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SOURCE PROVENANCE OF OBSIDIAN ARTIFACTS FROM THE KUTOYIS/TWO MEDICINE SITE, GLACIER COUNTY, BLACKFEET INDIAN RESERVATION, MONTANA

by

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Report Prepared for

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INTRODUCTION

The analysis here of seven obsidian artifacts from the Kutoyis/Two Medicine site indicates a dominance of artifacts produced from the Bear Gulch source in eastern Idaho, and one artifact produced from the obsidian from the Obsidian Cliff quarry in Yellowstone National Park, Wyoming.

LABORATORY SAMPLING, ANALYSIS AND INSTRUMENTATION

This assemblage was analyzed on a Spectrace/Thermo *QuanX* energy-dispersive x-ray spectrometer at the Archaeological XRF Laboratory, Department of Earth and Planetary Sciences at the University of California, Berkeley. All samples were analyzed whole with little or no formal preparation. The results presented here are quantitative in that they are derived from “filtered” intensity values ratioed to the appropriate x-ray continuum regions through a least squares fitting formula rather than plotting the proportions of the net intensities in a ternary system (McCarthy and Schamber 1981; Schamber 1977). Or more essentially, these data through the analysis of international rock standards, allow for inter-instrument comparison with a predictable degree of certainty (Hampel 1984).

The spectrometer is equipped with an electronically cooled Cu x-ray target with a 125 micron Be window, an x-ray generator that operates from 4-50 kV/0.02-2.0 mA at 0.02 increments, using an IBM PC based microprocessor and WinTrace™ reduction software. The x-ray tube is operated at 30 kV, 0.14 mA, using a 0.05 mm (medium) Pd primary beam filter in an air path at 200 seconds livetime to generate x-ray intensity $K\alpha$ -line data for elements titanium (Ti), manganese (Mn), iron (as Fe^T), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb). Trace element intensities were converted to concentration estimates by employing a least-squares calibration line established for each element from the analysis of international rock standards certified by the National Institute of Standards and Technology

(NIST), the US. Geological Survey (USGS), Canadian Centre for Mineral and Energy Technology, and the Centre de Recherches Pétrographiques et Géochimiques in France (Govindaraju 1994). Further details concerning the petrological choice of these elements in North American obsidians is available in Shackley (1992, 1995, 2005; also Mahood and Stimac 1990; and Hughes and Smith 1993). Specific standards used for the best fit regression calibration for elements Ti through Nb include G-2 (basalt), AGV-1 (andesite), GSP-1, SY-2 (syenite), BHVO-1 (hawaiite), STM-1 (syenite), QLO-1 (quartz latite), RGM-1 (obsidian), W-2 (diabase), BIR-1 (basalt), SDC-1 (mica schist), TLM-1 (tonalite), SCO-1 (shale), all US Geological Survey standards, and BR-N (basalt) from the Centre de Recherches Pétrographiques et Géochimiques in France, and JR-1 and JR-2 obsidian standards from the Japan Geological Survey (Govindaraju 1994). In addition to the reported values here, Ni, Cu, Zn, Th, and Ga were measured, but these are rarely useful in discriminating glass sources and are not generally reported.

The data from both systems were translated directly into Excel™ for Windows software for manipulation and on into SPSS™ for Windows for statistical analyses. In order to evaluate these quantitative determinations, machine data were compared to measurements of known standards during each run. An analysis of RGM-1 analyzed during each run is included in Table 1. Source assignments were made by reference to the Berkeley data base and information supplied by Fred Nelson, Brigham Young University, and Richard Hughes. Little source data for some of these sources is available in print or on the web. Further information on the laboratory instrumentation can be found at: <http://www.swxrflab.net/>. Trace element data exhibited in Table 1 are reported in parts per million (ppm), a quantitative measure by weight (see also Figure 1). This assemblage, contained a number of samples that were near the smallest size that can be reliably analyzed with EDXRF (see Davis et. al. 1998; Table 1 here).

DISCUSSION

The two sources that are represented in this small assemblage are both over 400 km south of the site in Idaho and Wyoming (Figure 2). Obsidian Cliff was one of the most dominant obsidian raw materials throughout prehistory and early history in the northern Plains, and has been found as far south as the Gulf of Mexico and throughout the Plains and Eastern States particularly during the Hopewell period (Hughes 1992; Mills 1907; Shackley 1997; Figure 1 here). The dominant source, Bear Gulch in eastern Idaho, is also relatively common in sites in the region. Bear Gulch, Idaho has been found at least as far east as Indiana (Shackley 1997).

