X-Ray Fluorescence Analysis of Artifact Obsidian from the La Plant I Site, New Madrid County, Missouri

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A single obsidian artifact from the La Plant I Site (23-NM-51), New Madrid County, Missouri, was submitted for energy dispersive X-ray fluorescence trace element provenience analysis. The sample was prepared and analyzed at the Northwest Research Obsidian Studies Laboratory under the accession number 2001-21.

Analytical Methods

X-Ray Fluorescence Analysis. Nondestructive trace element analysis of the sample was completed using a Spectrace 5000 energy dispersive X-ray fluorescence spectrometer. The system is equipped with a Si(Li) detector with a resolution of 155 eV FHWM for 5.9 keV X-rays (at 1000 counts per second) in an area 30 mm^2. Signals from the spectrometer are amplified and filtered by a time variant pulse processor and sent to a 100 MHZ Wilkinson type analog-to-digital converter. The X-ray tube employed is a Bremsstrahlung type, with a rhodium target, and 5 mil Be window. The tube is driven by a 50 kV 1 mA high voltage power supply, providing a voltage range of 4 to 50 kV.

The diagnostic trace element values used to characterize the sample are compared directly to those for known obsidian sources reported in the literature and with unpublished trace element data collected through analysis of geologic source samples (Skinner 2002). Artifacts are correlated to a parent obsidian or basalt source (or geochemical source group) if diagnostic trace element values fall within about two standard deviations of the analytical uncertainty of the known upper and lower limits of chemical variability recorded for the source. Occasionally, visual attributes are used to corroborate the source assignments although sources are never assigned solely on the basis of megascopic characteristics.

Additional details about specific analytical methods and procedures used for the analysis of the elements reported in Table A-1 are available at the Northwest Research Obsidian Studies Laboratory World Wide Web site at *www.obsidianlab.com.*

Results of Analysis

X-Ray Fluorescence Analysis. The trace element composition of the obsidian artifact indicates that it originated from the Obsidian Cliff source located in Yellowstone National Park, Wyoming. The locations of the site and the identified obsidian source are shown in Figure 1. Analytical results are presented in Table A-1 in the Appendix and are summarized in Figure 3.

The spectacular Obsidian Cliff source in Yellowstone National Park (Figure 2) was one of the first obsidian sources to be described in modern scientific literature (Holmes 1879; Iddings 1888). Many archaeological sites in North Dakota, South Dakota, Iowa, Illinois, Michigan, Ohio, Wisconsin, Minnesota, Montana, Wyoming, Washington, Idaho, and central Canada have yielded artifacts correlated with this Yellowstone source (Anderson et al. 1986; Baugh and Nelson 1988; Brose 1994; Cannon and

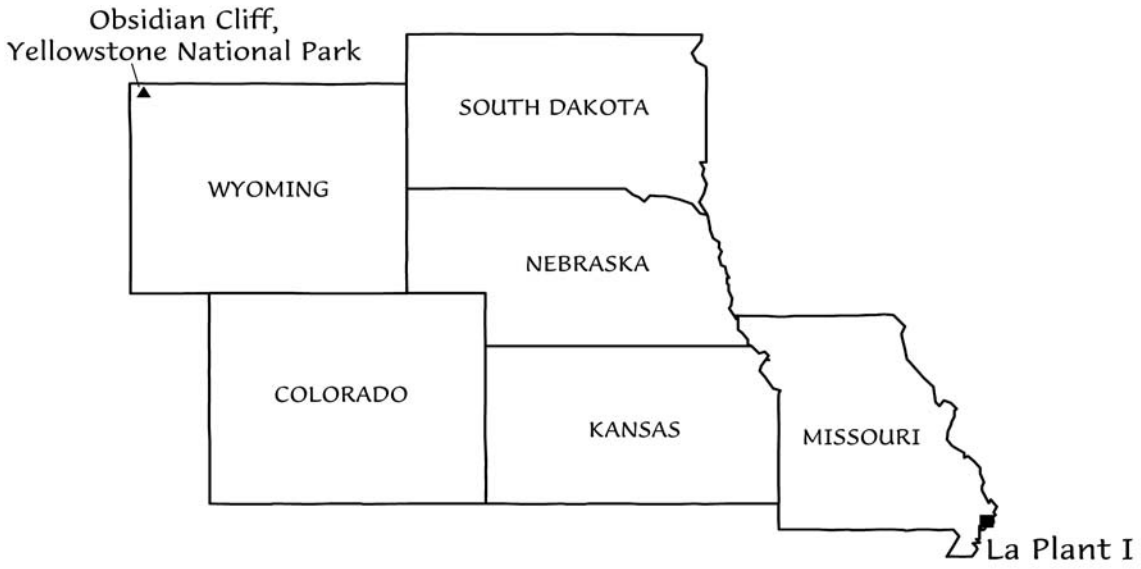

Figure 1. Location of 23-NM-51 and the geologic source of the characterized artifact from the site.

Hughes 1993; Davis 1972; Davis et al. 1995; Griffin et al. 1969; Hatch 1990; Hughes and Nelson 1987; Logan et al. 2001; Smith 1999; Stewart 1994; Thompson et al. 1997; Vehik and Baugh 1994). The geology, geochemistry, and prehistoric use of obsidian from Obsidian Cliff are best summarized and described by Davis et al. (1995).

