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X-RAY FLUORESCENCE (XRF) ANALYSIS OF OBSIDIAN ARTIFACTS FROM
SHOOFLY RUIN, CENTRAL ARIZONA

by

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Introduction

The following is a report of a x-ray fluorescence analysis of 27 obsidian artifacts from Shoofly Ruin, central Arizona. The analysis indicates that 17 (63%) of the artifacts were procured from the Government Mountain source to the north. Seven (26%) of the specimens were most likely procured from the Superior (Picketpost Mountain) glass source to the south. The remaining three specimens most closely match the Mule Creek/Gwynn Canyon source in west central New Mexico (two specimens), and one specimen cannot be confidently assigned to a source.

Methodology

All obsidian debitage, and projectile points were subjected to the same analytic conditions. Melt incompatible trace elements were used to determine the source.

The samples were analyzed for rubidium (Rb), strontium (Sr), zirconium (Zr), niobium (Nb) using the semi-quantitative rapid scan method (Jack and Carmichael 1969) on a manual Philips PW 1410 wavelength x-ray spectrometer with a Philips power supply, ratemeter and teletype in the Chemistry Department at Arizona State University. A tungsten (W) x-ray tube, scintillation counter and LiF (200) crystal were used operated in a vacuum path at 45KV and 45mA for 80 live-seconds per element. The intensity values for all elements were computed for ratios of RbKa, SrKa, ZrKa, and NbKa radiation lines. The data were reduced through specific programs with a Zenith Z-161 Data Systems microprocessor. The elemental proportions are divided by the rubidium peak intensity and summed. These results are then divided by the summed intensities and the resulting element ratios are plotted in a ternary system for comparison to known obsidian sources in the Southwest (see Table 1 and Figures 1 and 2). The solid incompatible elements Rb, Sr, Zr, and Nb are quite sensitive in separating rhyolite glass sources (Cann 1983; Cox et al. 1979; Zielinski et al. 1977). Niobium (Nb) is normally utilized when strontium values are low. In this study, niobium was used to attempt verification of source assignment

on two specimens (#'s 7062 and 9023). It should be emphasized that source assignments are probabilities and confidence is directly proportional to the number of known sources in a given region (Hughes 1984).

Discussion

The data are displayed in Table 1 and Figures 1 and 2. The material assigned to the Government Mountain source was based on geochemical and megascopic criteria. While some of the specimens overlap the envelope for the Cow Canyon source, the megascopic character is consistent with Government Mountain glass and quite distinct from Cow Canyon, a consistently near transparent/banded small nodule source in east central Arizona (Shackley 1986c). Government Mountain obsidian is distinctly sub-vitreous, nearly opaque and gray in color. The sub-vitreous fabric is probably due to high concentrations of magnetite $[(Fe,Mg) Fe_2O_4]$ microlites in the glass (Shackley 1986c). Government Mountain glass seems to exhibit greater chemical variability than most sources in the San Francisco Volcanic Field.

Superior glass was also common in the assemblage. It is distinct by its consistent transparent brown fabric. The specimens assigned to this source are fairly confident assignments. The Mule Creek material occurs in Hohokam contexts (i.e. Spur Cross Ranch Site) in central Arizona with some regularity, but in low frequencies (Shackley 1986a). The one unknown, while overlapping Kendrick Peak (Sr) and Slate

Mountain (Nb) is too inconsistent to assign to either source. The specimen is a near transparent glass typical of mid-Tertiary marekanite sources in central Arizona and western New Mexico and may be a chemical outlier of Superior, Vulture, Saucedo Mountains or some other locality. No confident source assignment can be made.

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Table 1. X-ray fluorescence net intensity ratios for obsidian artifacts from Shoofly Ruin, central Arizona

SAMPLE NO.	Rb/Rb	Sr/Rb	Zr/Rb	SUM	Rb	Sr	Zr	PROBABLE SOURCE
8396	1.00	0.1549	1.1847	2.3397	0.4274	0.0662	0.5064	Superior
11236	1.00	0.1425	1.2701	2.4125	0.4145	0.0590	0.5265	Superior
1147	1.00	0.8429	1.2965	3.1394	0.3185	0.2685	0.4130	Govt. Mtn
7303	1.00	0.0905	0.5714	1.6619	0.6017	0.0545	0.3438	Mule Cr/Gwynn Cyn, NM
15264	1.00	0.8846	1.1256	3.0103	0.3322	0.2939	0.3739	Govt. Mtn
8397	1.00	0.8953	1.2820	3.1773	0.3147	0.2818	0.4035	Govt. Mtn
8242	1.00	0.8831	1.1604	3.0435	0.3286	0.2901	0.3813	Govt. Mtn
8248	1.00	1.1126	1.4620	3.5746	0.2797	0.3112	0.4090	Govt. Mtn
1278	1.00	0.7905	0.9951	2.7856	0.3590	0.2838	0.3572	Govt. Mtn
3157	1.00	0.9348	1.2109	3.1457	0.3179	0.2972	0.3849	Govt. Mtn
4118	1.00	0.7752	1.0251	2.8003	0.3571	0.2768	0.3661	Govt. Mtn
73	1.00	0.8261	1.0778	2.9039	0.3444	0.2845	0.3712	Govt. Mtn
15266	1.00	0.0730	1.1361	2.2091	0.4527	0.0331	0.5143	Superior
7026	1.00	0.0000	1.5806	2.5806	0.3875	0.0000	0.6125	unknown (Cent. AZ?)
4224	1.00	0.9717	1.5483	3.5199	0.2841	0.2760	0.4399	Govt. Mtn
9023	1.00	0.0945	0.5222	1.6168	0.6185	0.0585	0.3230	Mule Cr/Gwynn Cyn
1381	1.00	0.7343	0.9792	2.7135	0.3685	0.2706	0.3609	Govt. Mtn
9432	1.00	0.1092	1.1084	2.2175	0.4510	0.0492	0.4998	Superior
4121	1.00	0.8485	1.0507	2.8991	0.3449	0.2927	0.3624	Govt. Mtn
3149	1.00	0.8485	1.1446	2.9930	0.3341	0.2835	0.3824	Govt. Mtn
2144	1.00	0.7867	0.9551	2.7418	0.3647	0.2869	0.3483	Govt. Mtn
9182	1.00	0.9259	1.2725	3.1984	0.3127	0.2895	0.3978	Govt. Mtn
2003	1.00	0.0764	0.9933	2.0697	0.4832	0.0369	0.4799	Superior
2128	1.00	0.7555	1.0109	2.7664	0.3615	0.2731	0.3654	Govt. Mtn
15143	1.00	0.7780	0.8789	2.6568	0.3764	0.2928	0.3308	Govt. Mtn
9384	1.00	0.1150	1.0075	2.1224	0.4712	0.0542	0.4747	Superior
10435	1.00	0.1126	1.1663	2.2789	0.4388	0.0494	0.5118	Superior
	Rb/Rb	Nb/Rb	Zr/Rb	SUM	Rb	Nb	Zr	
7026	1.00	0.3688	1.5806	2.9494	0.3391	0.1251	0.5359	unknown (Cent. AZ?)
9023	1.00	0.1427	0.5222	1.6650	0.6006	0.0857	0.3137	Mule Cr/Gwynn Cyn

