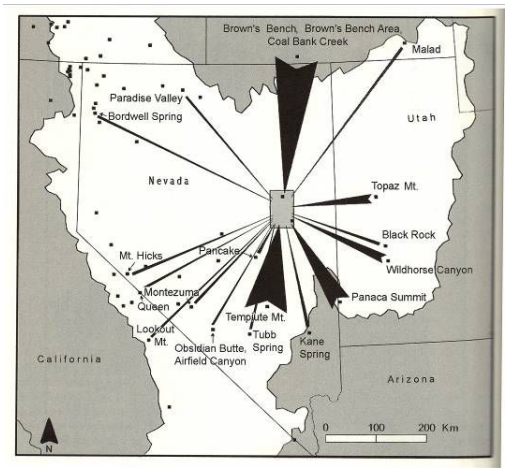
GEOARCHAEOLOGICAL XRF LAB

GEOARCHAEOLOGICAL X-RAY FLUORESCENCE SPECTROMETRY LABORATORY
8100 WYOMING BLVD., SUITE M4-158 ALBUQUERQUE, NM 87113
USA

and

NORTHWEST RESEARCH OBSIDIAN STUDIES LABORATORY

SOURCE PROVENANCE OF OBSIDIAN PALEOARCHAIC BIFACES FROM THE GREAT BASIN



Source provenance of Paleoarchaic projectile points in the Beck and Jones (2011) study, many of which are present in this study.

by

M. Steven Shackley Ph.D., Director
Geoarchaeological XRF Laboratory
Albuquerque, New Mexico

and

Craig Skinner, Director
Northwest Research Obsidian Studies Laboratory
Bend, Oregon

Report Prepared for

Mr. John Garrett
Fort Worth, Texas

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INTRODUCTION

The analysis here of 51 Paleoarchaic bifaces (49 obsidian) from the North American Great Basin indicates a very diverse provenance assemblage derived throughout western North America. The XRF analysis and most of the source assignments was performed at the Geoarchaeological XRF Laboratory in Albuquerque, New Mexico, and some of the source assignments, mainly from Oregon sources, was performed by Craig Skinner, former Director of the Northwest Research Obsidian Studies Laboratory, Bend, Oregon. The Skinner/Shackley database of 261 North American obsidian source data was mainly used to assign to source.

LABORATORY SAMPLING, ANALYSIS AND INSTRUMENTATION

All archaeological samples are analyzed whole. 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; Shackley 2011).

All analyses for this study were conducted on a ThermoScientific *Quant'X* EDXRF spectrometer, located in the Geoarchaeological XRF Laboratory, Albuquerque, New Mexico, equipped with a thermoelectrically Peltier cooled solid-state Si(Li) X-ray detector, with a 50 kV, 50 W, ultra-high-flux end window bremsstrahlung, Rh target X-ray tube and a 76 µm (3 mil) beryllium (Be) window (air cooled), that runs on a power supply operating 4-50 kV/0.02-1.0 mA at 0.02 increments. The spectrometer is equipped with a 200 l min^{-1} Edwards vacuum pump, allowing for the analysis of lower-atomic-weight elements between sodium (Na) and titanium (Ti). Data acquisition is accomplished with a pulse processor and an analogue-to-digital converter.

Elemental composition is identified with digital filter background removal, least squares empirical peak deconvolution, gross peak intensities and net peak intensities above background.

The analysis for mid Zb condition elements Ti-Nb, Pb, Th, the x-ray tube is operated at 30 kV, using a 0.05 mm (medium) Pd primary beam filter in an air path at 100 seconds livetime to generate x-ray intensity Kα-line data for elements titanium (Ti), manganese (Mn), iron (as $Fe_2O_3^T$), cobalt (Co), nickel (Ni), copper, (Cu), zinc, (Zn), gallium (Ga), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), niobium (Nb), lead (Pb), and thorium (Th). Not all these elements are reported since their values in many volcanic rocks are very low. Trace element intensities were converted to concentration estimates by employing a least-squares calibration line ratioed to the Compton scatter 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). Line fitting is linear (XML) for all elements. Barium (Ba) is analyzed in the High Zb condition, the Rh tube is operated at 50 kV and up to 1.0 mA, ratioed to the bremsstrahlung region (see Davis 2011; Shackley 2011). Further details concerning the petrological choice of these elements in Southwest obsidians is available in Shackley (1988, 1995, 2005; also Mahood and Stimac 1991; and Hughes and Smith 1993). Nineteen specific pressed powder standards are used for the best fit regression calibration for elements Ti-Nb, Pb, Th, and Ba, include G-2 (basalt), AGV-2 (andesite), GSP-2 (granodiorite), SY-2 (syenite), BHVO-2 (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), NOD-A-1 and NOD-P-1 (manganese) all US Geological Survey standards, NIST-278 (obsidian), U.S. National Institute of Standards and Technology, BE-N

(basalt) from the Centre de Recherches Pétrographiques et Géochimiques in France, and JR-1 and JR-2 (obsidian) from the Geological Survey of Japan (Govindaraju 1994).

