Title
Source Provenance of Obsidian Artifacts from Las Colinas (AZ T:12:10 ASM) in the Lower Salt River Valley, Arizona

Authors
Shackley, M. Steven
Bardolph, Dana
Luu, Cuong

Publication Date
2006-08-24

Supplemental Material
https://escholarship.org/uc/item/77z78039#supplemental

Data Availability
The data associated with this publication are in the supplemental files.

BERKELEY ARCHAEOLOGICAL
XRF LAB

Department of Anthropology

232 Kroeber Hall
University of California
Berkeley, CA 94720-3710

SOURCE PROVENANCE OF OBSIDIAN ARTIFACTS FROM LAS COLINAS (AZ T:12:10 ASM) IN THE LOWER SALT RIVER VALLEY, ARIZONA

by

M. Steven Shackley
Professor and Director
Archaeological XRF Laboratory
University of California, Berkeley

Cuong Luu and Dana Bardolph
Undergraduate Research Assistants

Report Prepared for

Craig Fertelmes
Arizona State University

24 August 2006

INTRODUCTION

The analysis here of 179 obsidian artifacts from pre-classic Hohokam contexts at Las Colinas indicates a mix of source provenance typical of Lower Salt River Valley sites from this time period with sources in the Sonoran Desert and the Coconino Plateau dominating (see Shackley 2005). Superior, the nearest source to this site and others in the valley is nearly absent, typical of the Lower Salt area in the Colonial and Sedentary periods.

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). Weight percent iron ($Fe_2O_3^T$) can be derived by multiplying ppm estimates by 1.4297(10-4). 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 Southwest obsidians is available in Shackley (1992, 1995, 2003; 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 reported here.

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 nomenclature follows Shackley (1988, 1995, 1998, 2005). 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 Figures 1 and 2).

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). It is likely that at least some, if not all those sources that could not be assigned to source ("unknown") could be from known sources, but the elemental concentrations are too low to confidently assign to source. Similarly, some of the source assignments are just outside the source standard elemental concentrations, and cannot be as confidently assigned to source. It is also possible that at least some of the samples that could not be assigned to source (called "unknown" here) are actually from known sources. Nevertheless, the general pattern seems consistent with pre-classic obsidian source provenance in the Lower Salt River Valley.

DISCUSSION

Recent research of pre-Classic Hohokam obsidian procurement indicates that three of the "tool traditions" elucidated by Hoffman (1997) produced obsidian artifacts from very different sources (Shackley 2005). In the "Solares Tool Tradition" area that includes those pre-Classic sites along the Lower Salt River and surrounding areas, obsidian projectile points and other artifacts were produced from a nearly even mix of Sonoran Desert (relatively local) and Coconino Plateau (Government Mountain, RS Hill, Partridge Creek) sources. Indeed, some of the projectile point types were nearly identical to those produced on the Plateau, and were all produced from Government Mountain obsidian (Shackley 2005:167-168).

The larger sample here elucidates a more diverse source provenance assemblage than some of the other Lower Salt sites including a few sources from the Mogollon region (Mule Creek and Gwynn/Ewe Canyon), as well as the "local" Sonoran Desert and Coconino Plateau sources (see Table 2 and Figure 3). The Sonoran Desert sources contributed 65.5% while the Coconino Plateau sources contributed 32.2%, the latter still much greater than Classic sites in the Lower Salt, and other pre-classic sites along the Middle Gila or Lower Gila River valleys (i.e. Snaketown, Gatlin, etc.). Again, the obsidian source assemblages from Lower Salt sites indicate a relationship with contemporaneous Coconino Plateau groups to a much greater extent than

Hohokam living in sites in the Middle and Lower Gila River Valleys. Superior (Picketpost Mountain) obsidian, which is the nearest source to Las Colinas, is represented here by only four artifacts, while at Snaketown and other sites along the Middle Gila, Superior dominates the obsidian source provenance assemblage (Shackley 2005). If exchange was the primary mode through which obsidian raw material and finished tools moved through the Hohokam core area, Las Colinas exchanged more obsidian with the Plateau than other Hohokam, at least those living along the Middle Gila. The Las Colinas project here adds additional confirmation to the current model.