Figure 1. Ternary plot of Zr, Sr, Rb net intensity ratios of archaeological obsidian from Shoofly Ruin and selected Southwestern obsidian sources.

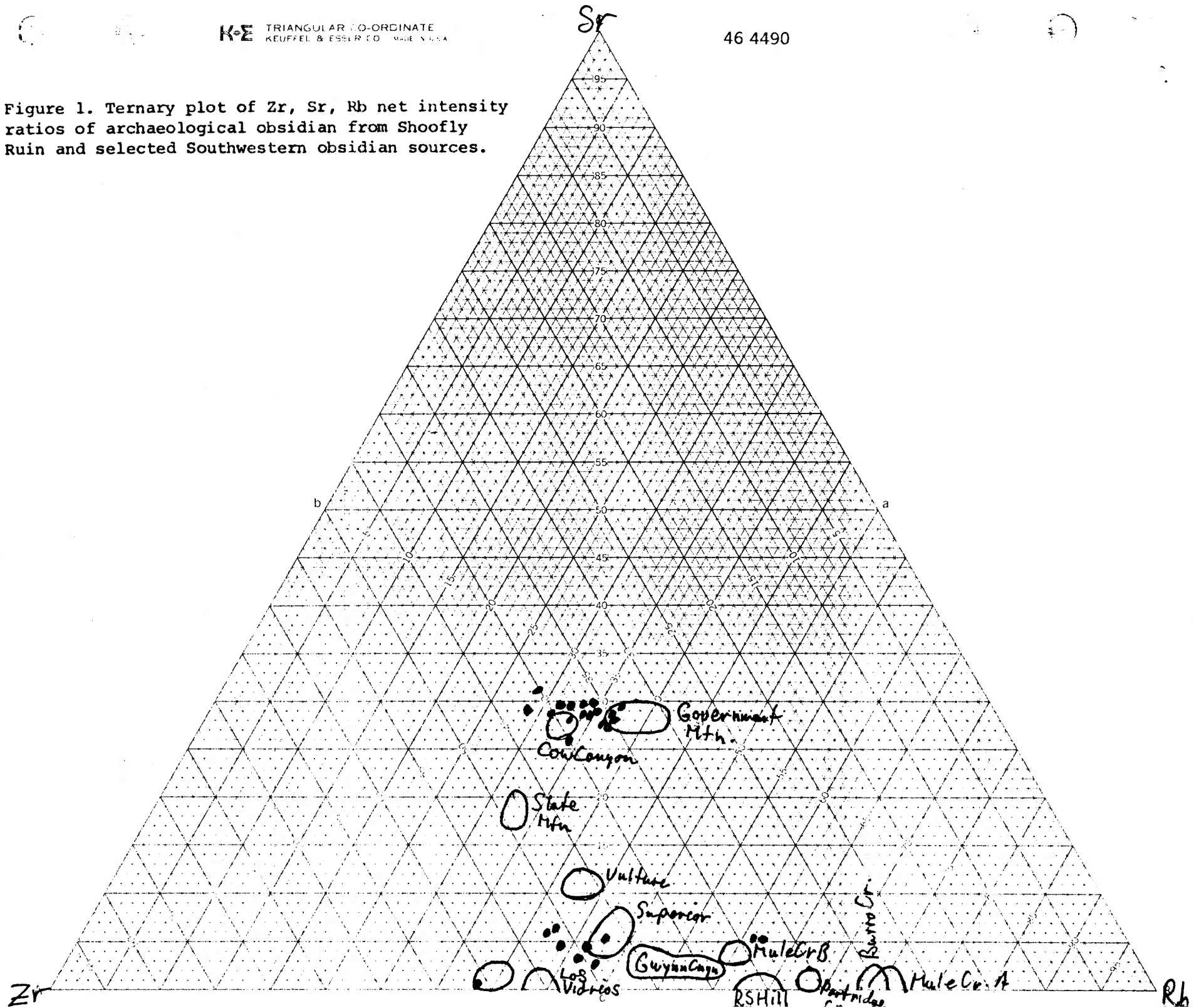


Figure 2. Ternary plot of Zr,Nb,Rb net intensity ratios of selected archaeological obsidian from Shoofly Ruin and selected Southwestern obsidian sources.

