

**X-Ray Fluorescence Analysis of Obsidian Artifacts from
Site 35-LK-DEMOSITE, Lake County, Oregon**

Alex J. Nyers

Northwest Research Obsidian Studies Laboratory

Two hundred sixty-seven artifacts from site 35-LK-DEMOSITE, Lake County, Oregon, were submitted for energy dispersive X-ray fluorescence trace element provenance analysis. The samples were prepared and analyzed at the Northwest Research Obsidian Studies Laboratory under the accession number 2018-DEMO.

Analytical Methods

X-Ray Fluorescence Analysis. Nondestructive trace element analysis of the samples was completed using a Thermo NORAN QuanX-EC energy dispersive X-ray fluorescence (EDXRF) spectrometer. The analyzer uses an X-ray tube excitation source and a solid-state detector to provide spectroscopic analysis of elements ranging from sodium to uranium (atomic numbers 11 to 92) and in concentrations ranging from a few parts per million to 100 percent. The system is equipped with a Peltier-cooled Si(Li) detector and an air-cooled X-ray tube with a rhodium target and a 76 micron Be window. The tube is driven by a 50 kV 2mA high voltage power supply, providing a voltage range of 4 to 50 kV. During operation, the tube current is automatically adjusted to an optimal 50% dead time, a variable that is significantly influenced by the varying physical sizes of the different analyzed samples. Small specimens are mounted in 32 mm-diameter sample cups with mylar windows on a 20-position sample tray while larger samples are fastened directly to the surface of the tray.

For the elements that are reported in Table A-1, we analyzed the collection with a 3.5 mm as well as an 8.8 mm beam collimator installed with tube voltage and count times adjusted for optimum results. Instrument control and data analysis are performed using WinTrace software (version 7) running under the Windows 7 operating system.

The diagnostic trace element values used to characterize the samples are compared directly to those for known obsidian and fine-grained volcanic (FGV) sources reported in the literature and with unpublished trace element data collected through analysis of geologic source samples (Northwest Research 2018a). Artifacts are correlated to a parent obsidian, FGV, or basalt source (or geochemical source group) if diagnostic trace element values fall within about two standard deviations of the analytical uncertainty of the known upper and lower limits of chemical variability recorded for the source. Occasionally, visual attributes are used to corroborate the source assignments although sources are never assigned solely on the basis of megascopic characteristics.

Results of Analysis

X-Ray Fluorescence Analysis. The obsidian artifacts analyzed by X-ray fluorescence methods were correlated with three known obsidian sources, Cougar Mountain, Drews Creek/Butcher Flat, and Cowhead Lake. The locations of the site and the identified sources are shown in Figure 1. Analytical results are presented in Table A-1 in the Appendix and are summarized in Table 1 and Figure 2.