REFERENCES CITED

Davis, M.K., T.L. Jackson, M.S. Shackley, T. Teague, and J. Hampel
1998 Factors Affecting the Energy-Dispersive X-Ray Fluorescence (EDXRF) Analysis of Archaeological Obsidian. In *Archaeological Obsidian Studies: Method and Theory*, edited by M.S. Shackley, pp. 159-180. Springer/Plenum Press, New York.

Govindaraju, K.
1994 1994 Compilation of Working Values and Sample Description for 383 Geostandards. *Geostandards Newsletter* 18 (special issue).

Hampel, Joachim H.
1984 Technical Considerations in X-ray Fluorescence Analysis of Obsidian. In *Obsidian Studies in the Great Basin*, edited by R.E. Hughes, pp. 21-25. Contributions of the University of California Archaeological Research Facility 45. Berkeley.

Hildreth, W.
1981 Gradients in Silicic Magma Chambers: Implications for Lithospheric Magmatism. *Journal of Geophysical Research* 86:10153-10192.

Hoffman, C.M.
1997 *Alliance Formation and Social Interaction During the Sedentary Period: A Stylistic Analysis of Hohokam Arrowpoints.* Ph.D. dissertation, Arizona State University. University Microfilms, Ann Arbor.

Hughes, Richard E., and Robert L. Smith
1993 Archaeology, Geology, and Geochemistry in Obsidian Provenance Studies. *In Scale on Archaeological and Geoscientific Perspectives*, edited by J.K. Stein and A.R. Linse, pp. 79-91. Geological Society of America Special Paper 283.

Mahood, Gail A., and James A. Stimac
1990 Trace-Element Partitioning in Pantellerites and Trachytes. *Geochemica et Cosmochimica Acta* 54:2257-2276.

McCarthy, J.J., and F.H. Schamber
1981 Least-Squares Fit with Digital Filter: A Status Report. In *Energy Dispersive X-ray Spectrometry*, edited by K.F.J. Heinrich, D.E. Newbury, R.L. Myklebust, and C.E. Fiori, pp. 273-296. National Bureau of Standards Special Publication 604, Washington, D.C.

Schamber, F.H.
1977 A Modification of the Linear Least-Squares Fitting Method which Provides Continuum Suppression. In *X-ray Fluorescence Analysis of Environmental Samples*, edited by T.G. Dzubay, pp. 241-257. Ann Arbor Science Publishers.

Shackley, M. Steven
1988 Sources of Archaeological Obsidian in the Southwest: An Archaeological, Petrological, and Geochemical Study. *American Antiquity* 53(4):752-772.

1990 *Early Hunter-Gatherer Procurement Ranges in the Southwest: Evidence from Obsidian Geochemistry and Lithic Technology*. Ph.D. dissertation, Arizona State University, Tempe.

1992 The Upper Gila River Gravels as an Archaeological Obsidian Source Region: Implications for Models of Exchange and Interaction. *Geoarchaeology* 7:315-326.

1995 Sources of Archaeological Obsidian in the Greater American Southwest: An Update and Quantitative Analysis. *American Antiquity* 60(3):531-551.

1998 Intrasource Chemical Variability and Secondary Depositional Processes: Lessons from the American Southwest. In *Archaeological Obsidian Studies: Method and Theory*, edited by M.S. Shackley, pp. 83-102. Advances in Archaeological and Museum Science 3. Springer Publishing, Berlin and New York.

2005 *Obsidian: Geology and Archaeology in the North American Southwest*. University of Arizona Press, Tucson.

