle d'Aosta region. (iii) Amphibole talc schists (i.e. soapstones) with a provenance in the Ticino area. It is worth noting that artifacts of *pietra ollare* lithotypes from the Western Alps (i.e. garnet chlorite schists and amphibole talc schists) were not detected in the archaeological sites of the Middle Adriatic coast of the Central Italy, belonging to the same Medieval time interval. This emphasises that the petrographic groups of *pietra ollare* from the Alps spread to the south of the Po Plain according to Western and Eastern trade along the Italian Peninsula, using respectively, the Tyrrhenian and the Adriatic Sea commercial routes.

1. Introduction

The Italian term *pietra ollare* (from the Latin *olla*, i.e. container) is normally used by the European archaeologists for artifacts of basic and ultrabasic metamorphic rocks, mostly belonging to the greenschist facies. All of the rocks referred to as *pietra ollare* are geologically linked to the Apennine-Alpine ophiolite axis which spread out for a long distance from Liguria (Italy) to the Stiria (Austria; Dietrich, 1980). These metamorphic rocks were highly prized for the production of pots and food containers because well workable (related to the presence of talc) and their resistance to fire (Antonelli et al., 2006). One of the most common lithotypes of Alpine *pietra ollare* is grey to pale-green, coarse to fine grained rocks consisting of talc, chlorite and carbonate minerals (mostly magnesite) cropping out in the Central and Western Alps (Mannoni et al., 1987). These magnesite-bearing talc schists are soapstones, usually derived from carbonate-free ultramafic rocks by interaction with an externally derived CO_2–H_2O fluid phase (Bucher and Frey, 2002). In fact, serpentinites represent the usual hydrated low-temperature alteration of mantle peridotites (lherzolites or harzburgites), but small amounts of CO_2 in the fluids are sufficient to convert serpentine assemblages into carbonate-bearing rocks. According to Bucher and Frey (2002) the three major types of carbonate-bearing ultramafic rocks are: ophimagnesites (antigorite + magnesite), soapstones (talc + magnesite) and sagvandites (enstatite + magnesite). The term soapstone (synonymous: steatite) is however commonly used for any talc-bearing schist. *Pietra ollare* groups soft grey-coloured (soapstones) and harder green-coloured lithotypes (chlorite schists, serpentine schists and amphibole schists) both very widespread among the artifacts of the archaeological sites throughout Italy and Central Europe. A useful mineralogical data-base of the different

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metamorphic rocks known as *pietra ollare* and cropping out in the Alps, is represented by the 11 petrographic groups (Table 1) recognised by Mannoni et al. (1987). The Central Alps quarries of Valchiavenna and Valmalenco (magnesite talc schists and chlorite schists), those of the Valle d'Aosta (garnet chlorite schists) and the Ticino Valley (various types of schists) in the Western Alps, were the most exploited sources in the whole Medieval period (Table 1; Mannoni et al., 1987). The use of the green-coloured *pietra ollare* is documented from the pre-Roman Period (Mannoni et al., 1987). The grey-coloured soapstones coming from Valchiavenna started to be used in the 1st century AD (Bolla, 1991). Valle d'Aosta green lithologies (garnet chlorite schists) became very widespread starting in the 4th century AD (Mollo Mezzena, 1987) with artifacts largely distributed around the outcropping areas of the Western Alps (Piemonte, Liguria and Provence). The use of the green-coloured *pietra ollare* gradually decreased with time in the Middle Age whereas the use of grey-coloured rocks (i.e. soapstones) increased (Lusuardi Siena and Sannazaro, 1987). This seems to be confirmed by recent findings of *pietra ollare* from Medieval archaeological strata of additional excavations in Pisa (works are still in progress) where the proportion of grey-coloured lithotypes strongly increase with time.