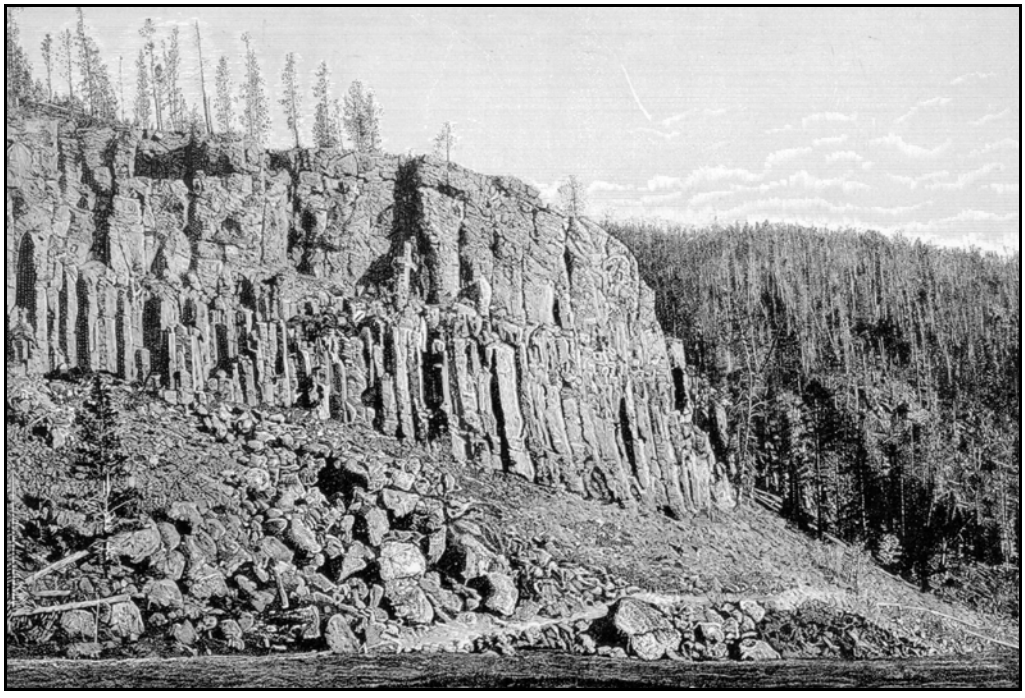

Figure 2. Obsidian Cliff, Yellowstone National Park (from Iddings 1888).

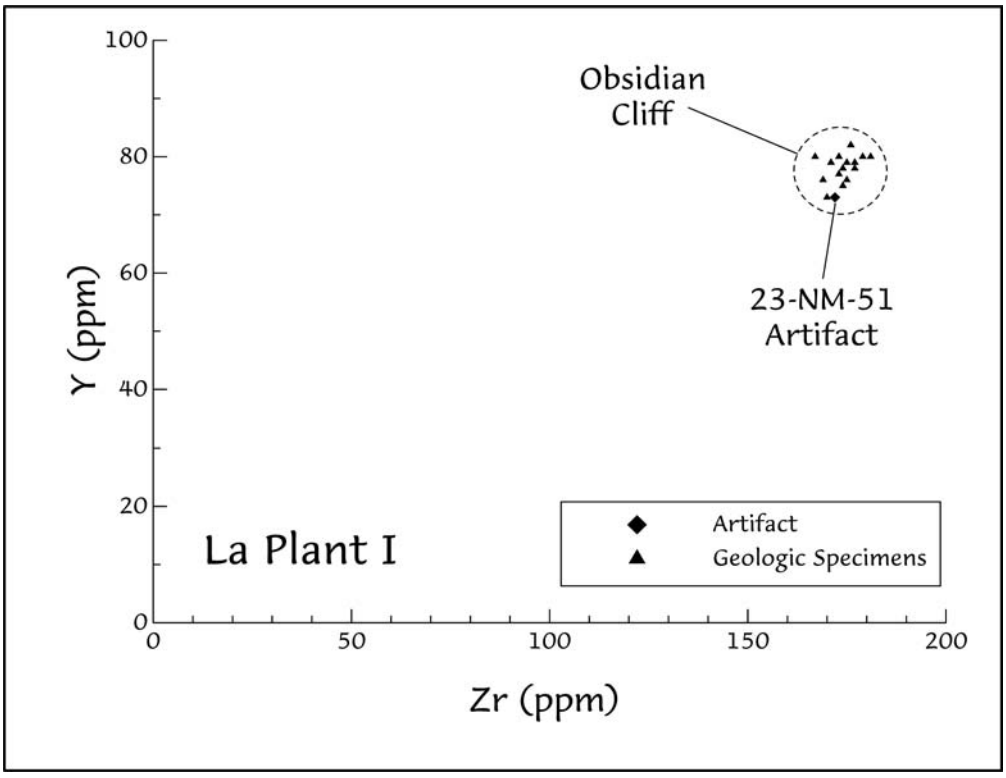

Figure 2. Scatterplot of yttrium (Y) plotted versus zirconium (Zr) for the analyzed obsidian artifact from 23-NM-51 and for geologic source specimens in the Northwest Research Obsidian Studies Laboratory reference collection.

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Appendix

Results of X-Ray Fluorescence Analysis

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Table A-1. Results of XRF Studies: La Plant I Site (23-NM-51), New Madrid County, Missouri

Site	Specimen No.	Catalog No.	Trace Element Concentrations											Ratios		Artifact Source
			Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	
23-NM-51	1	406	113	31	236	2	73	172	43	649	168	0	0.85	58.5	43.5	Obsidian Cliff, WY
			± 7	4	4	10	2	6	2	75	46	27	0.11			
NA	RGM-1	RGM-1	61	24	155	104	27	227	11	1500	284	746	1.80	62.6	38.0	RGM-1 Reference Standard
			± 6	3	3	6	2	6	2	77	46	28	0.11			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.
NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.