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	Probable Source[1]
3-1165	875	699	5215	118	20	23	47	55	unknown
3-1256	1079	410	6678	130	38	19	118	28	Vulture
3-1832A	2193	357	7813	117	94	27	165	6	too small
3-1832B	1155	276	9889	186	13	37	162	26	Gwynn/Ewe Cnyn
3-2192A	767	594	8568	107	82	15	79	49	Government Mtn
3-2192B	905	405	6194	120	49	11	109	22	Vulture
3-2585	972	255	11550	249	11	65	225	28	Los Vidrios
3-2710A	1526	417	8727	153	81	23	171	21	Sauceda Mts
3-2710B	1210	460	6619	122	38	4	104	16	too small
3-2753	1484	452	9224	151	74	23	184	22	Sauceda Mts
3-2769	1354	423	6995	124	38	14	119	22	Vulture
3-2780	795	309	5410	100	40	13	101	28	Vulture
3-2798	1411	463	9918	166	77	31	194	19	Sauceda Mts
3-2819	985	193	9817	216	16	66	199	23	Los Vidrios
3-2873	1841	390	8053	131	69	37	168	21	Sauceda Mts
3-2896	1345	360	9007	147	69	32	193	21	Sauceda Mts
3-2905	1557	400	9147	130	65	32	180	28	Sauceda Mts
3-3373	1274	617	8165	103	73	17	68	56	Government Mtn
3-3504A	1286	424	9034	151	69	32	196	23	Sauceda Mts
3-3504B	1404	394	9363	156	69	24	203	20	Sauceda Mts
3-3504C	1308	380	8720	137	66	30	183	7	Sauceda Mts
3-3518A	1219	270	10377	205	18	59	195	13	Los Vidrios
3-3518B	1759	434	10243	154	66	37	186	22	Sauceda Mts
3-3558	1637	252	7257	99	71	31	133	16	Sauceda Mts
3-3609	1408	407	10004	161	77	34	208	17	Sauceda Mts
3-3643A	1387	507	7944	145	50	25	120	13	too small
3-3643B	2642	319	10156	79	148	18	131	19	Presley Wash
3-3930	900	529	8121	234	10	35	85	49	Partridge Cr
3-3984	1431	454	9302	164	77	33	205	28	Sauceda Mts
3-4033	820	575	4842	109	28	17	63	56	too small
3-5041	1399	584	5922	107	14	18	83	27	Superior
3-5168	1084	377	7375	139	44	13	130	18	Vulture
3-5523	1188	301	5908	112	35	17	107	30	Vulture
3-5531A	1497	396	10068	163	74	34	206	33	Sauceda Mts
3-5531B	1366	428	9213	159	71	32	199	28	Sauceda Mts
3-5531C	1048	379	6719	132	40	14	121	20	Vulture
3-5531D	949	205	10676	227	12	61	212	20	Los Vidrios
3-5531E	1148	444	7179	135	42	21	121	33	Vulture
3-5531F	1399	421	10141	159	73	30	185	30	Sauceda Mts
3-5652	1204	384	6101	191	10	16	72	50	Bull Cr
3-580A	1391	383	9153	154	76	28	195	31	Sauceda Mts
3-580B	1671	429	9492	156	71	32	192	31	Sauceda Mts
3-580C	2539	221	7931	120	23	36	104	0	Superior
3-580D	1646	276	9258	194	11	43	147	29	too small
3-5908	1360	431	9953	170	74	25	212	35	Sauceda Mts
3-5912	1407	449	9494	147	68	34	174	20	Sauceda Mts
3-5958A	1001	219	10884	229	16	64	211	26	Los Vidrios
3-5958B	1181	318	12468	238	14	74	219	29	Los Vidrios
3-5958C	1314	423	9198	149	79	23	182	21	Sauceda Mts
3-5958D	2025	395	8736	133	67	40	154	17	Sauceda Mts

