Andean Past

Volume 2 | Article 5

1989

The Sources of Obsidian for Artifacts from Chobshi Cave, Ecuador

Richard L. Burger
Yale, richard.burger@yale.edu

Frank Asaro
deceased

Helen V. Michel

THE SOURCES OF OBSIDIAN FOR ARTIFACTS FROM CHOBSHI CAVE, ECUADOR

Richard L. Burger
Yale University
Frank Asaro
Helen V. Michel
Lawrence Berkeley Laboratory

In 1977 and 1978 obsidian artifacts from Chobshi Cave, in the Canton of Sigsig, Province of Azuay, Ecuador (Lynch 1989 in this volume) were analyzed by X-ray fluorescence (XRF) and high precision neutron activation analysis (NAA) at the Lawrence Berkeley Laboratory, University of California, Berkeley. This study was initiated in 1974 to complement a more extensive investigation of obsidian artifacts from Peru begun in 1973 (Burger and Asaro 1979). Artifacts from Ecuadorian sites of differing ages and regions were analyzed. The Chobshi Cave samples, submitted for study by Thomas Lynch, were of particular interest because they were the only samples studied from the southern highlands of Ecuador.

Two areas of primary obsidian deposits have been documented by Ernesto Salazar in the Ilalo region of northern Ecuador (Salazar 1980) and comparative samples provided by Emil Petersen from these geological sources and nearby workshop areas were analyzed for comparative purposes. The largest known source of Ecuadorian obsidian is at the headwaters of the Rio Guambi in the Mullumica Valley, due east of Quito at approximately 4,000 m above sea level. Obsidian outcrops and associated workshops are found for some 5 km along the flanks of this glacial valley, and large blocks of obsidian are a component of the talus at the foot of the valley slopes (Salazar 1980: 29-30). This same geological formation apparently extends into the neighboring Sigsichupa Valley, where there are also outcrops, workshop debris, and even a 3.7 m deep triangular tunnel dug to extract obsidian (Salazar 1980: 33). The second area of primary obsidian deposits is located 12 km south of the Mullumica source and 50 km southeast of Quito in the headwaters of the Quebrada Encañada. This source, originally noted in 1892 by Wolf (1976), has recently been confirmed at outcrops near the peaks of Yanaurco Chico (4228 m above sea level) and Quiscatola (4200 m above sea level) (Salazar 1980: 47-51).

In a pilot study (Asaro *et al.* 1981a, 1981b; Asaro *et al.* 1989), source samples from Quiscatola and Yanaurco were found to have a chemical composition indistinguishable from each other, despite the fact that these outcrops are located 5 km apart. They appeared to constitute portions of a single homogeneous geological formation, and for the purposes of this study, they may be considered as constituting a single primary source. In contrast, neutron activation analyses and X-ray fluorescence measurements strongly suggested that the Mullumica obsidian deposit is variable in composition with linear or nearly linear relationships between all measured elements; a similar pattern has been documented for obsidian from Borax Lake, California (Bowman *et al.* 1973). Fortunately, the systematic nature of the variability at Mullimica permits identification of artifacts from this source when high-precision analytical procedures like neutron activation are employed.[1]

Results

Ten obsidian flakes from Chobshi Cave were analyzed using NAA, and five of these were also tested by XRF. An eleventh sample was analyzed only by XRF. The methods employed have been described in detail elsewhere (Asaro *et al.* 1981a, 1981b) and will not be considered here. The measurements obtained are summarized in Table 1. These were compared with the samples from the primary sources at Mullumica and Quiscatola/Yanaurco in order to determine which, if any, of the Chobshi Cave obsidian had come from the Ilalo deposits. Of the sample studied, 45.5% (n=5) had a chemical composition characteristic of the Mullumica deposit and 18.2% (n=2) had compositions which matched the obsidian at the Quiscatola/Yanaurco source. The sample studied solely by XRF produced measurements very similar to Quiscatola-Yanaurco except for the Rb abundance. The unusual thinness of this sample may have caused measurement problems. Since no NAA determination was made, this sample is considered unassigned, although a Quiscatola-Yanaurco provenience is probable. The remaining three flakes had distinctive compositions apparently unrelated to the primary source areas currently identified. These samples point to the existence of at least two other primary sources from which the obsidian for these artifacts was procured.

