CMA4CH 2010, Mediterraneum Meeting

Application of Multivariate Analysis and Chemometry to Cultural Heritage and Environment
3rd ed., Taormina, Sicily island, Italy, Europe, 26-29 September 2010

The Obsidian Palmarola: Markers of Origin. A Example of Exploratory Data Analysis

A. Macchia[1], M. Malorgio[2], S.H. Plattner[1], M. Tiepolo[3], M. Ferretti[4], D. Ferro[1], L. Campanella[1], A. Zarattini[2]

[1]Sapienza, University of Rome, [2]Superintendence of Archaeological Heritage of Lazio, [3]Institute of Geosciences and Earth Resources, CNR Pavia, [4]National Research Council, Roma 1, Montelibretti, Italy

Abstract

This study represents the first phase of a broader study aimed at the reconstruction of the modes of procurement and circulation of obsidian from the geological sources and settlements in the Lazio region during the Neolithic. For several archaeological sites, included between the part from the SE part of Rome to the border with the Abruzzo, were collected a set of 86 objects: cores and tools. Some object (34) were selected to determine the geological area of origin of raw material through a multi-analytical approach. In particular, we sought to understand for what finds obsidian coming from the Pontine Palmarola island has been used, that one of the closer sources represent to the southern Latium.

For this purpose, non-destructive methods were used, as fluorescence X-ray energy dispersive (ED-XRF), scanning electron microscopy with energy dispersive microprobe (SEM-EDS), and a method of micro-destructive as laser ablation in combination with mass spectrometry inductively coupled plasma (LA-ICP-MS).

To identify the geological sources were considered in the literature databases and samples of obsidian Palmarola island. The study, although it is only the beginning, revealed new evidence for understanding the dynamics of spread during the late Neolithic and Copper Age in southern Lazio

Introduction

The study of provenance of obsidian was an important aspect of archaeological research for more than a quarter century and has reported an overview of the distribution of obsidian in the Mediterranean (Buchner 1949; Cann e Renfrew 1964; Hallam et al. 1976; Williams- Thorpe 1995; Bigazzi e Radi 1996; Tykot 1996).

The obsidian tools found in archaeological sites in Central and Western Mediterranean, which were analyzed, in most cases come from one of four sources in the Italian islands of Lipari, Palmarola, Pantelleria and Sardinia. Until recently, the deposits of the Central Mediterranean were not all fully documented and the number of artefacts actually tested for a certain area or time was limited.

This paper set out to understand what was the major source of supply of obsidian during prehistoric times in the territory of southern Latium.

In particular, research has focused on the island of Palmarola, the source closer to the coast of Latium to understand if it was actually used in the past for the creation of prehistoric tools. In the archaeological literature, this source is considered of poor quality and therefore poorly exploited.

Materials & Methods

Non-destructive methods were used, as fluorescence X-ray energy dispersive (ED-XRF), scanning electron microscopy with energy dispersive microprobe (SEM-EDS), and a method of micro-destructive as laser ablation in combination with mass spectrometry inductively coupled plasma (LA-ICP-MS) to study the chemical point of view 34 archaeological obsidian in order to identify similarities and differences for the possible geological sources of the four Palmarola Italian

Mediterranean islands, Sardinia, Lipari and Pantelleria. To understand the origin of our obsidian artifacts were considered Monte Tramontana 4 samples from one of the two flows of Palmarola and was necessary to consider also, the data provided in the literature.

Results

Regarding the archaeological provenance was possible to assign a degree in all samples, except for one sample, confirming what has already been highlighted by previous studies performed with X-ray fluorescence and LA-ICP-MS.

The SEM-EDXS can discriminate only part of the findings and in several cases the award is erroneous in view of the results of the other two techniques.

An assessment of the quality of data obtained by ED-XRF was possible through comparison with data acquired by LA-ICP-MS analysis. The relationship between the measured amount of some elements (Rb, Nb, Y, Th) with the two techniques is very close to one, confirming that despite the different characteristics of the two analytical techniques, it has a very satisfactory agreement which effectively attests to the increased effectiveness of these techniques compared to SEM-EDXS for characterization of obsidian in order to identify their areas of origin. In figure 1 it's reported the relation between Rb and Zr analyzed by LA-ICP-MS.

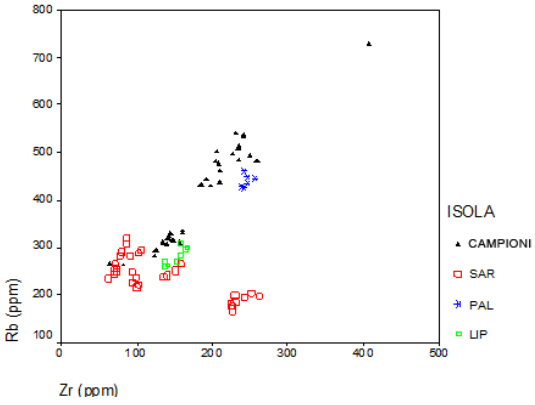

Fig.1, Archaeological finds distribution based on the elements Rb, Zr.

However, the literature seems to demonstrate that, also to the major elements, you can get more discrimination between different geological sources of obsidian. Should therefore be possible to extend further this part of the statistical data.

Conclusions

According to the chemical affinity between literature data and experimental results we can say that the obsidian derived from three of the four sources Italian Mediterranean: Sardinia, Lipari and Palmarola. Table 1 lists the findings according to geological sources.

Tabella 1 – List of finds according to the probable areas of origin, SAR - Sardegna, PAL - Palmarola, LIP - Lipari.

PAL	2	3	4	5	8	9	13	15	18	41	52	56	62	68	76	77	80	81	85
IP	6	7	10	11	12	14	16	26	28	35	37	65	86						
SAR	1	60																	

References

1) V. Francaviglia, Characterization of Mediterranean obsidian sources by classical petrochemical methods, *Preistoria Alpina*, 20, (1984) 311-332, ISSN 03930157

2) G. Bigazzi, M.Oddone, G. Radi, The Italian obsidian sources, *Archeometriai Muhely*, 1, (2005) 1-13

3) F.X. Le Bourdonnec, J.M. Bontempi, N. Marini, S. Mazet, P.F. Neuville, G. Poupeau, J. Sicurani, SEM-EDS characterization of western Mediterranean obsidians and the Neolithic site of A Fuata (Corsica), *J. Archaeol. Sci.*, 37(1), (2010) 92-106

4) D. Barca, A.M. de Francesco, G.M. Crisci, Application of laser ablation ICP-MS for characterization of obsidian fragments from peri-Tyrrhenian area, *J. Cult. Herit.*, 8(2), (2007) 141-150

5) L. Petrassi, A. Zarattini, Il valore dell'ossidiana e le vie terrestri, ipotesi dopo i primi risultati della fluorescenza ai raggi X, in A. Zarattini and L. Petrassi, *Casale del Dolce. Ambiente, economia e cultura di una comunità preistorica della Valle del Sacco*, *Baioni Stampa: Roma*, 1997; pp 191-208.

6) R.H. Tykot, Obsidian Procurement and Distribution in the Central and Western Mediterranean, *Journal of Mediterranean Archaeology*, 9(1), (1996) 39-82