Sample	Ti	Mn	Fe	Rb	Sr	Y	Zr	Nb	Source
3-5958E	1629	253	11936	220	20	58	184	29	Los Vidrios
3-602	1981	410	9224	146	69	19	164	32	Sauceda Mts
3-6130A	1398	358	8565	146	70	32	188	20	Sauceda Mts
3-6130B	2669	398	9250	160	75	26	193	36	Sauceda Mts
3-6130C	1335	435	8964	155	75	33	191	30	Sauceda Mts
3-6130D	1021	212	10238	204	11	61	189	19	Los Vidrios
3-6130E	1054	240	11046	228	10	63	208	34	Los Vidrios
3-6130F	1869	491	10030	147	66	34	175	22	Sauceda Mts
3-6130G	1654	475	9205	145	64	30	169	18	Sauceda Mts
3-6130H	956	267	11359	243	11	69	220	34	Los Vidrios
3-6130I	924	238	10434	218	16	61	210	21	Los Vidrios
3-6130J	950	189	9733	202	9	61	190	33	Los Vidrios
3-6130K	1462	432	9285	149	66	30	181	26	Sauceda Mts
3-6130L	986	304	11193	220	20	63	199	23	Los Vidrios
3-6130M	1275	450	8286	132	67	17	181	16	Sauceda Mts
3-6130N	901	250	10730	211	12	60	191	21	Los Vidrios
3-6130O	1036	243	11966	246	13	74	237	29	Los Vidrios
3-6130P	1495	460	9841	164	80	33	214	26	Sauceda Mts
3-6138	2005	497	8870	128	53	24	146	13	Vulture
3-6144A	1476	394	9122	153	74	30	193	20	Sauceda Mts
3-6144B	1234	321	8125	141	67	33	165	26	Sauceda Mts
3-6144C	1016	246	12214	245	23	69	229	37	Los Vidrios
3-6144D	1212	444	9257	155	76	32	194	14	Sauceda Mts
3-6144E	1471	416	8961	140	71	23	183	23	Sauceda Mts
3-6144F	1043	247	10771	231	13	68	211	35	Los Vidrios
3-6144G	1287	411	9330	157	71	31	197	21	Sauceda Mts
3-6144H	1549	549	10471	169	73	32	202	27	Sauceda Mts
3-6144I	2190	479	10959	164	67	24	187	18	Sauceda Mts
3-6206A	934	194	10748	228	12	60	214	34	Los Vidrios
3-6206B	900	208	11254	226	15	66	214	33	Los Vidrios
3-6206C	932	253	10513	227	13	66	214	30	Los Vidrios
3-6206D	1767	311	17431	192	69	74	196	23	Sauceda Mts
3-6206E	964	193	10525	224	19	57	204	30	Los Vidrios
3-6206F	1567	423	8973	149	73	34	201	26	Sauceda Mts
3-6206G	838	199	9891	216	12	66	211	31	Los Vidrios
3-6206H	963	237	11967	241	13	65	221	32	Los Vidrios
3-6206I	1499	410	10052	161	78	31	197	16	Sauceda Mts
3-6206J	1221	222	7240	148	7	34	158	26	unknown
3-6206K	1793	440	8653	139	60	19	171	22	Sauceda Mts
3-6206L	1874	403	9176	147	64	17	187	22	Sauceda Mts
3-6273	769	518	7418	97	76	17	67	59	Government Mtn
3-6282A	938	260	11013	233	11	63	214	34	Los Vidrios
3-6282B	1386	380	8806	153	72	32	182	33	Sauceda Mts
3-839A	1844	548	11388	186	88	35	188	26	Sauceda Mts
3-839B	1698	401	8803	142	59	22	172	12	Sauceda Mts
4-1234	1318	484	6444	74	59	16	60	27	Government Mtn
4-1597A	740	459	8677	364	10	80	160	250	RS Hill/Sitgreaves
4-1597B	648	466	7650	321	12	72	144	220	RS Hill/Sitgreaves
4-1619	1238	411	6697	271	12	65	114	206	RS Hill/Sitgreaves
4-1623	749	582	7435	94	72	12	79	52	Government Mtn
4-1626	795	465	8240	335	9	82	154	248	RS Hill/Sitgreaves
4-1707	796	595	8216	111	75	21	70	54	Government Mtn
4-1995A	740	412	7707	322	15	76	142	240	RS Hill/Sitgreaves
Sample	Ti	Mn	Fe	Rb	Sr	Y	Zr	Nb	Source