The data from the WinTrace software were translated directly into Excel for Windows and SPSS (ver. 21) and JMP 12.0.1 software for statistical manipulation. In order to evaluate these quantitative determinations, machine data were compared to measurements of known standards during each run. RGM-1 a USGS rhyolite standard is analyzed during each sample run for obsidian artifacts to check machine calibration (Table 1; see also Figures 1 and 2 here).

Discussion

Obsidian Paleoarchaic projectile points have been the focus of geoarchaeological research in the Great Basin for a number of years (Beck and Jones 2010, 2011; Hughes 2010; Jones et al. 2003; see cover image). Obsidian source provenance has been used to delineate Paleoarchaic procurement ranges and lithic conveyance zones in the Great Basin, and Southwest for decades (Beck and Jones 2010, 2011; Hughes 1994, 2010; Jones et al. 2003; Shackley 1989, 1996, 2005; Figures 2-5). While some of the earlier studies have documented relatively large distances from source to archaeological contexts, these data suggest a more limited lithic conveyance, except in a few cases (see Tables 1 and 2; Figures 4 and 5). What is conspicuous in this study is that many of the earliest projectile point forms, mainly Clovis, were produced from sources in the counties from which they were collected, somewhat divergent from the high residential mobility frequently evident in the Paleoindian period (Beck and Jones 2011; Shackley 1989, 1996, 2005; see Table 2 here). Admittedly, this is a relatively small sample compared to the Beck and Jones (2011) study with over 1000 samples. Still, this provenance examination indicates a relatively high level of movement and/or exchange during the Paleoarchaic period as seen in other Great Basin archaeological studies.

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Table 1. Elemental concentrations for the artifacts and USGS RGM-1 standard. Measurements in parts per million (ppm).

SAMPLE	Provenience	Ti	Mn	Fe	Zn	Rb	Sr	Y	Zr	Nb	Ba	Probable Source
JG11	unknown	1101	358	11345	87	100	46	53	140	16	1503	Cougar Mountain, Lake Co., OR
JG12	Esmeralda Co., NV	952	483	8703	55	183	71	23	94	17	279	Garfield Hills, Mineral Co., NV
JG13	Nye Co., NV	1035	375	8727	38	209	18	26	100	38	14	Crow Spring, Esmeralda Co., NV
JG14	Nye Co., NV	1097	344	8948	45	201	42	25	119	24	217	Sugarloaf Mtn-Coso, Inyo Co., CA
JG15	Esmeralda Co., NV	697	153	5413	15	0	20	4	18	1	0	not obsidian
JG16	Nye Co., NV	1892	287	16109	75	213	50	66	425	38	1568	Brown's Bench Area, ne NV, se ID,nw UT
JG17	Esmeralda Co., NV	950	539	8589	55	168	26	27	130	40	43	Queen, Mono Co., CA
JG18	Nye Co., NV	1558	339	11499	49	207	87	30	222	32	874	Coyote Spring, Washoe Co., NV
JG19	Esmeralda Co., NV	963	345	7819	31	158	27	19	86	25	42	Mt Hicks, Mineral Co., NV
JG20	Esmeralda Co., NV	1373	343	12701	44	161	100	18	186	16	1278	Casa Diablo (Lookout), Mono Co., CA
JG21	Nye Co., NV	1718	342	12475	49	163	128	21	205	15	1486	Casa Diablo (Lookout), Mono Co., CA
JG22	Nye Co., NV	1000	468	12134	78	204	142	35	169	28	785	Tempiute Mtn B, Lincoln Co., NV
JG23	Mineral Co., NV	1158	535	9120	65	169	28	27	134	38	39	Queen, Mono Co., CA
JG24	Esmeralda Co., NV	974	388	8459	39	213	14	20	102	32	14	Fish Springs, Inyo Co., CA
JG25	Esmeralda Co., NV	979	456	8796	48	181	72	20	100	17	290	Garfield Hills, Mineral Co., NV
JG26	Nye Co., NV	900	579	10103	64	363	10	49	107	47	0	Pink Butte, Nye Co.
JG27	Nye Co., NV	807	476	9056	54	327	11	48	110	37	0	Pink Butte, Nye Co.
JG28	Esmeralda Co., NV	1279	391	8880	45	133	215	11	103	15	1660	Cloverdale Canyon A, Nye Co., NV
JG29	Nye Co., NV	847	644	8251	51	209	17	37	95	42	0	Fish Springs, Inyo Co., CA
JG30	Nye Co., NV	1244	362	10817	45	153	133	21	165	20	1047	Obsidian Butte 5, Nye Co., NV
JG31	Nye Co., NV	1332	331	10644	55	148	125	28	168	9	1393	Obsidian Butte 5, Nye Co., NV
JG32	Inyo Co., CA	949	711	9030	59	218	17	32	101	41	0	Fish Springs, Inyo Co., CA
JG33	Esmeralda Co., NV	1247	375	10990	48	155	132	22	173	22	1069	Obsidian Butte 5, Nye Co., NV
JG34	Esmeralda Co., NV	1010	413	11400	84	189	123	33	163	28	829	Tempiute Mtn B, Lincoln Co., NV
JG35	Nye Co., NV	1260	361	10925	49	160	129	25	165	20	1051	Obsidian Butte 5, Nye Co., NV
JG36	Esmeralda Co., NV	861	297	10407	65	262	10	57	148	53	3	West Sugarloaf-Coso, Inyo Co., CA
DAW7	Mineral Co., NV	1376	280	11985	60	155	95	16	185	10	1245	Casa Diablo (Lookout), Mono Co., CA
DAW8	Washoe Co., NV	1201	618	9294	81	165	86	27	115	13	1269	Buffalo Hills, Washoe Co., NV

