Source Analysis and the Socioeconomic Role of Obsidian Trade in Northern Italy: New Data from the Middle Neolithic Site of Gaione

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Introduction

While geochemical fingerprinting of obsidian sources was first applied in the Mediterranean region nearly four decades ago (Cann & Renfrew 1964), a detailed understanding of the sequence of behaviors responsible for the acquisition, transport, manufacture, and use of obsidian was limited due to incomplete documentation of the obsidian sources and, until recently, the small number of artifacts analyzed from datable archaeological contexts (Tykot & Ammerman 1997). Whereas earlier provenance studies in Italy (e.g. Hallam *et al.* 1976, Bigazzi & Radi 1996) usually attributed obsidian artifacts to one of four island sources - Lipari, Palmarola, Pantelleria or Sardinia - recent field investigations and laboratory analysis have located and characterized discrete subsources on each island (Francaviglia 1986, Tykot 1996, 2002a, nd). At the same time, the development of non- or minimally destructive, and less-expensive analytical techniques has permitted the analysis of significant numbers of artifacts so that statistically meaningful patterns of obsidian source utilization may be determined. In this study, the precise geological provenance was determined for nearly the entire assemblage of obsidian artifacts recovered from the Middle Neolithic site of Gaione in northern Italy. The results for Gaione are compared with those available for other Middle Neolithic sites, and differences in source utilization are interpreted in terms of geographic location, transport methods, exchange mechanisms, and sociocultural factors.

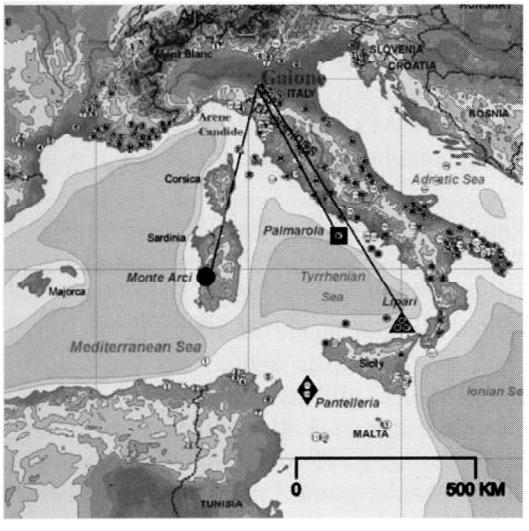

Figure 1 Map showing Gaione in northern Italy and the central Mediterranean obsidian sources.

The Gaione Site

Gaione (Catena) is an open-air settlement located about 6 km south of Parma (Fig. 1; Bernabò Brea *et al.* 1990). It is positioned in one of the major river valleys flowing into the Apennines, which may have served as a gateway between the Tyrrhenian coast and the Po Plain.

An initial surface collection at the site in 1987 by A. Ghiretti and S. Evans, under the direction of M. Bernabò Brea, yielded 99 pieces of obsidian, the most of any other site in northern Italy after Pescale (Modena) and Peep (Faenza). An additional 21 pieces were obtained in the course of excavations in

1995, and it has been estimated that 2000 pieces may exist in the plow-zone alone. Nevertheless, the obsidian artifacts recovered at Gaione are very small, with the entire assemblage weighing well under 100 grams. The collection consists primarily of blades and flakes, with the largest pieces, weighing up to 5 grams, identified as exhausted cores. Obsidian is only a small percentage of the lithic assemblage at Gaione, and along with the presence of high-quality flints, rock crystal, steatite, and ground stone axes attests to the participation of Gaione in regional and long-distance exchange networks. The presence of a necropolis at the site suggests that exchange may have taken place within socio-religious as well as economic contexts. Abundant ceramic remains date the site to the middle phase of the Square-Mouthed Pottery Culture (Middle Neolithic, ca. 5th millennium BC).

Source Analysis

In an earlier study using neutron activation analysis, Ammerman *et al.* (1990) reported that obsidian from Sardinia, Lipari and Palmarola was present among the 17 analyzed artifacts from Gaione. At the time this was the most samples analyzed from a single site in northern Italy, and the presence of obsidian from three island sources at a single site was also rare. We report here on the analysis of all but nine of the remaining 103 artifacts recovered from this important site, and reinterpret the original 17 attributions in light of the more detailed source information now available.