4-1995B	939	342	5918	79	59	20	51	54	too small
4-2121	1300	502	9056	368	6	70	149	227	RS Hill/Sitgreaves
4-2125	922	517	7149	88	71	17	63	42	Government Mtn
4-2138	756	488	8819	368	14	92	160	256	RS Hill/Sitgreaves
4-2342	717	437	6468	83	51	3	63	35	Government Mtn
4-2853	859	515	9916	385	8	81	147	251	RS Hill/Sitgreaves
4-3090	786	615	8290	108	83	17	79	46	Government Mtn
4-3178A	982	561	7821	91	77	19	69	41	Government Mtn
4-3178B	772	635	8303	102	77	12	77	52	Government Mtn
4-3178C	1130	674	8014	79	67	12	71	50	Government Mtn
4-3185	648	617	8018	103	82	17	77	57	Government Mtn
4-3221	781	593	7985	99	79	14	76	45	Government Mtn
4-3266	720	629	8849	113	82	10	85	55	Government Mtn
4-3306	780	548	7451	99	75	19	77	57	Government Mtn
4-3339	699	570	7487	100	75	22	78	48	Government Mtn
4-3354	838	659	8718	115	80	13	76	53	Government Mtn
4-3482	894	449	8013	333	8	70	143	231	RS Hill/Sitgreaves
4-3484A	1015	400	6615	131	39	12	124	25	Vulture
4-3484B	1125	447	7060	135	39	17	132	27	Vulture
4-3515	1327	370	9092	158	76	33	196	25	Sauceda Mts
4-3537	927	612	8593	115	73	8	73	59	Government Mtn
4-362	1086	586	6655	112	19	23	89	37	Superior
4-3963A	1687	618	7851	103	71	5	70	48	Government Mtn
4-3963B	790	504	8908	380	9	92	163	267	RS Hill/Sitgreaves
4-4065	884	562	11749	231	12	3	98	49	Partridge Cr
4-4077	1202	658	6457	331	13	58	94	105	Mule Cr/N Sawmill Cr
4-4436	965	415	8286	227	22	48	104	22	Partridge Cr
4-5390	1474	415	9742	149	80	25	187	23	Sauceda Mts
4-5396	1489	449	7237	121	43	24	122	29	Vulture
4-5398A	1009	371	5798	115	38	11	104	13	Vulture
4-5398B	1426	322	5173	79	23	10	79	14	too small
4-5448	774	624	7481	95	71	19	70	59	Government Mtn
4-5490	1049	442	6868	125	45	16	112	29	Vulture
4-6000	1096	614	8256	97	74	13	78	50	Government Mtn
4-6244A	791	592	7512	100	80	14	66	51	Government Mtn
4-6244B	648	395	7159	275	7	78	129	211	RS Hill/Sitgreaves
4-6346	1196	466	7655	138	54	14	120	23	Vulture
4-964	993	312	7460	267	15	66	127	221	RS Hill/Sitgreaves
4-969	726	502	7308	94	78	11	67	48	Government Mtn
4-997	740	546	7632	99	78	16	79	60	Government Mtn
5-1055	746	536	7127	97	73	10	67	55	Government Mtn
5-1236	1003	333	5954	110	33	13	102	39	Vulture
5-1282	1163	388	6358	117	36	7	125	23	Vulture
5-1294	1025	264	5886	99	36	21	106	20	too small
5-1866	1238	451	6718	112	37	26	113	20	Vulture
5-2756	1038	362	6403	121	37	11	110	23	Vulture
5-2862A	1230	431	7114	128	33	25	105	15	Vulture
5-2862B	1645	395	6672	118	35	6	112	21	Vulture
5-2870	748	522	7926	107	72	18	71	49	Government Mtn
5-2958	795	396	7919	340	9	82	148	233	RS Hill/Sitgreaves
5-3027	761	428	8376	352	11	81	158	248	RS Hill/Sitgreaves
5-3222	1700	423	7180	125	37	26	118	23	Vulture
5-3234	1089	728	8955	119	74	21	73	64	Government Mtn
Sample	Ti	Mn	Fe	Rb	Sr	Y	Zr	Nb	Source

5-3277A	815	462	7484	237	5	37	88	53	Partridge Cr
5-3277B	1163	403	6519	111	39	22	110	16	Vulture
5-3277C	1300	749	8579	107	75	17	69	44	Government Mtn
5-3277D	1445	388	7003	132	41	22	119	16	Vulture
5-5644	1784	264	6921	97	62	7	96	3	Government Mtn
5-5659	666	434	7431	294	8	82	130	219	RS Hill/Sitgreaves
5-847	1004	414	6502	131	41	17	126	28	Vulture
7-1377	802	515	7830	233	9	45	93	55	Partridge Cr
7-1885	1257	446	8049	149	48	15	138	27	Vulture
7-1973	1359	664	6495	122	18	18	83	30	Superior
7-2107	1252	403	6936	126	36	9	122	24	Vulture
7-2114	1723	361	6931	108	37	20	112	25	Vulture
7-2161	1087	412	7163	137	38	15	129	13	Vulture
7-2245	2129	427	6368	105	31	4	80	29	Vulture
7-2471	2087	297	7570	118	53	20	127	11	Vulture
72711A	1171	352	6541	126	36	17	120	24	Vulture
72711B	1027	437	6641	128	36	9	122	5	Vulture
7-2820	827	480	7354	95	75	17	76	58	Government Mtn
7-3174	846	659	7759	104	74	20	76	62	Government Mtn
7-511	1183	416	6604	89	66	11	67	33	Government Mtn
7-698	1152	496	7024	84	74	5	61	43	Government Mtn
7-7364	1214	241	9723	200	7	66	192	27	Los Vidrios
7-7654	788	195	9901	207	12	64	200	32	Los Vidrios
RGM1-S1	1756	301	13071	145	110	20	221	5	standard
RGM1-S1	1660	308	13109	153	110	18	224	12	standard
RGM1-S1	1670	298	13167	147	113	21	213	3	standard
RGM1-S1	1542	281	13130	142	113	22	218	4	standard
RGM1-S1	1580	339	13052	145	108	16	219	0	standard
RGM1-S1	1596	298	13153	144	108	27	217	15	standard
RGM1-S1	1628	299	13198	150	111	16	222	7	standard
RGM1-S1	1483	318	13126	146	109	18	218	8	standard
RGM1-S1	1626	326	13234	150	108	26	220	9	standard
RGM-S1	1599	323	13067	142	108	18	218	7	standard