DAW9	Lake Co., OR	1595	291	13400	165	143	53	36	273	20	1146	Double O, Lake Co., OR
DAW10	Inyo Co., CA	1664	326	13541	65	168	136	24	207	15	1480	Casa Diablo (Sawmill), Mono Co., CA
DAW11	Nye Co., NV	1065	546	9100	65	171	25	30	136	40	23	Queen, Mono Co., CA
DAW12	Nye Co., NV	1454	322	12605	49	159	90	21	186	18	1323	Casa Diablo (Lookout), Mono Co., CA
EO8	Inyo Co., CA	926	651	8618	63	218	16	32	103	45	0	Fish Springs, Inyo Co., CA
EO9	Inyo Co., CA	3515	539	30128	334	122	440	26	131	18	1289	dacite?
EO10	Inyo Co., CA	1368	300	11716	44	147	92	20	186	19	1260	Casa Diablo (Lookout), Mono Co., CA
EO11	Inyo Co., CA	1043	377	8252	43	184	106	17	106	13	748	Bodie Hills North, Mono Co., CA
SAMPLE	**Provenience**	**Ti**	**Mn**	**Fe**	**Zn**	**Rb**	**Sr**	**Y**	**Zr**	**Nb**	**Ba**	**Probable Source**
EO12	Inyo Co., CA	832	307	10674	72	273	16	55	144	54	15	W Sugarloaf-Coso, Inyo Co., CA
EO13	Inyo Co., CA	721	283	9823	63	243	14	49	119	44	0	Sugarloaf Mtn-Coso, Inyo Co., CA
EO14	Inyo Co., CA	706	260	9424	78	300	10	68	119	68	0	W Cactus Pk-Coso, Inyo Co., CA
DEW6	Churchill Co., NV	1593	753	16660	152	218	13	92	599	34	0	Massacre Lake/Guano, Humboldt/Washoe Co., NV
DEW7	Esmeralda Co., NV	796	459	8750	44	322	15	48	110	40	0	Montezuma Range, Esmeralda Co., NV
DEW8	Elko Co., NV	1029	384	8524	40	163	34	16	89	25	51	Mt Hicks, Mineral Co., NV
DEW9	Nye Co., NV	838	525	9307	57	345	9	43	107	38	0	Montezuma Range, Esmeralda Co., NV
DEW10	Washoe Co., NV	928	437	9987	48	176	71	16	101	12	482	Garfield Hills, Mineral Co., NV
DEW11	Esmeralda Co., NV	1045	485	9980	82	177	24	34	148	33	14	Saline Range, Variety 1 (Queen Impostor), Inyo Co., CA
DS8	Elko Co., NV	1589	321	16336	80	239	32	66	369	47	829	Coal Bank Spring, Cassia Co., ID
DS9	Lincoln Co., NV	1051	450	11245	75	194	131	30	161	28	682	Tempiute Mtn B, Lincoln Co., NV
DS10	Nye Co., NV	881	541	9762	62	347	9	47	106	44	0	Montezuma Range, Esmeralda Co., NV
DS11	Lincoln Co., NV	978	423	11365	83	196	127	34	174	29	810	Tempiute Mtn B, Lincoln Co., NV
DS12	Lincoln Co., NV	1043	397	10363	65	181	120	35	159	30	828	Tempiute Mtn B, Lincoln Co., NV
DS13	Lincoln Co., NV	998	409	10775	80	191	131	30	159	30	761	Tempiute Mtn B, Lincoln Co., NV
RGM1-S4		1502	278	13225	46	143	107	26	219	11	832	standard
RGM1-S4		1551	286	13204	43	151	105	24	225	7	839	standard
RGM1-S4		1600	296	13182	41	148	106	26	223	7	830	standard
RGM-1 USGS		1619	280	12995	32	150	110	25	220	9	810	USGS mean recommended values

Table 2. Crosstabulation of Source by County level provenience.

