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**AN ENERGY DISPERSIVE X-RAY FLUORESCENCE (EDXRF)
ANALYSIS OF 29 OBSIDIAN ARTIFACTS FROM THREE
PREHISTORIC SITES ON EDWARDS AIR FORCE BASE, KERN
COUNTY, CALIFORNIA**

by

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for

BRIAN MOONEY ASSOCIATES

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INTRODUCTION

The following report documents the XRF analysis of 29 obsidian artifacts from CA-Ker-526, 1180, and 3377. All the artifacts and debitage were produced from one of the rhyolite extrusions in the Coso Volcanic Field in eastern California.

ANALYSIS AND INSTRUMENTATION

The samples were analyzed whole, and were washed in distilled water before analysis. 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 trace element analyses were performed in the Department of Geology and Geophysics, University of California, Berkeley, using a Spectrace 440 (United Scientific Corporation) energy dispersive x-ray fluorescence spectrometer. The spectrometer is equipped with a Rh x-ray tube, a 50 kV x-ray generator, with a Tracor™ X-ray (Spectrace) TX 6100 x-ray analyzer using an IBM PC based microprocessor and Tracor™ reduction software. The x-ray tube was operated at 30 kV, .20 mA, using a .127 mm Rh primary beam filter in a vacuum path at 250 seconds livetime to generate x-ray intensity $K\alpha$ -line data for elements titanium (Ti), manganese (Mn), iron (as Fe^I), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb). Weight percent iron ($Fe=Fe_2O_3^I$) can be derived by multiplying ppm estimates by 1.4297. Trace element intensities were converted to concentration estimates by employing a least-squares calibration line established for each element from the analysis of up to 26 international rock standards certified by the US. Bureau of Standards, the US. Geological Survey, Canadian Centre for Mineral and Energy Technology, and the Centre de Recherches Pétrographiques et Géochimiques in France (Govindaraju 1989). Further details concerning the petrological choice of these elements in

Southwest obsidians is available in Shackley (1988, 1990, 1992; also Mahood and Stimac 1990).

The data from the Tracor software were translated directly into Quattro Pro for Windows software for manipulation and on into SPSSPC+ 3.0 for statistical analyses. In order to evaluate these quantitative determinations, machine data were compared to measurements of known standards. Table 1 shows a comparison between values recommended for two international rock standards, one rhyolite (RGM-1) and one obsidian (NBS-278). One of these standards is analyzed during each sample run to insure machine calibration. The results shown in Table 1 indicate that the machine accuracy is quite high, and other instruments with comparable precision should yield comparable results.

Trace element data exhibited in Tables 1 and 2 are reported in parts per million (ppm), a quantitative measure by weight. Table 2 exhibits the trace element concentrations for the archaeological samples. Figures 1 through 4 exhibit bivariate plots of six of the measured elements for the site data. Source assignment was made by comparison to Hughes (1988) source standard data.

DISCUSSION

All the artifacts were produced from obsidian procured from the Coso Volcanic Field in eastern California. It is possible that some of the very small debitage, too small to be analyzed, was derived from other sources; this is rarely the case, and the megascopic attributes are similar to Coso material (see Hughes 1988).

Recently, there has been some discussion concerning the chemical variability of various rhyolite glass extrusions in the Coso field (Bouey 1991; Ericson and Glascock 1992; Hughes 1988). This seldom has much relevance in terms of long-distance exchange and procurement, so no distinctions were made here. The dominance of Coso glass from the north in these sites is most likely an effect of the proximity to this source and the large nodule character compared to the small nodule Tertiary glass sources to the east such as Bagdad, Umpire, or Devil Peak.

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Table 1. X-ray fluorescence concentrations for selected trace elements of two international rock standards. \pm values represent first standard deviation computations for the group of measurements. All values are in parts per million (ppm) as reported in Govindaraju (1989) and this study. RGM-1 is a U.S. Geological Survey rhyolite (obsidian) rock standard, and NBS-278 is a National Bureau of Standards obsidian standard.

SAMPLE	Ti	Mn	Fe	Rb	Sr	Y	Zr	Nb
RGM-1 (Govindaraju 1989)	1600	279	12998	149	108	25	219	8.9
RGM-1 (this study)	1513.24 \pm 46	232.86 \pm 15	13813 \pm 59	149.58 \pm 4.05	108.03 \pm 3	22.7 \pm .86	226.8 \pm 2	10 \pm .28
NBS-278 (Govindaraju 1989)	1468	402	14256	127.5	63.5	41	295	n.r. ¹
NBS-278 (this study)	1405 \pm 93	365 \pm 8	15399 \pm 394	130 \pm 2	68 \pm 2	43 \pm 1.7	290 \pm 4	18 \pm 2

¹ n.r. = no report

Table 2. X-ray fluorescence concentrations for archaeological samples from CA-Ker-526,1180,3377. All values are in parts per million (ppm).

