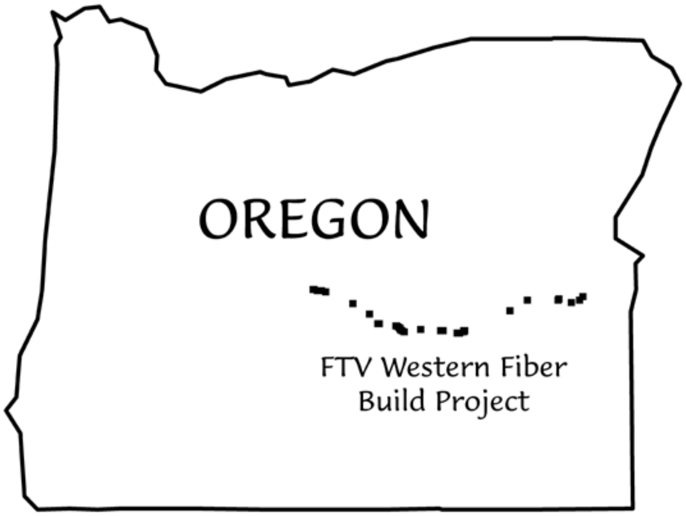
X-Ray Fluorescence Analysis and Obsidian Hydration Rim Measurement of Artifact Obsidian from 34 Archaeological Sites Associated with the Proposed FTV Western Fiber Build Project, Deschutes, Lake, Harney, and Malheur Counties, Oregon



Revised and Updated Version

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NORTHWEST RESEARCH OBSIDIAN STUDIES LABORATORY REPORT 1998-56

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Preface and Acknowledgments

Over the past decade, Northwest Research Obsidian Studies Laboratory has been actively engaged in a geochemical survey of obsidian sources throughout the State of Oregon. One of our areas of interest lay in the region between Bend and Vale-Ontario. Not only did the Glass Buttes Source Complex lay in this area but many other poorly-known sources of obsidian were also scattered along the length of the transect. By the beginning of 1998, we had pretty much completed our field work in the Bend to Burns area and were beginning to shift our focus to the Burns to Vale-Ontario stretch. It was at this point that we were approached about carrying out the analytical work that is presented in this report.

The initial trace element and obsidian hydration analyses associated with the archaeological survey work that was concluded prior to the completion of the FTV Western Fiber Build Project were finished in the fall of 1998. It was this version that initially made its way into the obscure and often impenetrable world of gray literature that is so common to the discipline of archaeology.

In the intervening years between the completion of the project and the present day, we continued our obsidian source studies in the project region. As a result, we have learned a great deal more about the many sources that were identified during the initial analytical work and we have resolved several of the unknown sources. Given the significant corpus of data associated with the project and its relative unavailability, it seemed a propitious time to reexamine the data and issue an updated and revised version of the original report.

What's new in this version? First off, all characterized artifacts and obsidian sources have been reevaluated in the light of the intervening field work. Several of the unknown sources, most notably the Jonesboro and Riley Mimic sources have been located, renamed, and geochemically characterized. The remaining intransigent unknown sources have been renamed. All changes in source names are summarized in the table below.

Original Source Assignment	Updated Source Assignment
Indian Grade Spring Unknown 2	Curtis Creek
Jonesboro	Gregory Creek
Riley Mimic	Coyote Wells
Unknown 2	Tank Creek
Unknown 3	China Lake
Unknown 4	Van Gulch
Unknown 5	Unknown 2
Unknown 6	Skull Springs
Unknown 7	Coyote Wells East
Unknown 8	Eldorado

We have also updated literature references for all identified obsidian sources, particularly in Table 3 in which each source is briefly described. In addition, we have added significantly more detail to the obsidian source distribution map (Figure 4). Further information about the obsidian sources identified in the current investigation may be found at *www.sourcecatalog.com*.

Since the completion of the original final report in 1998, site trinomials have been assigned to all of the project sites and these changes are reflected throughout this report. Both the new and original project site numbers are presented in Table 1. Two of the sites, 35-LK-2544 and ORE 90, were combined into a single site, 35-LK-2544.

This report and any other later revisions will available as an Adobe Acrobat document through the research section of our laboratory website at *www.obsidianlab.com*.

We would like to thank Nancy Sharp, formerly of Northwest Archaeological Associates in Seattle, Washington, for obtaining permission to unearth and distribute this revised volume. We hope that readers find it useful.