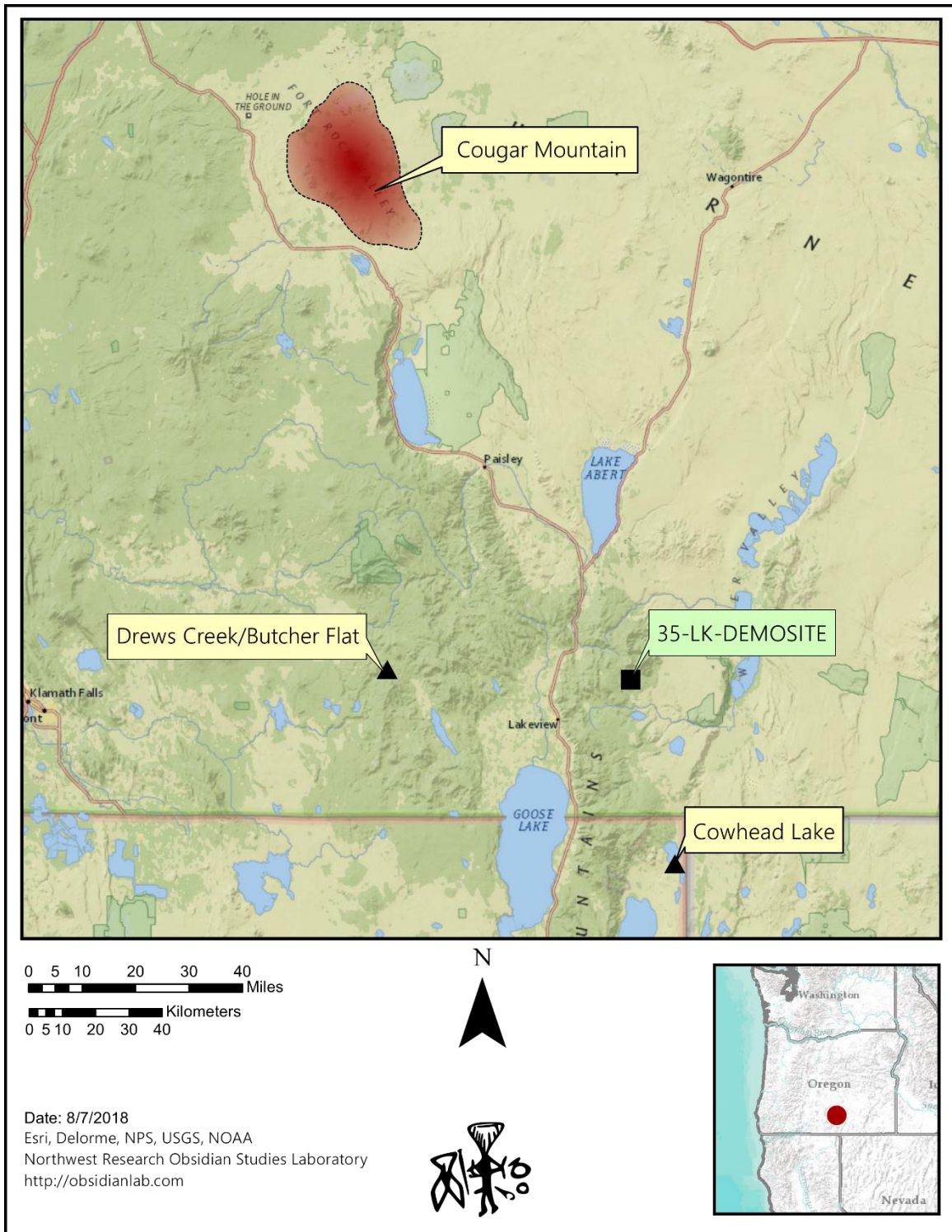


Figure 1. Locations of the project site and sources of the analyzed obsidian artifacts.

Table 1. Summary of results of trace element analysis of the project specimens.

GEOCHEMICAL SOURCE	N=	PERCENTAGE
Cougar Mountain	142	53.2
Cowhead Lake	107	40.1
Drews Creek/Butcher Flat	18	6.7
TOTAL	267	100.0

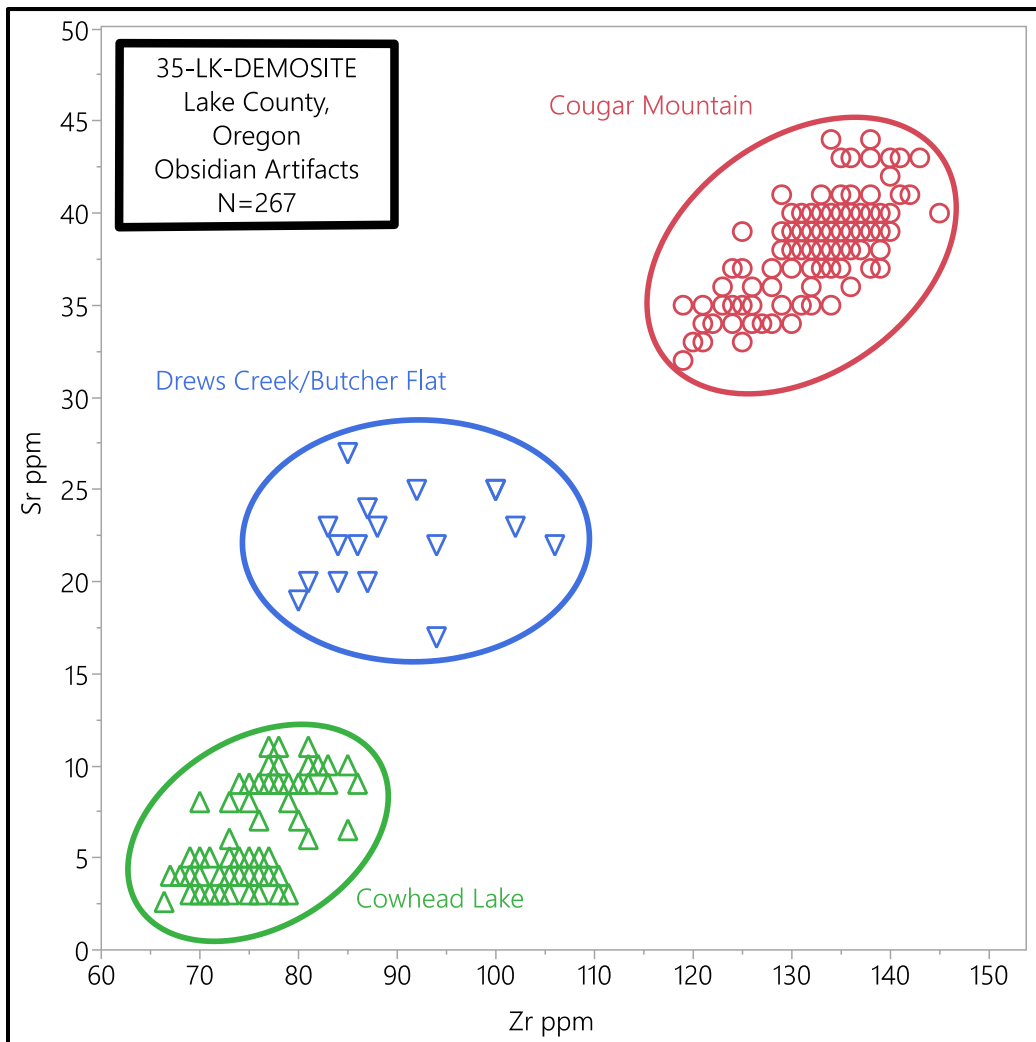


Figure 2 - Scatterplot of zirconium (Zr) plotted versus strontium (Sr) for analyzed artifacts.

Information concerning the location, geologic setting, and prehistoric use of obsidian sources identified in the current investigation may be found at www.sourcecatalog.com (Northwest Research 2018b).

References Cited

Northwest Research Obsidian Studies Laboratory

2018a Northwest Research Obsidian Studies Laboratory World Wide Web Site (www.obsidianlab.com).