			Provenience										
			Churchill Co., NV	Elko Co., NV	Esmeralda Co., NV	Inyo Co., CA	Lake Co., OR	Lincoln Co., NV	Mineral Co., NV	Nye Co., NV	unknown	Washoe Co., NV	Total
Source	Bodie Hills North, Mono Co., CA	Count	0	0	0	1	0	0	0	0	0	0	1
		% within Source	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	Brown's Bench Area, ne NV, se ID,nw UT	Count	0	0	0	0	0	0	0	1	0	0	1
		% within Source	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.3%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	2.0%
	Buffalo Hills, Washoe Co., NV	Count	0	0	0	0	0	0	0	0	0	1	1
		% within Source	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	2.0%
	Casa Diablo (Lookout), Mono Co., CA	Count	0	0	1	1	0	0	1	2	0	0	5
		% within Source	0.0%	0.0%	20.0%	20.0%	0.0%	0.0%	20.0%	40.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	8.3%	12.5%	0.0%	0.0%	50.0%	12.5%	0.0%	0.0%	10.2%
		% of Total	0.0%	0.0%	2.0%	2.0%	0.0%	0.0%	2.0%	4.1%	0.0%	0.0%	10.2%
	Casa Diablo (Sawmill), Mono Co., CA	Count	0	0	0	1	0	0	0	0	0	0	1
		% within Source	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	Cloverdale Canyon A, Nye Co., NV	Count	0	0	1	0	0	0	0	0	0	0	1
		% within Source	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	Coal Bank Spring, Cassia Co., ID	Count	0	1	0	0	0	0	0	0	0	0	1
		% within Source	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	Cougar Mountain, Lake Co., OR	Count	0	0	0	0	0	0	0	0	1	0	1
		% within Source	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	2.0%
	Coyote Spring, Washoe Co., NV	Count	0	0	0	0	0	0	0	1	0	0	1
		% within Source	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.3%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	2.0%
	Crow Spring, Esmeralda Co., NV	Count	0	0	0	0	0	0	0	1	0	0	1
		% within Source	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.3%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	2.0%
	Double O, Lake Co., OR	Count	0	0	0	0	1	0	0	0	0	0	1
		% within Source	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	Fish Springs, Inyo Co., CA	Count	0	0	1	2	0	0	0	1	0	0	4
		% within Source	0.0%	0.0%	25.0%	50.0%	0.0%	0.0%	0.0%	25.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	8.3%	25.0%	0.0%	0.0%	0.0%	6.3%	0.0%	0.0%	8.2%
		% of Total	0.0%	0.0%	2.0%	4.1%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	8.2%
	Garfield Hills, Mineral Co., NV	Count	0	0	2	0	0	0	0	0	0	1	3
		% within Source	0.0%	0.0%	66.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	33.3%	100.0%
		% within Provenience	0.0%	0.0%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	50.0%	6.1%
		% of Total	0.0%	0.0%	4.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	6.1%
	Massacre Lake/Guano, Humboldt/Washoe Co., NV	Count	1	0	0	0	0	0	0	0	0	0	1
		% within Source	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	Montezuma Range, Esmeralda Co., NV	Count	0	0	1	0	0	0	0	2	0	0	3
		% within Source	0.0%	0.0%	33.3%	0.0%	0.0%	0.0%	0.0%	66.7%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	8.3%	0.0%	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%	6.1%
		% of Total	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	4.1%	0.0%	0.0%	6.1%
	Mt Hicks, Mineral Co., NV	Count	0	1	1	0	0	0	0	0	0	0	2
		% within Source	0.0%	50.0%	50.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	50.0%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.1%
		% of Total	0.0%	2.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.1%
	Obsidian Butte 5, Nye Co., NV	Count	0	0	1	0	0	0	0	3	0	0	4
		% within Source	0.0%	0.0%	25.0%	0.0%	0.0%	0.0%	0.0%	75.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	8.3%	0.0%	0.0%	0.0%	0.0%	18.8%	0.0%	0.0%	8.2%
		% of Total	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	6.1%	0.0%	0.0%	8.2%
	Pink Butte, Nye Co.	Count	0	0	0	0	0	0	0	2	0	0	2
		% within Source	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%	4.1%
		% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.1%	0.0%	0.0%	4.1%
	Queen, Mono Co., CA	Count	0	0	1	0	0	0	1	1	0	0	3
		% within Source	0.0%	0.0%	33.3%	0.0%	0.0%	0.0%	33.3%	33.3%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	8.3%	0.0%	0.0%	0.0%	50.0%	6.3%	0.0%	0.0%	6.1%
		% of Total	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	2.0%	2.0%	0.0%	0.0%	6.1%
	Saline Range, Variety 1 (Queen Impostor), Inyo Co., CA	Count	0	0	1	0	0	0	0	0	0	0	1
		% within Source	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	Sugarloaf Mtn-Coso, Inyo Co., CA	Count	0	0	0	1	0	0	0	1	0	0	2
		% within Source	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	0.0%	50.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%	0.0%	6.3%	0.0%	0.0%	4.1%
		% of Total	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	4.1%
	Tempiute Mtn B, Lincoln Co., NV	Count	0	0	1	0	0	4	0	1	0	0	6
		% within Source	0.0%	0.0%	16.7%	0.0%	0.0%	66.7%	0.0%	16.7%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	8.3%	0.0%	0.0%	100.0%	0.0%	6.3%	0.0%	0.0%	12.2%
		% of Total	0.0%	0.0%	2.0%	0.0%	0.0%	8.2%	0.0%	2.0%	0.0%	0.0%	12.2%
	W Cactus Pk-Coso, Inyo Co., CA	Count	0	0	0	1	0	0	0	0	0	0	1
		% within Source	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	W Sugarloaf-Coso, Inyo Co., CA	Count	0	0	0	1	0	0	0	0	0	0	1
		% within Source	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	0.0%	12.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
	West Sugarloaf-Coso, Inyo Co., CA	Count	0	0	1	0	0	0	0	0	0	0	1
		% within Source	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
		% within Provenience	0.0%	0.0%	8.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
		% of Total	0.0%	0.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%
Total		Count	1	2	12	8	1	4	2	16	1	2	49
		% within Source	2.0%	4.1%	24.5%	16.3%	2.0%	8.2%	4.1%	32.7%	2.0%	4.1%	100.0%
		% within Provenience	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	2.0%	4.1%	24.5%	16.3%	2.0%	8.2%	4.1%	32.7%	2.0%	4.1%	100.0%