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Acknowledgements. X-ray fluorescence analytical procedures used in the analysis of all obsidian samples were originally developed by M. Kathleen Davis (BioSystems Analysis and Northwest Research Obsidian Studies Laboratory). We thank John Shafer (Malheur National Forest Volunteer) for his attempts to locate the Jonesboro area sources. Scott Thomas (Burns BLM) contributed obsidian samples from the Malheur River area near Drewsey. The sample collecting enthusiasm of Bill Lyons (University of Washington) was instrumental in locating both the Coyote Wells and Curtis Creek sources. The equally enthusiastic support by Don Hann (Malheur National Forest) of Malheur National Forest source studies was critical in determining the many geochemical sources of artifacts originating to the north of the project area.

X-Ray Fluorescence Analysis and Obsidian Hydration Rim Measurement of Artifact Obsidian from 34 Archaeological Sites Associated with the FTV Western Fiber Build Project, Deschutes, Lake, Harney, and Malheur Counties, Oregon

Introduction

Six-hundred and eighteen obsidian artifacts from 34 archaeological sites associated with the FTV Western Fiber Build Project, Oregon, were submitted for energy dispersive X-ray fluorescence trace element provenance analysis (see Figure 1 and Table 1). The artifacts were also processed for obsidian hydration rim measurements. The samples were prepared and analyzed at the Northwest Research Obsidian Studies Laboratory under the accession number 1998-56.