2018b Northwest Research U. S. Obsidian Source Catalog (www.sourcecatalog.com).

Appendix



Results of X-Ray Fluorescence Analysis

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	1	1	100 ± 4	41 3	59 3	136 5	12 3	NM NM	NM NM	1369 49	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	2	2	119 ± 3	4 3	30 4	76 3	17 3	NM NM	NM NM	0 51	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	3	3	120 ± 3	10 2	27 3	78 2	12 2	NM NM	NM NM	0 47	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	4	4	103 ± 5	39 2	53 4	137 3	15 2	NM NM	NM NM	1352 36	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	5	5	117 ± 5	4 3	31 2	74 5	15 5	NM NM	NM NM	0 51	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	6	6	119 ± 2	4 5	30 5	75 2	18 4	NM NM	NM NM	0 54	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	7	7	99 ± 3	3 4	29 4	69 2	16 5	NM NM	NM NM	0 37	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	8	8	112 ± 3	3 3	32 4	73 3	15 3	NM NM	NM NM	0 43	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	9	9	118 ± 4	9 4	25 4	77 2	14 2	NM NM	NM NM	0 54	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	10	10	103 ± 5	2 5	29 3	66 5	17 4	NM NM	NM NM	0 36	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	11	11	110 ± 2	3 5	30 3	73 4	15 5	NM NM	NM NM	0 31	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	12	12	113 ± 5	8 2	25 4	75 3	13 2	NM NM	NM NM	0 38	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	13	13	95 ± 3	37 4	49 3	132 4	11 2	NM NM	NM NM	1228 28	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	14	14	123 ± 3	5 3	31 2	77 5	16 2	NM NM	NM NM	0 57	NM NM	NM	NM	Cowhead Lake

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.

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Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	15	15	99 ± 4	39 3	54 5	136 4	9 3	NM NM	NM NM	1333 38	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	16	16	120 ± 5	4 3	33 2	76 4	16 4	NM NM	NM NM	0 54	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	17	17	100 ± 4	37 4	58 4	139 2	13 3	NM NM	NM NM	1397 32	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	18	18	111 ± 2	4 2	31 4	72 4	16 2	NM NM	NM NM	0 52	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	19	19	112 ± 5	6 4	31 2	73 4	17 4	NM NM	NM NM	0 30	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	20	20	119 ± 5	10 4	26 4	81 5	12 5	NM NM	NM NM	0 47	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	21	21	98 ± 4	37 2	55 4	128 5	12 5	NM NM	NM NM	1084 51	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	22	22	110 ± 4	5 4	31 5	71 5	15 4	NM NM	NM NM	0 45	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	23	23	96 ± 2	38 3	53 4	131 2	12 5	NM NM	NM NM	1200 59	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	24	24	98 ± 2	40 3	57 5	130 5	14 5	NM NM	NM NM	1359 29	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	25	25	97 ± 5	37 2	56 2	132 2	10 5	NM NM	NM NM	1213 41	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	26	26	131 ± 4	10 5	29 3	85 4	14 4	NM NM	NM NM	0 56	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	27	27	96 ± 4	40 5	54 5	132 3	12 3	NM NM	NM NM	1190 51	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	28	28	118 ± 3	4 3	32 4	77 5	17 4	NM NM	NM NM	0 36	NM NM	NM NM	NM NM	Cowhead Lake

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			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	29	29	91 ± 5	36 4	54 3	128 3	11 3	NM NM	NM NM	1228 55	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	30	30	116 ± 4	4 3	31 2	73 2	16 3	NM NM	NM NM	0 44	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	31	31	106 ± 4	3 5	28 4	69 5	15 3	NM NM	NM NM	0 39	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	32	32	124 ± 5	10 3	29 3	77 5	12 4	NM NM	NM NM	0 33	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	33	33	94 ± 5	37 5	53 4	135 5	14 5	NM NM	NM NM	1203 28	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	34	34	106 ± 2	41 3	60 4	141 5	16 2	NM NM	NM NM	1299 57	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	35	35	105 ± 5	43 4	59 2	141 2	13 4	NM NM	NM NM	1341 28	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	36	36	90 ± 2	34 3	54 4	127 5	11 4	NM NM	NM NM	1170 43	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	37	37	95 ± 4	39 4	54 3	130 3	12 4	NM NM	NM NM	1389 30	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	38	38	93 ± 4	37 3	54 3	125 5	12 5	NM NM	NM NM	1252 50	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	39	39	86 ± 5	34 4	52 5	122 5	10 3	NM NM	NM NM	1072 38	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	40	40	89 ± 4	34 5	57 5	128 4	10 3	NM NM	NM NM	1189 59	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	41	41	95 ± 3	37 3	54 4	134 3	11 3	NM NM	NM NM	1155 54	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	42	42	108 ± 2	5 4	30 4	70 3	17 2	NM NM	NM NM	0 37	NM NM	NM	NM	Cowhead Lake