Discussion

The small sample of flakes studied from Chobshi Cave suggest that the occupants of Chobshi Cave in the southern highlands of Ecuador obtained obsidian directly or indirectly from two primary sources in the Ilalo region of the northern highlands. The Mullumica and the Quiscatola/Yanaurco sources are located at air distances of 300 km and 290 km respectively from Chobshi Cave. If the Chobshi Cave deposits, including the obsidian, date to approximately 8060-5585 B.C., as indicated by Lynch's research, then models of Preceramic lifeways emphasizing only local ecological variables must be reconsidered. Clearly interregional interaction should be considered as a significant factor when trying to understand the dynamics of Preceramic hunting and gathering societies in the Ecuadorian highlands. Much more study is needed to determine the mechanisms by which the obsidian was successfully procured by the Chobshi Cave inhabitants and, conversely, why contemporary occupants of the Santa Elena Peninsula on the southern Ecuadorian coast lacked either the ability or the motivation to acquire it (Stothert 1985, personal communication). Moreover, the information on obsidian exchange must be placed within the larger context of regional and interregional exchange of perishable and imperishable goods.

---

[1] The identification of the Mullumica deposit as a heterogeneous obsidian source is a strong inference based mainly on the systematic variability in the chemical composition of artifacts. Definitive confirmation must await additional neutron activation analyses of samples from different parts of the geological source.

Table 1. Analysis of Obsidian Artifacts from Chobshi Cave, Ecuador.

Run Number		NAA Data							XRF Data			Tentative Source Identification
NAA	XRF	Mn ppm	Na%	Ba ppm	Dy ppm	K%	Rb ppm	Fe%	Rb/Zr	Sr/Zr	Zr ppm	
1029 M	8059 2	345±7	2.92±.06	872±27	1.37±.09	3.99±.25	190±6	.389±.010	2.171	1.053	76	Quiscatola/ Yanaurco
1029 O	8059 4	347±7	3.00±.06	902±30	1.26±.10	4.30±.26	190±6	.396±.010	2.153	1.167	72	Quiscatola/ Yanaurco
	8059 7								1.96	1.12	74	Unassigned[a]
1029 N	8059 3	360±7	2.96±.06	1005±29	1.42±.10	4.11±.26	164±5	.504±.011	1.521	1.245	94	Mullumica
1029 P	8059 5	359±7	3.13±.06	1101±33	1.55±.10	3.82±.26	162±5	.480±.011	1.489	1.160	94	Mullumica
1029 Q	8059 6	358±7	3.09±.06	1080±45	1.38±.11	3.68±.24	158±5	.504±.011	1.432	1.216	88	Mullumica
845 S	8074 F	360±7	3.14±.06	1098±31	1.42±.09	3.50±.22	156±10	.529±.013				Mullumica
845 V	8074 I	372±7	3.17±.06	1031±38	1.54±.16	3.46±.22	144±10	.572±.013				Mullumica
845 T	8074 G	473±9	3.19±.06	1284±42	5.36±.12	3.69±.23						Unknown source 1
845 W	8074 J	470±9	3.13±.06	1185±43	5.21±.12	3.46±.03						Unknown source 1
845 U	8074 H	445±9	2.69±.05	1088±41	1.63±.11	4.89±.24						Unknown source 2

[a] (probably Quiscatola-Yanaurco)

Considering the distance from the primary obsidian deposits, it is not surprising that obsidian comprised less than 1% of the Chobshi Cave lithics. This situation is quite different from the high frequency (97% of excavated lithics) of obsidian at El Inga (Mayer-Oakes 1986: 142, cf. Bell 1965), which is located only 9 air km west of the two source areas. In our analyses of samples from El Inga, both the Mullumica and Quiscatola sources were represented.[2] The utilization of these primary obsidian sources early in the Ecuadorian Preceramic has a direct parallel in Peru, where the Quispisisa source in Huancavelica provided obsidian for the early inhabitants of Ayacucho by the Ayacucho phase, dated by MacNeish prior to 9,000 BC, and to Uschkumachay in the Junin puna by the fourth or fifth millennium BC (Burger and Asaro 1979: Cuadros 4, 6).

As noted earlier, three of the eleven samples studied come from primary sources yet to be identified. Considering the highly volcanic character of northern Ecuador, it is likely that other usable obsidian deposits exist and that the two unidentified samples come from two sources in this region. The fact that these samples represent only a minority of the Chobshi Cave obsidian analyzed and that obsidian is scarce at the site suggests that the unidentified sources for this obsidian were probably located at considerable distances perhaps equal to or greater than the distances to the Mullumica and Quiscatola/Yanaurco sources. Naturally, factors other than distance, such as obsidian quality and patterns of social interaction, could also have influenced patterns of obsidian procurement.

