

# Magnetic sourcing of obsidians from a Neolithic site in Northern Italy

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The distribution of ancient obsidian utensils is one of the few ways to trace trades during the Neolithic. Such material is suitable for provenance investigations due to the rarity of volcanic sources where magmatic rocks solidify as amorphous. Although obsidian provenance investigations base on chemical analysis, also chemical-physical properties revealed efficacious to relate tool fragments and geological deposits and during the last decades several studies have demonstrated that magnetic properties are useful too [1]. In the amorphous matrix, crystal grains have different compositions, distributions, and diameter dimensions. Some contain iron and their magnetic behaviour can be studied to highlight differences in distribution and size of ferrous particles through the associated magnetic state.

The properties of 20 obsidian artefacts found in the Neolithic site of Via Guidorossi (Parma, Italy) have been investigated [2]. Magnetic grain-size analyses were performed including the measurement of susceptibility ( $\chi$ ), anhysteretic susceptibility ( $\chi_a$ ), and saturation isothermal remanent magnetizations at room ( $SIRM_{293}$ ), and liquid nitrogen ( $SIRM_{77}$ ) temperatures. The measurement of SIRM at two temperatures allowed to estimate the amount of smaller grains ferromagnetic at low temperature, superparamagnetic at room temperature.  $SIRM_{77}$  revealed fundamental for provenance as the ratios  $St = SIRM_{77}/SIRM_{293}$  and  $Q_a = \chi_a/\chi$  discriminate samples from most Mediterranean sites [3]. Furthermore, the anisotropy degree of susceptibility,  $P$ , revealed useful to discriminate obsidians coming from Lipari and Sardinia–SA. Comparing magnetic properties of the artefacts with geological samples from outcrops in the Mediterranean suggests they come from Lipari. Moreover, SEM-EDS microanalyses were also performed on geological samples. Inclusions were mapped to relate the magnetic behaviours to the morphology of the iron-oxide particles. Obsidian from Lipari is characterized by relatively abundant and uniformly dispersed grains with diameter  $d < 10 \mu\text{m}$ , while samples from Sardinia–SA show less abundant crystallites with  $d$  values up to  $100 \mu\text{m}$ .

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[3] E. Zanella, E. Ferrara, L. Bagnasco, A. Ollà, R. Lanza, C. Beatrice, *Magnetite grain size analysis and sourcing of Mediterranean obsidians*, *Journal of Archaeological Science*, 39 (5), 1493–1498, 2012