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Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	43	43	98 ± 4	39 5	53 4	132 4	10 3	NM NM	NM NM	776 55	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	44	44	102 ± 4	44 5	57 2	138 4	10 3	NM NM	NM NM	1327 54	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	45	45	116 ± 2	4 5	31 2	74 5	16 2	NM NM	NM NM	0 48	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	46	46	113 ± 4	3 2	32 5	75 4	18 3	NM NM	NM NM	0 33	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	47	47	94 ± 5	37 5	54 3	125 2	10 2	NM NM	NM NM	1057 45	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	48	48	104 ± 2	22 5	23 4	106 3	10 3	NM NM	NM NM	85 41	NM NM	NM	NM	Drews Creek/Butcher Flat
35-LK-DEMO	49	49	88 ± 3	33 3	52 4	121 5	12 3	NM NM	NM NM	1176 50	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	50	50	87 ± 2	35 5	52 4	123 4	13 4	NM NM	NM NM	1189 51	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	51	51	109 ± 5	4 2	31 5	68 3	16 3	NM NM	NM NM	0 32	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	52	52	94 ± 5	38 2	51 5	130 2	7 5	NM NM	NM NM	1160 42	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	53	53	116 ± 5	4 4	32 2	77 5	15 3	NM NM	NM NM	0 59	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	54	54	110 ± 2	17 3	23 5	94 4	10 5	NM NM	NM NM	0 52	NM NM	NM	NM	Drews Creek/Butcher Flat
35-LK-DEMO	55	55	97 ± 2	37 3	57 4	139 5	12 2	NM NM	NM NM	1148 32	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	56	56	100 ± 3	43 3	61 4	135 2	14 4	NM NM	NM NM	1281 37	NM NM	NM	NM	Cougar Mountain

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			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	57	57	123 ± 3	9 5	28 2	80 2	12 2	NM NM	NM NM	0 43	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	58	58	96 ± 5	40 4	53 3	134 5	10 2	NM NM	NM NM	1259 53	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	59	59	127 ± 2	8 5	29 5	79 2	12 5	NM NM	NM NM	0 48	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	60	60	103 ± 3	41 2	55 2	133 4	13 5	NM NM	NM NM	1300 44	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	61	61	90 ± 5	35 4	52 4	124 2	12 3	NM NM	NM NM	1005 32	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	62	62	101 ± 5	39 5	52 3	137 2	12 4	NM NM	NM NM	1270 45	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	63	63	110 ± 4	4 4	31 5	72 5	17 2	NM NM	NM NM	0 57	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	64	64	102 ± 2	40 2	57 3	137 3	12 3	NM NM	NM NM	1192 51	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	65	65	115 ± 2	5 3	30 4	74 2	15 4	NM NM	NM NM	0 32	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	66	66	107 ± 5	43 5	59 5	138 3	10 4	NM NM	NM NM	1284 49	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	67	67	103 ± 3	39 2	55 3	134 4	18 2	NM NM	NM NM	1384 57	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	68	68	122 ± 4	9 5	28 5	77 5	14 4	NM NM	NM NM	0 37	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	69	69	93 ± 4	38 3	54 5	133 2	13 3	NM NM	NM NM	1202 35	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	70	70	95 ± 4	40 5	59 3	137 4	14 5	NM NM	NM NM	1332 29	NM NM	NM NM	NM NM	Cougar Mountain

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			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	71	71	98 ± 4	40 3	58 3	135 4	9 2	NM NM	NM NM	1282 36	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	72	72	93 ± 3	41 4	54 5	129 3	19 4	NM NM	NM NM	1245 36	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	73	73	93 ± 2	35 3	55 2	132 3	11 2	NM NM	NM NM	1371 53	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	74	74	119 ± 5	3 2	31 4	78 3	16 3	NM NM	NM NM	0 47	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	75	75	91 ± 4	38 3	53 2	135 5	15 4	NM NM	NM NM	1082 48	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	76	76	102 ± 4	27 4	23 4	85 4	12 4	NM NM	NM NM	55 39	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat
35-LK-DEMO	77	77	98 ± 5	38 5	56 5	131 3	11 2	NM NM	NM NM	1261 56	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	78	78	92 ± 2	34 5	53 5	127 4	10 5	NM NM	NM NM	1163 47	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	79	79	93 ± 3	36 3	57 2	136 2	12 2	NM NM	NM NM	1117 59	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	80	80	123 ± 5	6 4	32 2	81 4	20 5	NM NM	NM NM	46 52	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	81	81	89 ± 5	35 4	48 3	119 2	9 4	NM NM	NM NM	1236 53	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	82	82	121 ± 3	4 4	32 4	75 3	18 5	NM NM	NM NM	0 46	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	83	83	99 ± 3	38 5	56 4	133 2	7 4	NM NM	NM NM	1286 46	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	84	84	116 ± 4	20 5	24 4	87 4	10 4	NM NM	NM NM	0 40	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat

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			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	85	85	107 ± 4	5 4	29 4	69 4	17 3	NM NM	NM NM	0 52	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	86	86	96 ± 3	35 3	53 3	121 4	10 4	NM NM	NM NM	1053 38	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	87	87	92 ± 5	38 3	51 2	129 4	15 5	NM NM	NM NM	1237 38	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	88	88	104 ± 2	43 2	58 2	136 2	10 3	NM NM	NM NM	1345 41	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	89	89	100 ± 4	37 5	56 3	133 5	8 3	NM NM	NM NM	1161 59	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	90	90	107 ± 3	4 2	31 3	69 2	16 4	NM NM	NM NM	0 42	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	91	91	107 ± 2	10 3	29 5	78 4	15 4	NM NM	NM NM	68 30	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	92	92	122 ± 5	9 2	27 2	80 2	13 2	NM NM	NM NM	0 59	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	93	93	105 ± 4	4 4	30 4	74 4	18 5	NM NM	NM NM	0 31	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	94	94	109 ± 4	40 5	57 3	145 3	10 4	NM NM	NM NM	1277 37	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	95	95	91 ± 4	37 2	53 2	132 2	15 4	NM NM	NM NM	1342 35	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	96	96	113 ± 4	4 2	30 2	72 5	17 3	NM NM	NM NM	0 50	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	97	97	93 ± 2	38 2	58 4	132 5	12 5	NM NM	NM NM	1150 60	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	98	98	116 ± 5	11 5	25 2	77 5	12 5	NM NM	NM NM	0 35	NM NM	NM NM	NM NM	Cowhead Lake

