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Magnetite grain-size and sourcing of archaeological obsidians

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McDougall et al. (1983) first suggested that magnetic propertiers could be an effective alternative to chemical analyses in tracing the sources of obsidian prehistoric artefacts within a geographic region. Eventual investigations have shown that the values of various magnetic parameters may vary from one source to another, however results from different sites often overlap because of the wide within-source dispersion. In our study, attention focussed on the relative grain-size distribution of the magnetite grains over geological specimens sampled in neolithic obsidian sources of Mediterranean Sea: Lipari, Palmarola, Pantelleria, Milos.

Hysteresis cycles run at liquid nitrogen and room temperature showed variable contributions of superparamagnetic (SP) grains. The saturation isothermal remanent magnetization (SIRM) was therefore measured at both temperatures on all specimens, and the ratio ST = SIRM77/SIRM298 was used to estimate the relative abundance of SP to SD+MD grains. Anhysteretic remanent magnetization (ARM) and low field susceptibility were measured to calculate the ratio of the anhysteretic to the low-field susceptibility, Qa = χARM/χ, which is a sensitive grain-size indicator giving an estimate of the relative abundance of SD to MD grains.

The King plot (King et al. 1982) shows that the Qa value, and thus the SD relative content, varies slightly at each individual site and increases from Pantelleria to Lipari, Palmarola, and Milos. The value of the ST ratio is close to 1 at Milos and up to 4.3 at Lipari, which is the site with the highest content of SP grains. The data from individual sites plotted in the Qa vs. ST diagram fall in distinct, not overlapping areas. These results suggest that the grain-size analysis by magnetic parameters is a promising approach in sourcing obsidian archaeological artefacts. Moreover, the measurements of the four quantities used in the King and Qa vs. ST plots are simple, quick and feasible on very small specimens, with little damage to archaeological findings.

References

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