Physical characteristics, including density, transparency and luster are useful for identifying the source of central Mediterranean obsidian artifacts (Tykot nd, Tykot & Ammerman 1997). Lipari, Sardinia A and Sardinia B have low density and high transparency and luster; Palmarola and Sardinia C have higher density and low transparency; and the peralkaline Pantellerian obsidian has very high density and is green in transmitted light. Lipari can often be distinguished from the Sardinian obsidian by a close examination of color shades and the presence or absence of microlite and spherulite crystals.

In this study, 52 of 94 Gaione artifacts were definitively assigned a specific provenance based on their physical attributes alone; all 52 were blades and flakes clearly of Lipari obsidian. Chemical analysis was performed on the remaining artifacts for which we were less certain. For those 42 artifacts, the elemental results show that we were still correct more than 75% of the time based on visual characteristics and density measurements. It should be pointed out that even higher success rates would have been possible if the artifacts were not so small, as it is difficult to obtain precise density measurements and visual assessments on artifacts which weigh only a few tenths of a gram.

Laser-ablation ICP-MS was selected to analyze the Gaione artifacts because it provides quantitative results for a large number of trace elements in a virtually non-destructive manner (Tykot & Young 1996, Gratuze 1999). The 42 artifacts were analyzed at the Archaeometry Laboratory at MURR using a Thermo-Elemental Axiom high-resolution magnetic-sector ICP-MS coupled to a Merchantek Nd-YAG laser-ablation unit. The laser was scanned across a rectangular raster pattern of about 4 mm^2, with data acquisition beginning on the second pass.

The results obtained were calibrated against NIST standard reference glass wafers and also against obsidian standards, and then normalized to 100% by converting the relative concentrations to oxides. A simple bivariate plot of Ca vs. Mn is sufficient to distinguish among the Mediterranean obsidian sources (Fig. 2), although this is confirmed by using several plots with different elements, as well as by multivariate discriminant function analysis.

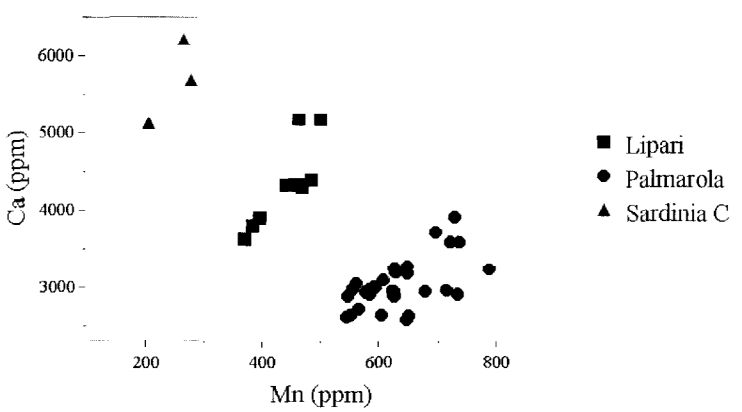

Figure 2 LA-ICP-MS data for Ca and Mn (in ppm) for Gaione obsidian artifacts.

Discussion

Of the 94 artifacts examined in this study, 62 were assigned to Lipari, 29 to Palmarola, and 3 to Sardinia C (Table 1). In the earlier NAA study of 17 artifacts (Ammerman *et al.* 1990), Palmarola was not nearly so well represented, and this illustrates the difficulty of determining obsidian distribution patterns without a statistically representative set of samples. In fact, very few sites in Italy have had more than several artifacts analyzed, and it has generally been considered that sites in southern Italy and Sicily have almost exclusively Lipari obsidian, while sites in central and northern Italy have modest amounts of Sardinia and perhaps some Palmarola obsidian along with Lipari. In addition, the preliminary visual assessment made as part of the 1990 study attributed about 40% of 99 Gaione artifacts to Sardinia and only a few percent to Palmarola. More detailed knowledge of the Sardinian sources in particular and advances in visual-assessment criteria for all central Mediterranean sources account for the very different yet reliable results presented here (see also Tykot & Ammerman 1997).

Table 1 Obsidian source frequencies at Gaione.