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35-LK-DEMO	99	99	129 ± 3	9 3	28 2	81 5	13 5	NM NM	NM NM	0 46	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	100	100	121 ± 5	3 5	33 5	75 4	18 4	NM NM	NM NM	0 53	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	101	101	121 ± 3	10 2	27 5	77 5	12 4	NM NM	NM NM	0 32	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	102	102	93 ± 5	36 2	55 4	128 4	11 3	NM NM	NM NM	1203 40	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	103	103	93 ± 2	39 3	53 3	136 5	9 4	NM NM	NM NM	1124 60	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	104	104	96 ± 4	36 3	54 2	132 3	9 5	NM NM	NM NM	1188 59	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	105	105	93 ± 4	37 3	54 3	133 5	12 5	NM NM	NM NM	1336 30	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	106	106	99 ± 4	37 4	54 4	130 2	13 2	NM NM	NM NM	1250 29	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	107	107	96 ± 3	39 4	57 2	130 4	13 5	NM NM	NM NM	1274 45	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	108	108	115 ± 2	8 4	32 3	75 2	19 3	NM NM	NM NM	0 40	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	109	109	100 ± 5	40 3	58 4	131 4	11 4	NM NM	NM NM	1277 39	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	110	110	107 ± 5	8 3	24 3	70 3	14 4	NM NM	NM NM	0 39	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	111	111	99 ± 4	40 3	56 5	138 2	14 4	NM NM	NM NM	1322 54	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	112	112	101 ± 2	40 3	54 2	136 5	16 2	NM NM	NM NM	1315 54	NM NM	NM NM	NM NM	Cougar Mountain

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Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	113	113	93 ± 3	38 5	53 2	134 3	14 5	NM NM	NM NM	1196 52	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	114	114	106 ± 4	23 4	22 5	88 5	11 3	NM NM	NM NM	0 52	NM NM	NM	NM	Drews Creek/Butcher Flat
35-LK-DEMO	115	115	115 ± 5	7 4	30 2	76 4	16 3	NM NM	NM NM	0 55	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	116	116	102 ± 3	41 2	57 5	142 5	9 4	NM NM	NM NM	1346 32	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	117	117	118 ± 5	10 4	28 2	78 2	12 4	NM NM	NM NM	0 29	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	118	118	103 ± 5	39 5	53 3	140 4	15 5	NM NM	NM NM	1297 40	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	119	119	104 ± 3	40 5	54 5	133 5	12 2	NM NM	NM NM	1185 28	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	120	120	105 ± 5	40 3	58 2	139 3	14 4	NM NM	NM NM	1311 57	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	121	121	95 ± 5	36 2	53 4	132 5	14 5	NM NM	NM NM	798 44	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	122	122	130 ± 2	9 3	27 4	79 2	12 2	NM NM	NM NM	0 56	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	123	123	96 ± 3	35 4	50 2	134 3	9 4	NM NM	NM NM	1069 28	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	124	124	123 ± 4	9 3	27 3	75 4	13 5	NM NM	NM NM	0 46	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	125	125	98 ± 2	39 4	58 5	136 5	11 3	NM NM	NM NM	1297 54	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	126	126	117 ± 4	20 4	19 4	81 5	11 2	NM NM	NM NM	55 49	NM NM	NM	NM	Drews Creek/Butcher Flat

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	127	127	97 ± 3	37 5	57 3	138 5	15 5	NM NM	NM NM	1158 39	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	128	128	118 ± 3	9 2	27 4	74 5	11 5	NM NM	NM NM	0 43	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	129	129	109 ± 4	24 2	22 3	87 2	10 5	NM NM	NM NM	65 52	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat
35-LK-DEMO	130	130	101 ± 4	22 5	24 3	86 4	12 2	NM NM	NM NM	52 31	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat
35-LK-DEMO	131	131	93 ± 3	36 2	53 3	126 3	13 3	NM NM	NM NM	1225 48	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	132	132	113 ± 3	4 4	31 5	72 4	16 2	NM NM	NM NM	0 51	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	133	133	102 ± 4	4 3	27 4	67 3	16 5	NM NM	NM NM	0 31	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	134	134	117 ± 2	5 5	32 3	75 2	18 5	NM NM	NM NM	0 54	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	135	135	90 ± 5	35 2	53 3	126 4	12 4	NM NM	NM NM	1154 59	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	136	136	106 ± 5	41 3	60 3	142 5	13 2	NM NM	NM NM	1249 31	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	137	137	92 ± 2	35 3	54 5	131 3	10 3	NM NM	NM NM	1289 46	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	138	138	92 ± 5	34 5	54 5	130 2	11 5	NM NM	NM NM	1238 59	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	139	139	117 ± 3	9 2	26 3	79 2	13 3	NM NM	NM NM	0 59	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	140	140	113 ± 5	3 3	29 3	76 4	16 4	NM NM	NM NM	0 47	NM NM	NM NM	NM NM	Cowhead Lake