SAMPLE	Ti	Mn	Fe	Rb	Sr	Y	Zr	Nb	Source
<u>CA-Ker-526</u>									
1	490.4	249.2	10361.1	273.1	13.3	49.6	145.4	48.67	All specimens from the Coso Volcanic Field
3	598.5	299.4	12210.5	210.2	15.4	26.2	142.3	32.132	
4	332.3	218.5	9219.8	231.5	14.4	44.3	129.1	43.143	
5	469.7	232.2	10456.1	267.8	14.4	51.4	146.5	48.39	
7	363.1	245.7	9483.1	269.8	14.7	54.1	139.2	43.782	
11	385.6	236.7	9509.6	250.1	15.3	50.2	137.3	47.88	
14	385.5	199.9	9932.2	279.0	10.4	53.5	137.1	45.023	
20	684.1	284.3	11827.8	253.7	14.5	47.5	123.8	31.138	
21	565.3	213.5	9381.7	249.9	11.6	44.1	119.8	36.852	
<u>CA-Ker-1180</u>									
22	468.2	270.4	10872.6	297.4	13.9	55.2	158.4	52.847	
23	488.3	251.4	10297.6	269.2	16.6	52.9	138.8	45.189	
24	611.4	242.4	10493.4	257.9	17.0	53.4	138.3	47.354	
25	497.5	191.7	7841.6	209.0	9.8	40.8	113.6	44.427	
26	432.5	241.1	9983.7	276.8	11.3	49.6	131.1	39.533	
<u>CA-Ker-3377</u>									
41	359.7	224.0	9886.7	275.9	12.4	58.4	141.8	51.011	
43	630.4	224.8	9241.5	245.6	17.2	47.0	120.9	33.623	

Figure 1. Ti versus Fe concentration plot of archaeological specimens.

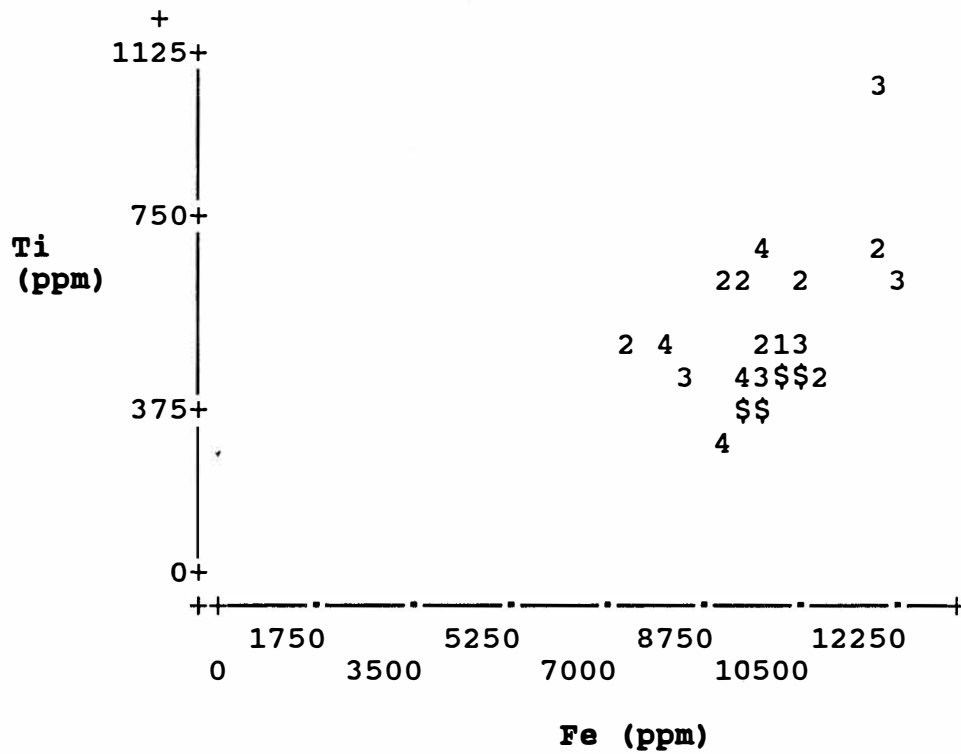


Figure 2. Rb versus Sr concentration plot of archaeological specimens.