Nevertheless, the information available leads us to conclude that there are probably no usable primary obsidian sources in southern Ecuador. Obsidian sources likewise do not occur in the northern highlands of Peru. All of the dozen or more primary sources of obsidian exploited in Prehispanic Peru were located in the south-central or southern Peruvian highlands, and obsidian is even rarer at sites in northern Peru than it is in southern Ecuador. A single point of obsidian is known from the early Preceramic site of La Cumbre on the north coast. XRF analysis indicated that it was made from raw material derived from the Quispisisa source, Huancavelica (Burger and Asaro 1979: Cuadro 3). Claude Chauchat (1988: 49), however, believes this obsidian artifact may not be contemporary with the well-known Preceramic materials. The obsidian used for tools and debitage recovered from the Early Horizon occupation of the Pacopampa area in the Department of Cajamarca and Early Intermediate Period/Middle Horizon sites in the Huamachuco region, Department of La Libertad in the northern Peruvian highlands was likewise procured from distant sources in the south-central and southern highlands of Peru (Burger and Asaro 1979; Burger 1984). Considering the distance between Chobshi Cave and the obsidian sources in Peru (approx. 1240 km), it is highly unlikely that deposits in southern Peru are the source of the three unidentified Chobshi Cave flakes. The NAA results available on these samples likewise suggest that they do not belong to any of the chemical groups defined for Peru.

---

[2] R. Burger, F. Asaro, and Helen V. Michel, unpublished data; an article on the study of obsidian artifacts from El Inga, Guangala, and other Ecuadorian sites is currently in preparation with F. Stross as co-author (Asaro *et al.* 1989). This article will include the final results of the Chobshi Cave analysis.

References

Asaro, Frank, Helen V. Michel, and Richard L. Burger
1981a Major Sources of Ecuadorian Obsidian and Provenience Assignment of Artifacts. *Lawrence Berkeley Laboratory Report* 1346: 1-18. Berkeley.
1981b Chemical Source Groups in Ecuadorian Obsidian. *Lawrence Berkeley Laboratory Report* 1347: 1-26. Berkeley.

Asaro, Frank, Helen V. Michel, Richard L. Burger, Ernesto Salazar, and Fred Stross
1989 Major Sources of Archaeological Obsidian from Ecuador. Manuscript in possession of the authors.

Bell, Robert
1965 *Investigaciones arqueológicas en el Sitio de El Inga, Ecuador*. Quito: Editorial Casa de la Cultura Ecuatoriana.

Bowman, H. R., Frank Asaro, and I. Perlman
1973 Composition Variations in Obsidian Sources and Archaeological Implications. *Archaeometry* 15: 123-127.

Burger, Richard
1984 Archaeological Areas and Prehistoric Frontiers: The Case of Formative Ecuador and Peru. In Social and Economic Organization in the Prehistoric Andes, *BAR International Series* 194, edited by D. Browman, R. Burger, and M. Rivera, pp. 33-71. Oxford.

Burger, Richard and Frank Asaro
1979 Análisis de rasgos significativos en la obsidiana de los andes centrales. *Revista del Museo Nacional* 43(1977): 281-326. Lima.

Chauchat, Claude
1988 Early Hunter-gatherers on the Peruvian coast. In *Peruvian Prehistory*, edited by Richard Keatinge, pp. 41-66. Cambridge: Cambridge University Press.

Lynch, Thomas F.
1989 Chobshi Cave in Retrospect. *Andean Past* 2: 1-32 (this volume).

Mayer-Oakes, William
1986 El Inga, a Paleo-Indian Site in the Sierra of Northern Ecuador. *Transactions of the American Philosophical Society* 76(Part 4): 1-235.

Salazar, Ernesto
1980 *Talleres prehistóricos en los altos Andes del Ecuador*. Cuenca, Ecuador: Universidad de Cuenca.

Stothert, Karen
1985 The Preceramic Las Vegas Culture of Coastal Ecuador. *American Antiquity* 50: 613-637.

Wolf, Teodoro
1976 *Geografía y geología del Ecuador*. Quito: Editorial Casa de la Cultura Ecuatoriana.