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	141	141	95 ± 5	38 4	55 4	135 4	12 5	NM NM	NM NM	1235 41	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	142	142	105 ± 2	40 3	56 2	131 2	12 5	NM NM	NM NM	1240 54	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	143	143	96 ± 3	39 3	56 4	125 4	12 2	NM NM	NM NM	1127 30	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	144	144	120 ± 2	9 2	26 2	78 3	11 5	NM NM	NM NM	0 42	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	145	145	118 ± 5	4 3	30 4	76 5	17 3	NM NM	NM NM	0 55	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	146	146	100 ± 4	41 4	57 2	142 4	11 5	NM NM	NM NM	1260 37	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	147	147	131 ± 4	10 4	28 5	83 3	11 2	NM NM	NM NM	0 54	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	148	148	105 ± 5	4 5	30 3	69 2	15 4	NM NM	NM NM	0 56	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	149	149	101 ± 4	40 2	54 3	133 3	12 5	NM NM	NM NM	1333 50	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	150	150	101 ± 2	38 5	55 2	135 2	12 3	NM NM	NM NM	1336 28	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	151	151	116 ± 5	9 3	26 3	76 5	12 4	NM NM	NM NM	0 33	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	152	152	101 ± 3	39 3	57 3	138 2	12 2	NM NM	NM NM	1387 48	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	153	153	112 ± 4	23 2	24 4	102 5	12 5	NM NM	NM NM	98 44	NM NM	NM	NM	Drews Creek/Butcher Flat
35-LK-DEMO	154	154	96 ± 4	39 3	53 2	133 2	12 5	NM NM	NM NM	1294 43	NM NM	NM	NM	Cougar Mountain

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	155	155	102 ± 5	41 5	58 2	133 5	12 2	NM NM	NM NM	1265 36	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	156	156	101 ± 5	43 4	60 3	140 5	13 5	NM NM	NM NM	1363 60	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	157	157	110 ± 4	11 3	29 3	81 5	15 2	NM NM	NM NM	95 55	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	158	158	115 ± 3	4 3	30 5	74 3	15 4	NM NM	NM NM	0 53	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	159	159	92 ± 4	34 4	54 3	126 4	12 5	NM NM	NM NM	1289 38	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	160	160	99 ± 2	38 3	58 4	139 2	16 5	NM NM	NM NM	1190 28	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	161	161	123 ± 2	9 5	26 5	83 5	11 5	NM NM	NM NM	0 42	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	162	162	126 ± 3	11 2	27 2	81 2	13 5	NM NM	NM NM	0 44	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	163	163	121 ± 5	9 2	27 2	77 3	13 5	NM NM	NM NM	0 46	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	164	164	100 ± 5	41 5	58 4	135 4	12 3	NM NM	NM NM	1341 43	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	165	165	96 ± 4	38 3	58 4	137 3	12 3	NM NM	NM NM	1261 28	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	166	166	101 ± 2	38 4	55 2	136 5	10 4	NM NM	NM NM	1228 38	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	167	167	118 ± 5	4 2	31 3	73 5	16 4	NM NM	NM NM	0 60	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	168	168	93 ± 5	40 3	55 3	134 4	11 5	NM NM	NM NM	1193 55	NM NM	NM NM	NM NM	Cougar Mountain

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	169	169	101 ± 4	44 3	58 3	134 4	12 2	NM NM	NM NM	1161 56	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	170	170	106 ± 2	41 2	55 2	136 2	12 5	NM NM	NM NM	1283 57	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	171	171	96 ± 2	39 4	56 4	134 4	14 2	NM NM	NM NM	1069 55	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	172	172	121 ± 2	6 2	30 3	86 5	15 2	NM NM	NM NM	22 28	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	173	173	110 ± 3	3 5	31 3	72 2	13 5	NM NM	NM NM	0 35	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	174	174	122 ± 3	10 3	27 5	78 3	12 5	NM NM	NM NM	0 60	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	175	175	126 ± 2	9 4	28 2	78 2	14 3	NM NM	NM NM	0 32	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	176	176	90 ± 4	35 4	53 2	123 4	12 5	NM NM	NM NM	1062 33	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	177	177	93 ± 4	39 5	56 4	135 5	14 3	NM NM	NM NM	1323 59	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	178	178	102 ± 2	40 4	58 5	136 3	14 3	NM NM	NM NM	1279 46	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	179	179	90 ± 5	37 2	53 4	124 4	11 5	NM NM	NM NM	1124 37	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	180	180	103 ± 2	41 5	60 5	138 5	10 2	NM NM	NM NM	1111 30	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	181	181	101 ± 4	23 4	20 4	83 3	12 2	NM NM	NM NM	65 51	NM NM	NM	NM	Drews Creek/Butcher Flat
35-LK-DEMO	182	182	130 ± 3	10 5	28 3	85 3	14 5	NM NM	NM NM	0 28	NM NM	NM	NM	Cowhead Lake