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Table 1. Elemental concentrations and source assignments for the archaeological specimens. All measurements in parts per million (ppm).

Sample	Ti	Mn	Fe	Rb	Sr	Y	Zr	Nb	Source
1	1761	362	12716	169	44	41	283	64	Bear Gulch, ID
2	1917	298	14231	190	49	45	303	58	Bear Gulch, ID
3	1777	426	13303	180	54	42	304	58	Bear Gulch, ID
4	1478	304	11361	167	53	41	283	64	Bear Gulch, ID
5	938	237	10254	253	9	86	169	40	Obsidian Cliff, WY
6	1505	345	11320	170	44	36	251	49	Bear Gulch, ID
7	1770	412	11994	163	49	46	279	67	Bear Gulch, ID
RGM1-S3	1637	323	13320	151	113	25	217	2	standard

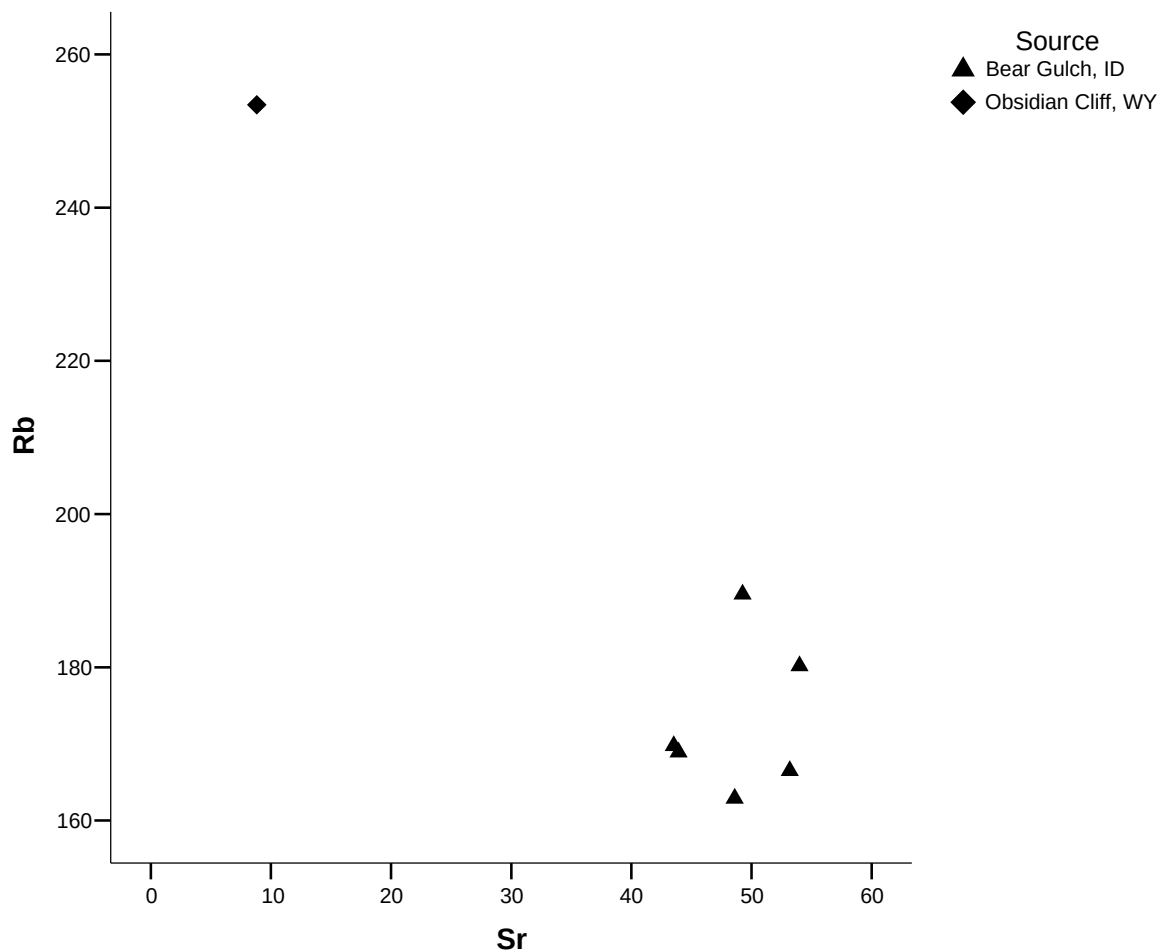


Figure 1. Rb versus Sr, plot of the elemental concentrations for the archaeological specimens.



Figure 2. Location of the Kutoyis Site and obsidian sources.