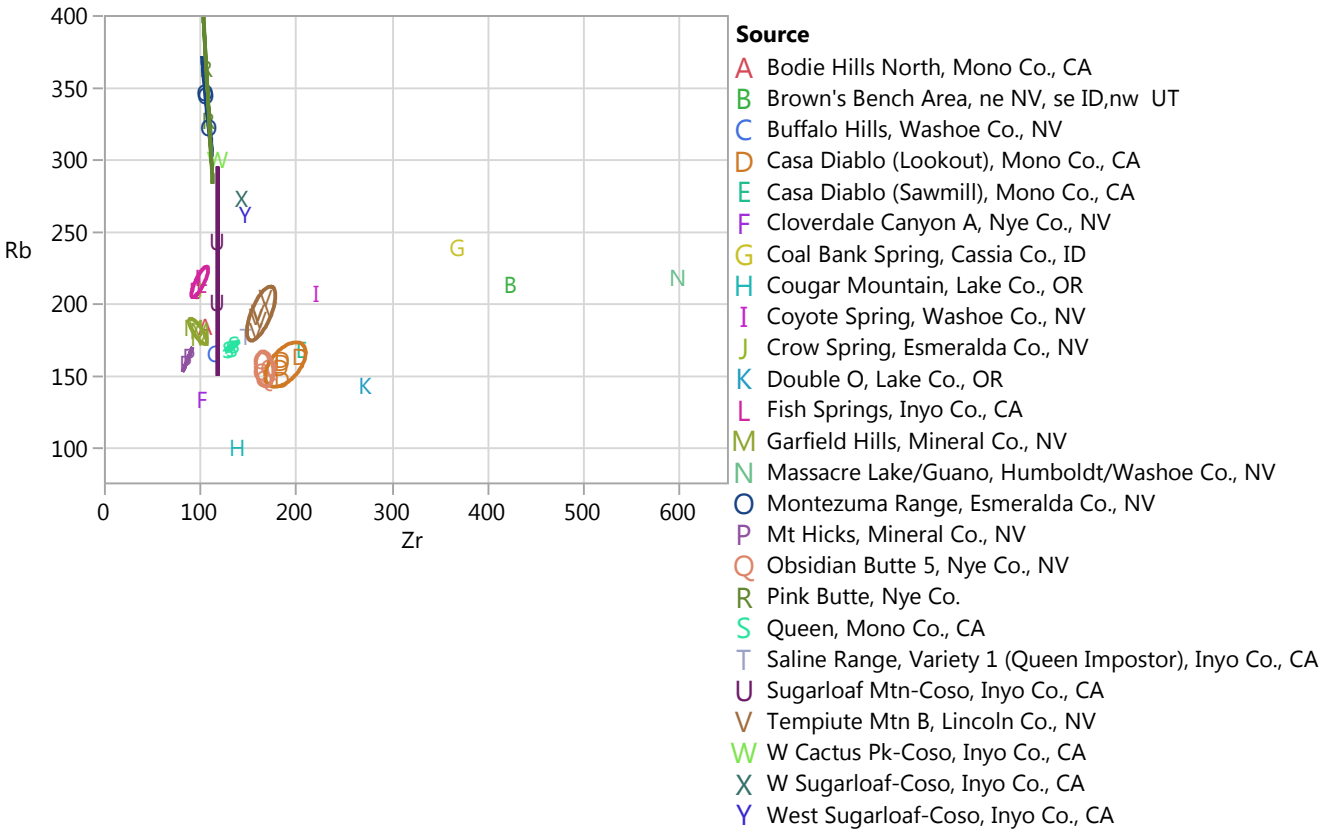

Figure 1. Zr versus Rb bivariate plot of the archaeological specimens from data in Table 1. Confidence ellipses at 95%.