[1] Some of the samples were quite small and below the recommended sample size for effective analysis (see Davis et al. 1998). While attempts were made to work with these samples, it was not always possible, and some of the elemental concentrations reported here are slightly outside the range of reported source standards (see Shackley 1995, 2005).

Table 2. Ranked frequency distribution of obsidian source provenance in late period contexts at Las Colinas.

		Frequency	Percent
Source	Sauceda Mts	48	28.1
	Government Mtn	34	19.9
	Vulture	33	19.3
	Los Vidrios	26	15.2
	RS Hill/Sitgreaves	15	8.8
	Partridge Cr	5	2.9
	Superior	4	2.3
	unknown	2	1.2
	Presley Wash	1	.6
	Bull Cr	1	.6
	Gwynn/Ewe Cnyn	1	.6
	Mule Cr/N Sawmill Cr	1	.6
	Total	171	100.0

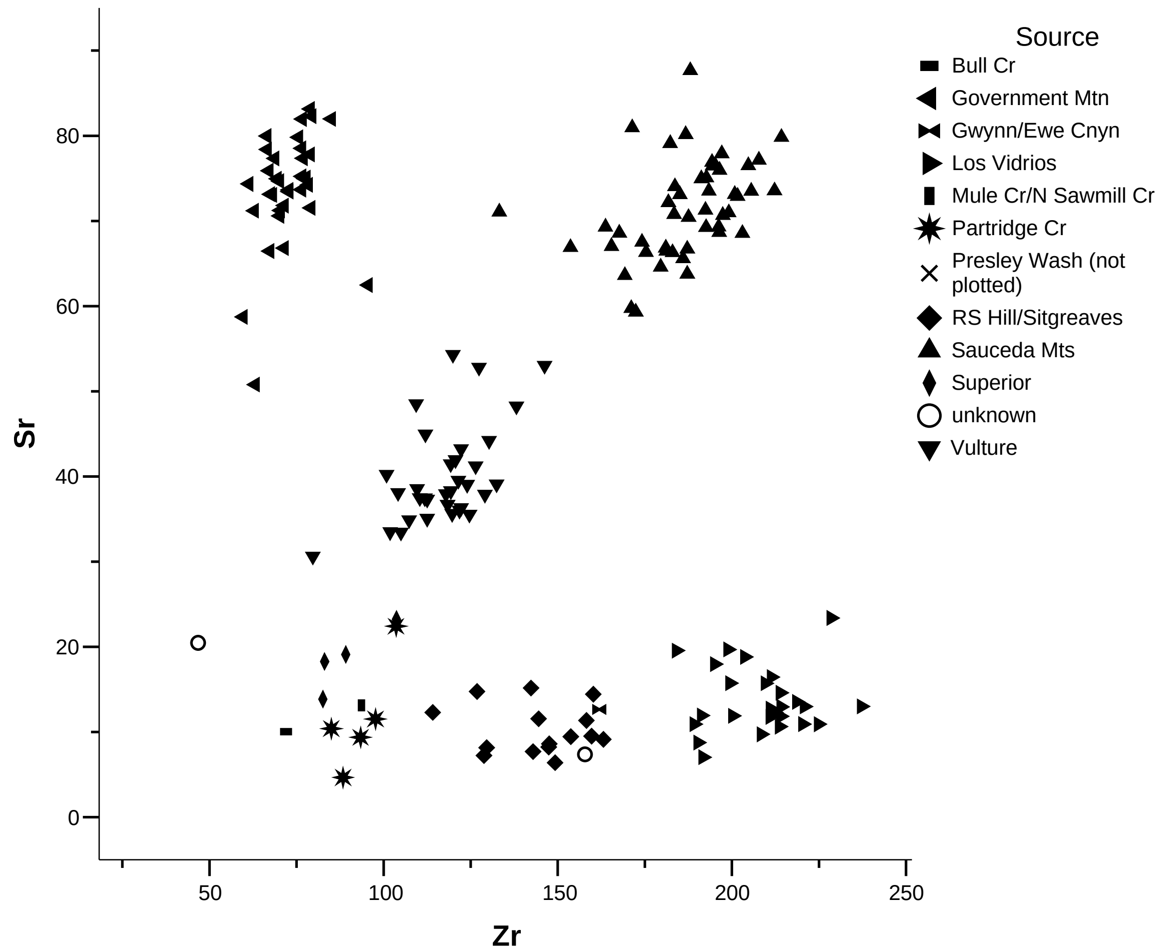

Figure 1.Sr versus Zr scatterplot of the elemental concentrations for the archaeological specimens effectively separating Superior and Vulture. See the Rb versus Zr biplot below for clarity in discriminating Partridge Creek and others.

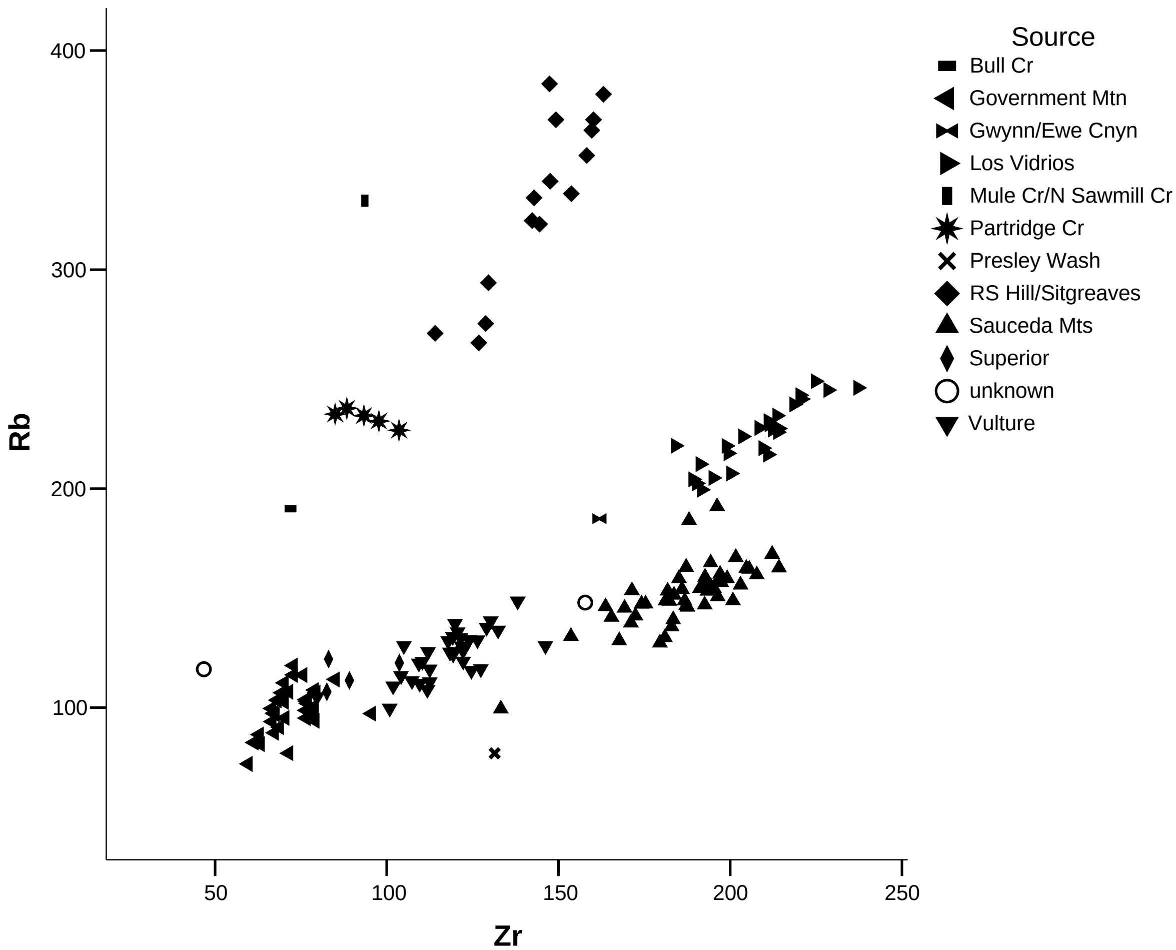

Figure 2. Rb versus Zr biplot of the elemental concentrations more effectively separating Partridge Creek and other assigned artifacts.