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	183	183	116 ± 5	25 4	25 3	100 4	13 3	NM NM	NM NM	67 31	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat
35-LK-DEMO	184	184	108 ± 5	9 5	29 3	75 3	17 5	NM NM	NM NM	59 40	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	185	185	122 ± 3	11 2	27 5	78 3	15 3	NM NM	NM NM	0 33	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	186	186	105 ± 2	41 5	56 4	141 4	10 5	NM NM	NM NM	1278 36	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	187	187	103 ± 5	39 5	62 5	139 4	10 3	NM NM	NM NM	1180 43	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	188	188	97 ± 4	39 3	60 5	137 3	11 3	NM NM	NM NM	1266 42	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	189	189	104 ± 3	43 4	60 4	143 4	9 5	NM NM	NM NM	1370 56	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	190	190	86 ± 4	34 5	49 4	121 2	12 3	NM NM	NM NM	1190 58	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	191	191	114 ± 5	5 2	31 4	77 2	15 2	NM NM	NM NM	0 55	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	192	192	97 ± 4	34 3	54 3	127 5	11 3	NM NM	NM NM	1285 46	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	193	193	121 ± 5	4 2	33 3	77 4	16 3	NM NM	NM NM	0 51	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	194	194	89 ± 4	34 5	55 2	122 3	10 5	NM NM	NM NM	1269 41	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	195	195	99 ± 4	39 5	57 4	136 2	13 5	NM NM	NM NM	1179 46	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	196	196	112 ± 5	19 2	20 5	80 4	11 4	NM NM	NM NM	58 54	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	197	197	102 ± 5	43 5	59 5	138 5	10 3	NM NM	NM NM	1224 35	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	198	198	91 ± 3	32 5	51 4	119 3	11 3	NM NM	NM NM	1152 43	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	199	199	97 ± 4	40 2	59 2	139 3	14 3	NM NM	NM NM	1328 28	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	200	200	104 ± 2	43 2	58 2	136 5	10 5	NM NM	NM NM	1345 29	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	201	201	117 ± 2	4 2	30 3	75 5	16 4	NM NM	NM NM	0 55	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	202	202	93 ± 2	38 4	52 3	132 4	11 5	NM NM	NM NM	1314 54	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	203	203	93 ± 4	35 3	51 3	129 2	13 4	NM NM	NM NM	1271 41	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	204	204	101 ± 5	41 4	54 2	135 5	12 3	NM NM	NM NM	1305 37	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	205	205	99 ± 2	40 4	55 5	139 4	10 5	NM NM	NM NM	1243 57	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	206	206	110 ± 3	3 2	31 4	73 3	17 5	NM NM	NM NM	0 43	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	207	207	116 ± 3	5 4	32 5	73 2	17 5	NM NM	NM NM	0 33	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	208	208	108 ± 3	3 3	31 4	72 3	17 5	NM NM	NM NM	0 42	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	209	209	106 ± 4	4 3	30 5	69 3	16 3	NM NM	NM NM	0 39	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	210	210	112 ± 5	3 4	32 4	71 4	18 4	NM NM	NM NM	0 35	NM NM	NM	NM	Cowhead Lake

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	211	211	94 ± 3	38 5	55 5	136 3	12 2	NM NM	NM NM	1211 34	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	212	212	117 ± 5	25 5	24 5	100 5	9 4	NM NM	NM NM	75 36	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat
35-LK-DEMO	213	213	111 ± 4	7 5	29 3	80 2	17 3	NM NM	NM NM	51 41	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	214	214	123 ± 2	3 3	36 5	79 4	20 2	NM NM	NM NM	0 53	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	215	215	117 ± 3	5 4	31 3	74 2	16 5	NM NM	NM NM	0 56	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	216	216	89 ± 3	35 4	49 2	121 4	11 4	NM NM	NM NM	1071 56	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	217	217	124 ± 4	10 4	26 3	78 5	14 2	NM NM	NM NM	0 59	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	218	218	95 ± 2	39 2	57 2	134 2	12 5	NM NM	NM NM	1349 28	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	219	219	95 ± 3	35 2	55 5	132 4	12 2	NM NM	NM NM	1194 54	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	220	220	95 ± 3	38 4	51 2	134 3	13 2	NM NM	NM NM	1214 34	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	221	221	115 ± 4	3 3	30 3	73 2	16 3	NM NM	NM NM	0 49	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	222	222	91 ± 2	35 2	53 4	126 2	11 2	NM NM	NM NM	1090 34	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	223	223	114 ± 5	5 4	31 4	71 3	17 2	NM NM	NM NM	0 50	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	224	224	87 ± 5	35 5	51 5	125 4	10 2	NM NM	NM NM	1174 52	NM NM	NM NM	NM NM	Cougar Mountain

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	225	225	109 ± 2	4 4	30 5	70 3	15 5	NM NM	NM NM	0 38	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	226	226	109 ± 2	3 3	30 2	70 3	15 2	NM NM	NM NM	0 32	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	227	227	112 ± 5	25 5	23 3	92 2	10 5	NM NM	NM NM	56 30	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat
35-LK-DEMO	228	228	113 ± 5	4 4	29 3	73 5	16 2	NM NM	NM NM	0 46	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	229	229	103 ± 2	41 4	60 3	138 2	10 2	NM NM	NM NM	1111 50	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	230	230	95 ± 2	37 5	52 2	134 2	12 5	NM NM	NM NM	1059 53	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	231	231	121 ± 4	9 4	25 3	78 5	13 2	NM NM	NM NM	0 57	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	232	232	108 ± 4	8 4	24 2	75 5	11 2	NM NM	NM NM	0 60	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	233	233	99 ± 5	39 4	54 5	135 2	14 4	NM NM	NM NM	1201 28	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	234	234	90 ± 5	33 4	52 4	125 5	11 3	NM NM	NM NM	1246 34	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	235	235	127 ± 2	10 2	28 3	78 2	13 4	NM NM	NM NM	0 33	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	236	236	121 ± 3	4 3	32 3	78 3	16 4	NM NM	NM NM	0 49	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	237	237	119 ± 5	4 3	30 5	77 5	16 2	NM NM	NM NM	0 36	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	238	238	115 ± 4	8 2	25 4	73 2	12 4	NM NM	NM NM	0 40	NM NM	NM NM	NM NM	Cowhead Lake