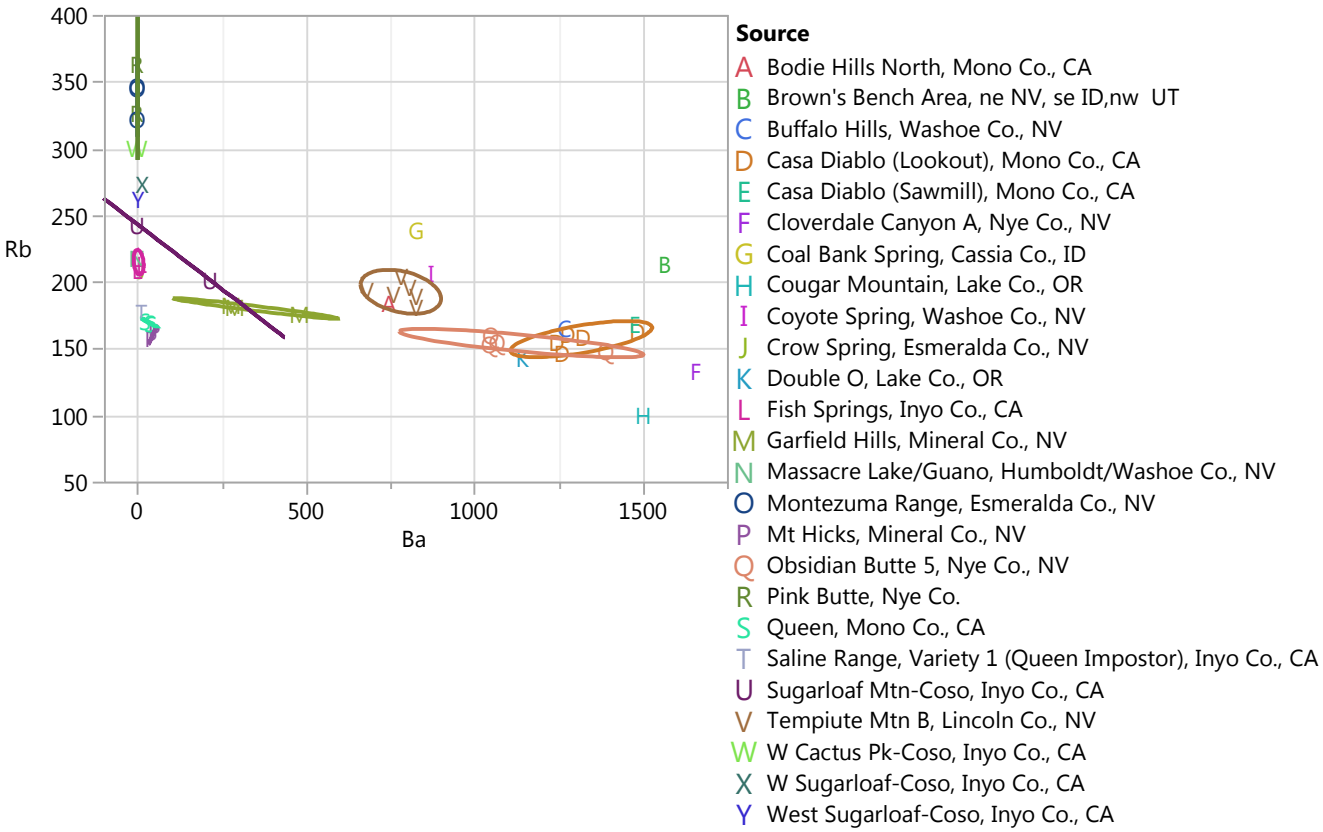

Figure 2. Ba versus Rb bivariate plot of the archaeological specimens from data in Table 1. Confidence ellipses at 95%.