Provenance of *pietra ollare* from Alpine quarries and production centres was established for numerous findings in Roman and Middle Age archaeological sites of (i) Northern Italy (Mannoni and Messiga, 1980; Mannoni, 1986; Mannoni et al., 1987; Alberti, 1997; Bonazza et al., 1999; Malaguti and Zane, 1999) and (ii) Adriatic regions of the Central-Southern Italy (Mannoni, 1986; Alberti, 1997; Santi et al., 2005). No comparable detailed mineralogical, petrographic and geochemical data exist for the *pietra ollare* artifacts found in Medieval (6–13th century AD) archaeological sites of Tuscany. In this work we present a petrographic classification and relative provenance of 18 *pietra ollare* fragments coming from archaeological excavations located in the provinces of Pisa and Livorno and the cities of Pisa and Florence (Fig. 1). Although the most useful parameter to unravel source areas of the *pietra ollare* groups is the modal mineralogy, we also compared the whole rock chemical data of the Tuscan findings with the available literature data of the Alpine outcrops such as those of the Valle d'Aosta (Mugnaini, 1995), Valmalenco (Bonazza et al., 1999), and Valchiavenna (Santi et al., 2005). Due to the chemical heterogeneity of the single quarries, statistical processing of the whole rock chemical data was not carried out. Whole rock chemical comparisons will be used to support a provenance however well constrained by modal mineralogy and texture. These new mineralogical, petrographic and whole rock chemical data will be finally compared with the available provenances of the *pietra ollare* artifacts from other archaeological sites of Central Italy, in particular of those concerning Medieval findings of the same time interval found in the regions of the Middle Adriatic coast (Marche and Abruzzo; Fig. 1). A framework of the *pietra ollare* trade networks during the Middle Age for the Central Italian regions will be finally outlined.

2. Exploitation technology and trade of the *pietra ollare* in antiquity

The Alpine *pietra ollare* lithotypes were exploited since the prehistoric age and widely used from the Roman Empire to the entire Middle Age when the artifacts became very widespread throughout Italy and Central Europe (Mannoni and Messiga, 1980; Mannoni et al., 1987). The most ancient recorded artifacts as oil lamps and crucibles, dating back to the Iron Age, come from some valleys of the Central Alps (Mannoni and Messiga, 1980) in areas located very close to the outcrops. The production of small artifacts (containers for cooking and preserving food) with a local network distribution, continued until the 1st century AD. Manufacturing of the *pietra ollare* using the lathe is known since the Iron Age. The introduction of big hydraulic lathes in the 4th century AD could have produced enough *pietra ollare* to reach areas outside the production zones (extra-regional trade). According to historic documents (e.g. *Naturalis Historiae*, Pliny the Elder, 1st century AD; *Enciclopédie*, Diderot, 1782) the use of *pietra ollare* for making artifacts in the Alpine valleys persisted for almost 18 centuries. The production of the *pietra ollare* containers attained a peak during the 5–7th century AD as shown by findings in archaeological sites of Italy, Switzerland, France, Austria and Germany (Mannoni and Messiga, 1980).

Two type of excavations for *pietra ollare* were generally recognised, correlated with the nature of raw material outcrops: (i) surface exploitation working erratic blocks transported along fluvial or glacial valleys, far from the primary outcrops; (ii) opencast quarries and underground galleries developed in lenses or veins (Donati, 1986a). The exploitation of the *pietra ollare* in the Alps removed entire outcrops leaving relatively few traces behind. Numerous traces of "drillings" tests are represented by 20–25 cm long (the average height necessary to make an artefact using the lathe) holes which were made on the surface of the *pietra ollare* outcrops to detect the rock suitability (Donati, 1986a). In some Alpine artifacts, Mannoni (1986 and reference therein) and Donati (1986b) recognised four different production techniques on the

Table 1
Summary on the macroscopic colour, modal mineralogy, classification, petrographic groups and provenance of the different *pietra ollare* lithotypes from the Alps (according to Mannoni et al., 1987).

Macroscopic colour	Modal mineralogy	Classification	Petrographic groups	Alpine Provenance
Light grey-green	Talc, carbonates (magnesite), chlorite, opaques	Magnesite talc schists	C (coarse grained) D (fine grained)	Valtellina, Valbregaglia, Valchiavenna
Light grey-green	Talc, carbonates, chlorite, amphibole, opaques	Amphibole talc schists	B (coarse grained) E (fine grained)	Ticino and Toce Valleys
Green	Chlorite, epidote, garnet, chloritoid, opaques ± talc	Chlorite schists	F (fine grained) G (coarse grained)	Valle d'Aosta, Valtellina, Valmalenco, Val di Lanzo (F)
Light green	Serpentine, chlorite, talc, opaques ± carbonates ± olivine	Serpentine schists	A	Ticino and Toce Valleys
Dark green	Pyroxene, amphibole, talc ± olivine ± mica ± plagioclase	Meta-gabbros	H	Ticino and Toce Valleys (H)
Dark green-grey	Amphibole, chlorite, opaques ± talc ± mica ± quartz ± epidote	Amphibole schists	I	Ticino Valley
Grey-white	Olivine, talc, chlorite, opaques ± carbonates ± serpentine	Olivine schists	K	Ticino Valley
Green	Chlorite, epidote, opaques +/-; albite ± mica ± quartz	Prasinites	L	Rare outcrops