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	239	239	114 ± 3	9 3	26 2	78 2	11 3	NM NM	NM NM	0 39	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	240	240	119 ± 4	25 5	24 3	100 3	12 2	NM NM	NM NM	90 39	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat
35-LK-DEMO	241	241	99 ± 3	22 2	23 4	84 2	11 2	NM NM	NM NM	0 36	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat
35-LK-DEMO	242	242	96 ± 3	38 3	55 5	136 3	12 2	NM NM	NM NM	1279 32	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	243	243	131 ± 5	10 5	27 4	82 4	12 2	NM NM	NM NM	0 46	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	244	244	118 ± 5	4 4	32 2	76 5	15 3	NM NM	NM NM	0 54	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	245	245	112 ± 5	22 2	23 5	94 5	10 5	NM NM	NM NM	48 30	NM NM	NM NM	NM NM	Drews Creek/Butcher Flat
35-LK-DEMO	246	246	113 ± 4	5 4	31 3	76 3	15 4	NM NM	NM NM	0 51	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	247	247	92 ± 2	36 5	53 3	123 3	12 3	NM NM	NM NM	1130 42	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	248	248	101 ± 4	40 3	54 3	140 3	13 2	NM NM	NM NM	1377 59	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	249	249	95 ± 4	39 4	52 5	131 2	13 3	NM NM	NM NM	1175 57	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	250	250	100 ± 3	39 4	57 4	135 4	16 5	NM NM	NM NM	1228 28	NM NM	NM NM	NM NM	Cougar Mountain
35-LK-DEMO	251	251	107 ± 5	6 3	31 4	73 2	15 2	NM NM	NM NM	0 38	NM NM	NM NM	NM NM	Cowhead Lake
35-LK-DEMO	252	252	94 ± 5	39 2	54 2	129 4	9 3	NM NM	NM NM	1113 40	NM NM	NM NM	NM NM	Cougar Mountain

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.

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Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ² O ³ T	Fe:Mn	Fe:Ti	
35-LK-DEMO	253	253	103 ± 3	43 2	58 3	143 4	13 4	NM NM	NM NM	1237 34	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	254	254	112 ± 3	4 5	30 2	72 3	17 4	NM NM	NM NM	0 49	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	255	255	90 ± 5	36 5	53 4	128 5	9 5	NM NM	NM NM	1191 45	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	256	256	122 ± 2	9 5	27 4	79 3	11 4	NM NM	NM NM	0 55	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	257	257	110 ± 2	4 4	29 5	70 2	16 2	NM NM	NM NM	0 45	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	258	258	102 ± 4	41 3	57 4	142 4	12 4	NM NM	NM NM	1217 51	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	259	259	108 ± 2	20 2	24 4	84 3	9 4	NM NM	NM NM	0 40	NM NM	NM	NM	Drews Creek/Butcher Flat
35-LK-DEMO	260	260	103 ± 5	42 2	56 3	140 2	14 5	NM NM	NM NM	1208 59	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	261	261	121 ± 3	9 5	26 5	86 3	12 3	NM NM	NM NM	0 54	NM NM	NM	NM	Cowhead Lake
35-LK-DEMO	262	262	93 ± 5	34 4	50 2	128 4	13 5	NM NM	NM NM	1074 36	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	263	263	89 ± 3	33 3	50 3	120 3	11 5	NM NM	NM NM	1247 34	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	264	264	98 ± 5	37 5	57 5	138 2	15 5	NM NM	NM NM	1336 35	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	265	265	102 ± 4	40 3	56 5	140 5	13 5	NM NM	NM NM	1311 30	NM NM	NM	NM	Cougar Mountain
35-LK-DEMO	266	266	103 ± 5	5 2	31 3	69 2	17 3	NM NM	NM NM	0 30	NM NM	NM	NM	Cowhead Lake

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide.

NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.

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Table A-1. Results of XRF Studies: 35-LK-DEMOSITE, Lake County, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations									Ratios		Geochemical Source
			Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe ²⁺ O ^{3T}	Fe:Mn	Fe:Ti	
35-LK-DEMO	267	267	89	34	52	124	10	NM	NM	1229	NM	NM	NM	Cougar Mountain
			± 5	2	5	4	3	NM	NM	29	NM			
NA	RGM-1	RGM-1	148	109	22	222	9	NM	NM	794	NM	NM	NM	RGM-1 Reference Standard
			± 2	2	5	2	2	NM	NM	31	NM			

All trace element values reported in parts per million; ± = analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide. NA = Not available; ND = Not detected; NM = Not measured; * = Small sample; FGV = Fine-grained volcanic specimen.