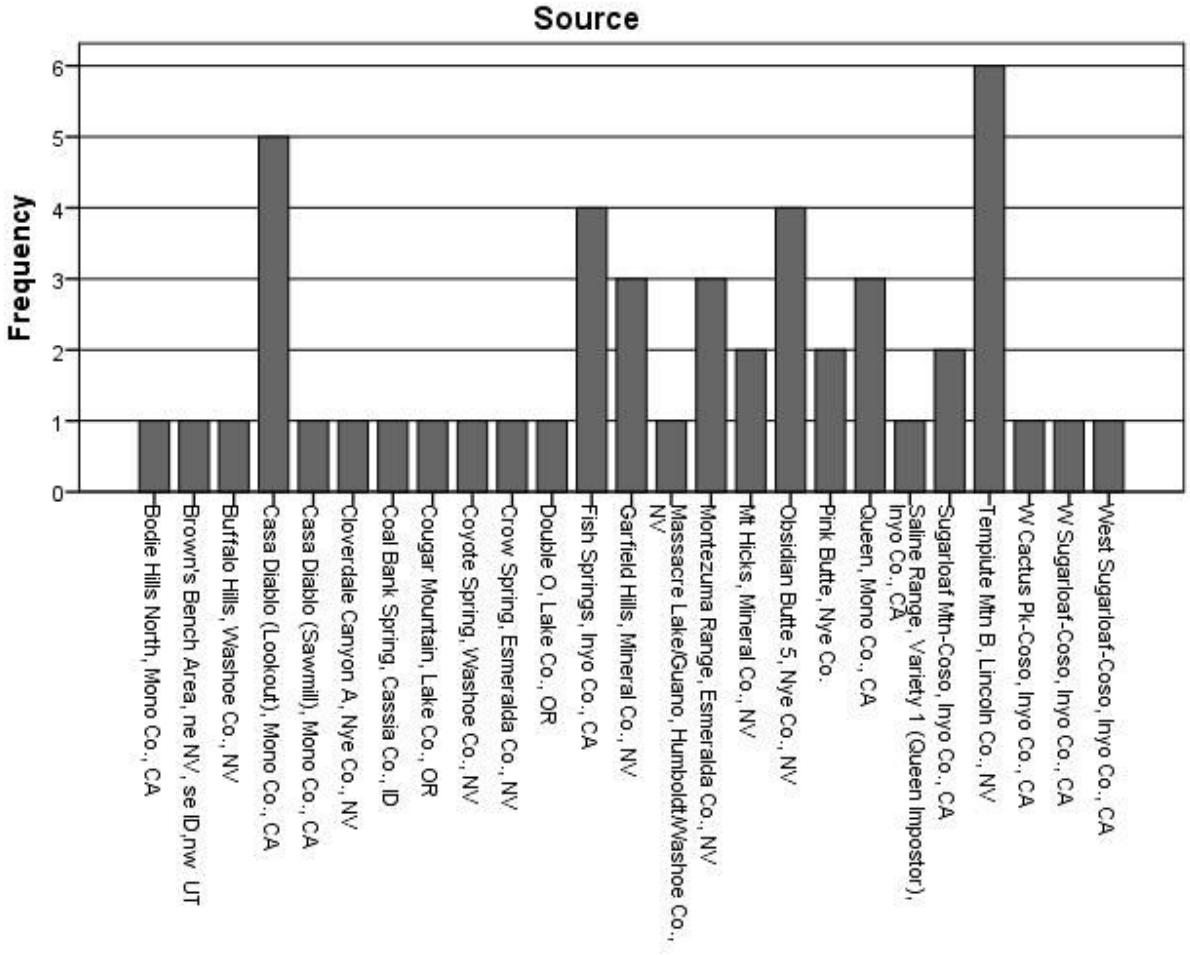

Figure 3. Frequency distribution of obsidian source provenance.