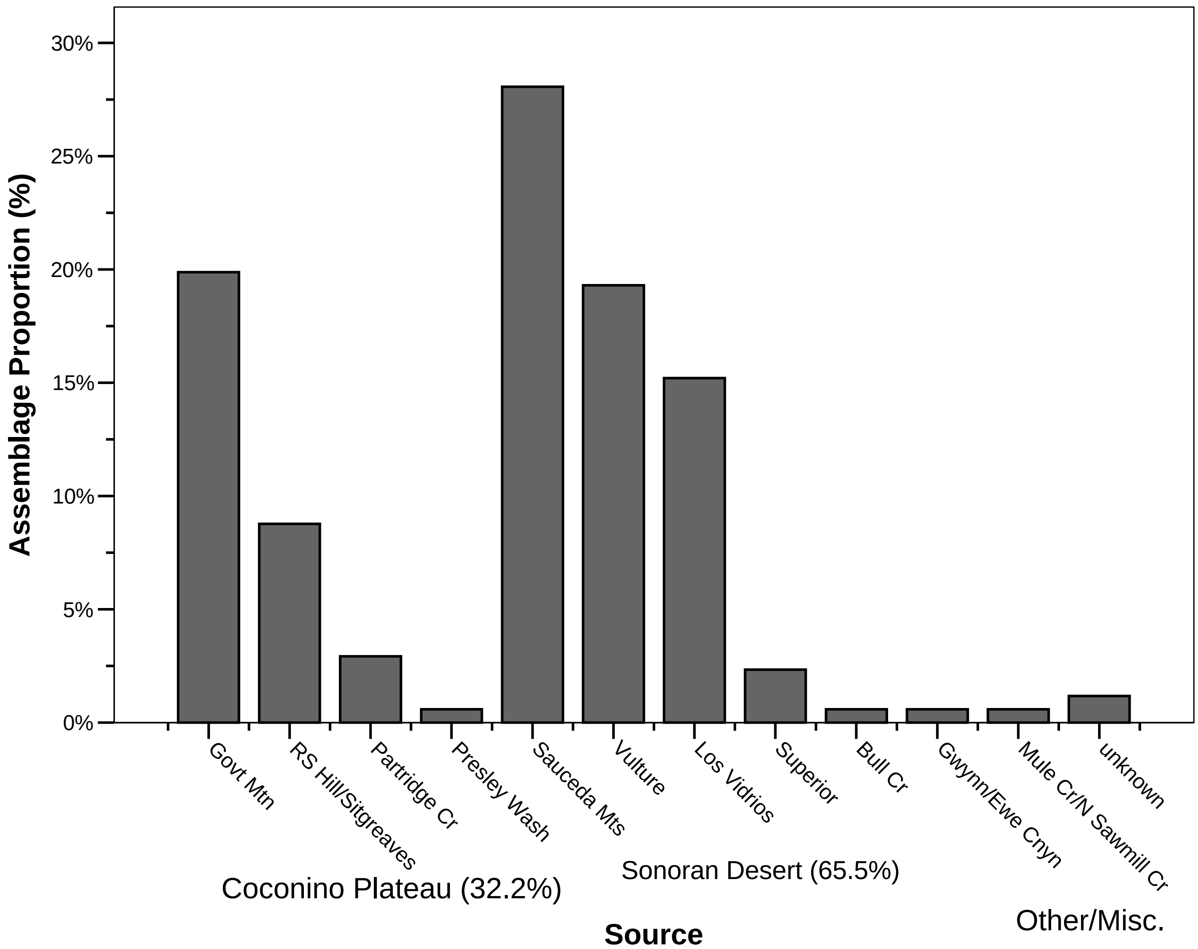

Figure 3. Frequency distribution of source provenance by region (see also Table 2).