Lipari	Palmarola	Sardinia C	Total	Reference
12 (70.6%)	2 (11.8%)	3 (17.6%)	17	Ammerman *et al.* 1990
62 (66.0%)	29 (30.9%)	3 (3.2%)	94	this study
74 (66.7%)	31 (27.9%)	6 (5.4%)	111	Total

In combination with the elemental analyses, these results are beginning to show that Palmarola obsidian was much more important in central and northern Italy than previously thought.

It had also been proposed that Lipari obsidian was traded primarily as finished blades, while obsidian from other sources was more likely to have been traded as cores and then reduced at its destination (Ammerman *et al.* 1990). Our measurements confirm that the blade tools from Lipari are bigger and heavier than from the other sources, despite their lower thickness, and do dominate the Lipari obsidian artifacts found at Gaione. Three cores of Lipari obsidian were also identified, however, suggesting that at least some of the Lipari obsidian was reduced at Gaione. This appears definitely to have been the case for the Palmarola obsidian examined, which includes five cores and five chunks as well as 19 blades and flakes.

Gaione may now be added to a growing number of individual sites with significant numbers of analyzed artifacts. The attribution of obsidian artifacts to specific Sardinian sources rather than just Monte Arci in general has revealed a similar pattern of usage from Sardinia to Corsica to Tuscany to Liguria, supporting the hypothesis of a down-the-line trade mechanism (Tykot 1996, 2002b,c, Tykot *et al.* 2002). Gaione, located in the Po Plain and far from the Tyrrhenian coast, appears to be part of a separate trade network. Obsidian from other sites in northern Italy is now being examined to see if it has similar patterns to Gaione.

In addition to the Sardinian (Monte Arci) sources, specific subsource attributions are possible for the other central Mediterranean islands, especially Pantelleria and Palmarola. For the latter, workable obsidian is mainly to be found in two locations, at Monte Tramontana in the north and Punta Vardella on the southeast tip of the tiny island, and chemical analysis of geological samples from Palmarola shows that distinctions may be made between Tramontana and two areas of Punta Vardella (Tykot *et al.* this volume). Discriminant function analysis of the LA-ICP-MS data for the Palmarola geological samples and the Gaione artifacts show that they appear to come mostly, if not entirely, from the Monte Tramontana source (Fig. 3). It is suggested that the exploitation of this subsource, which in contrast to Punta Vardella is near a protected landing area and part of the island where encampment was possible, would have been entirely consistent with other activities likely to have occurred on Palmarola and the other Pontine islands, including fishing and possibly bird-hunting.

Expeditions to Palmarola primarily for the purpose of obtaining obsidian likely would have resulted in a combination of the subsource groups represented at archaeological sites, in particular including the Punta Vardella subsource which has glassy and highly transparent obsidian.

Obsidian sourcing is not an end in itself. By analyzing large numbers of artifacts and attributing them to precise source locations, and in conjunction with technological and use-wear studies, we can reconstruct the actual mechanisms of exploitation and exchange used thousands of years ago, and the human behaviors which resulted in the transportation of small quantities of material over such great distances.

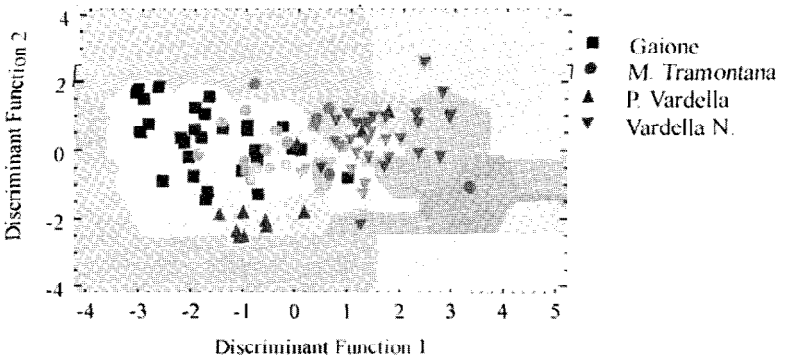

Figure 3 Discriminant function analysis of LA-ICP-MS data for Gaione artifacts and geological samples from Palmarola.

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