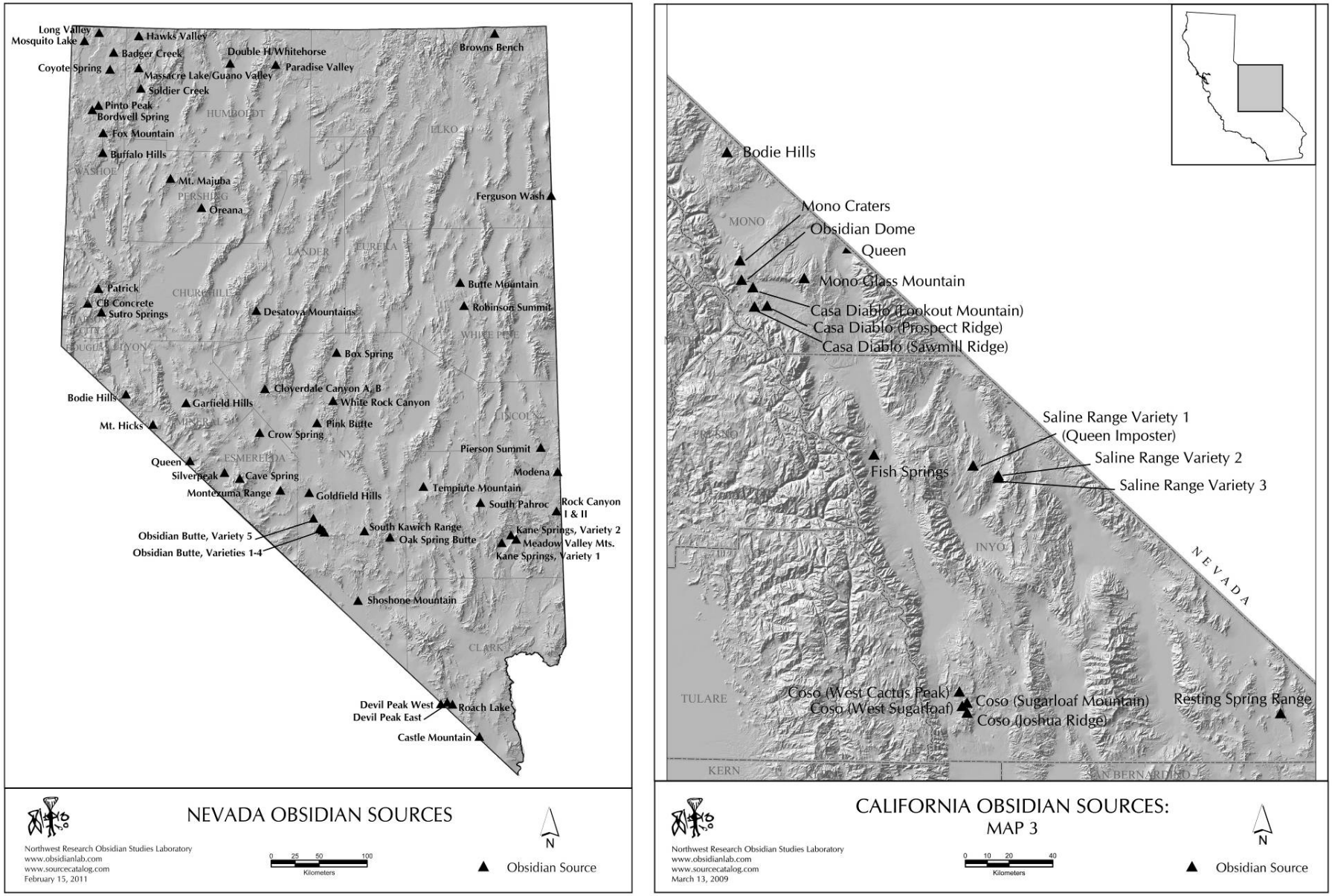

Figure 4. Obsidian sources present in this study in Nevada and southeastern California (from http://www.sourcecatalog.com/sourcecatalog/s_home.html)

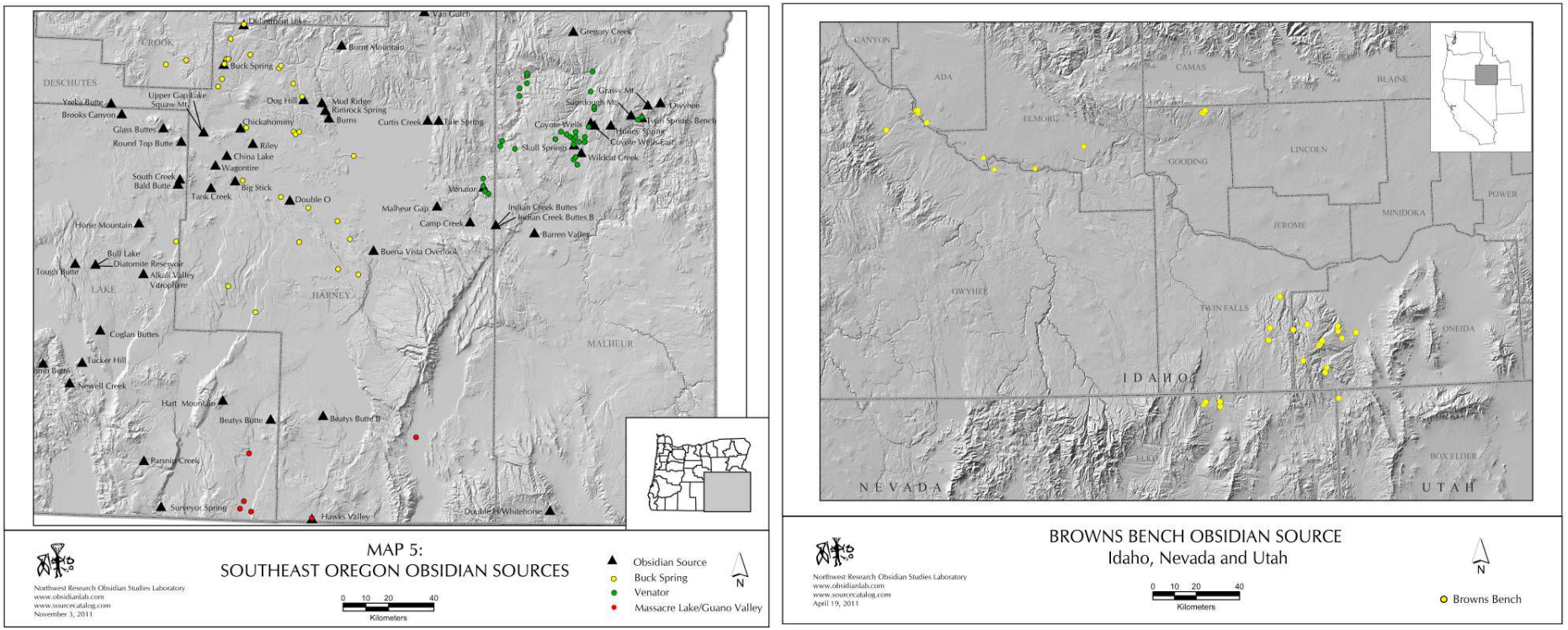

Figure 5. Obsidian sources present in this study in southeast Oregon and the distribution of Brown's Bench chemical group (from http://www.sourcecatalog.com/sourcecatalog/s_home.html)