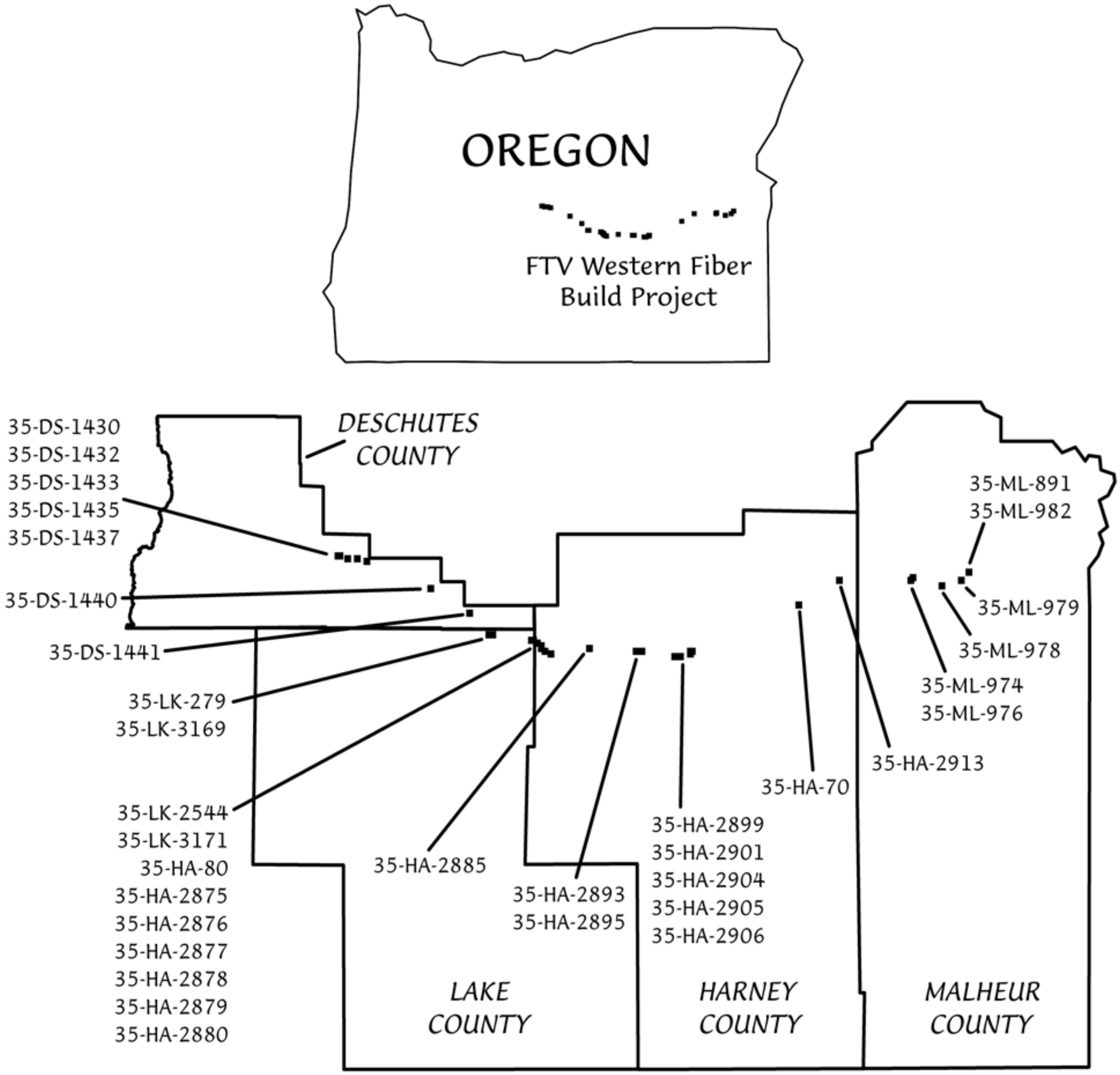

Figure 1. Geographic distribution of project sites.

Table 1. Summary of archaeological sites and artifacts selected for obsidian provenance and hydration studies. The No. Column refers to assigned laboratory numbers that appear in data tables in Appendices A and B.

No.	**Trinomial**	**Project Site Number**	**Milepost**	**County**	**Lab No.**	**N =**
1	35-DS-1430	97 FTV-ORE 15	26.2	Deschutes	1 - 20	20
2	35-DS-1432	97 FTV-ORE 17	26.95	Deschutes	21 - 24	4
3	35-DS-1433	97 FTV-ORE 19	29.15	Deschutes	25 - 44	20
4	35-DS-1435	97 FTV-ORE 6	31.35	Deschutes	45 - 64	20
5	35-DS-1437	97 FTV-ORE 8	34.0 - 34.3	Deschutes	65 - 84	20
6	35-DS-1440	97 FTV-ORE 34	51.9	Deschutes	85 - 104	20
7	35-DS-1441	97 FTV-ORE 29	63.8 - 64.1	Deschutes	105 - 124	20
8	35-LK-279	35-LK-279	71.3	Lake	125 - 141	17
9	35-LK-3169	97 FTV-ORE 39	72.5	Lake	142 - 161	20
10-11	35-LK-2544	97 FTV-ORE 90 35-LK-2544	82.7 - 83.1	Lake	162 - 201	40
12	35-LK-3171	97 FTV-ORE 89	83.7	Lake	202 - 221	20
13	35-HA-80	35-HA-80	85.0	Harney	222 - 241	20
14	35-HA-2875	97 FTV-ORE 85	85.7	Harney	242 - 257	16
15	35-HA-2876	97 FTV-ORE 84	86.0	Harney	278 - 297	20
16	35-HA-2877	97 FTV-ORE 83	86.1	Harney	298 - 317	20
17	35-HA-2878	97 FTV-ORE 82	86.3	Harney	318 - 337	20
18	35-HA-2879	97 FTV-ORE 70	87.35	Harney	338 - 357	20
19	35-HA-2880	97 FTV-ORE 95	89.1	Harney	258 - 277	20
20	35-HA-2885	97 FTV-ORE 62	99.0	Harney	528 - 547	20
21	35-HA-2893	97 FTV-ORE 75	111.5	Harney	398 - 417	20
22	35-HA-2895	97 FTV-ORE 72	113.0	Harney	579 - 598	20
23	35-HA-2899	97 FTV-ORE 56	121.8	Harney	358 - 377	20
24	35-HA-2901	97 FTV-ORE 54	123.4	Harney	378 - 397	20
25	35-HA-2904	97 FTV-ORE 101	126.25	Harney	418 - 437	20
26	35-HA-2905	97 FTV-ORE 102	126.5	Harney	599 - 618	20
27	35-HA-2906	97 FTV-ORE 103	127.0	Harney	438 - 457	20
28	35-HA-70	35-HA-70	162.1 - 162.3	Harney	508 - 527	20
29	35-HA-2913	97 FTV-ORE 123	175.1	Harney	458 - 467	10
30	35-ML-974	97 FTV-ORE 133	199.5	Malheur	488 - 507	20
31	35-ML-976	97 FTV-ORE 132	200.5	Malheur	548 - 556	9
32	35-ML-978	97 FTV-ORE 124	209.8	Malheur	468 - 487	20
33	35-ML-979	97 FTV-ORE 125	216.5	Malheur	557 - 576	20
34	35-ML-981	97 FTV-ORE 128	219.9	Malheur	577	1
35	35-ML-982	97 FTV-ORE 129	220.1	Malheur	578	1
					Total	**618**

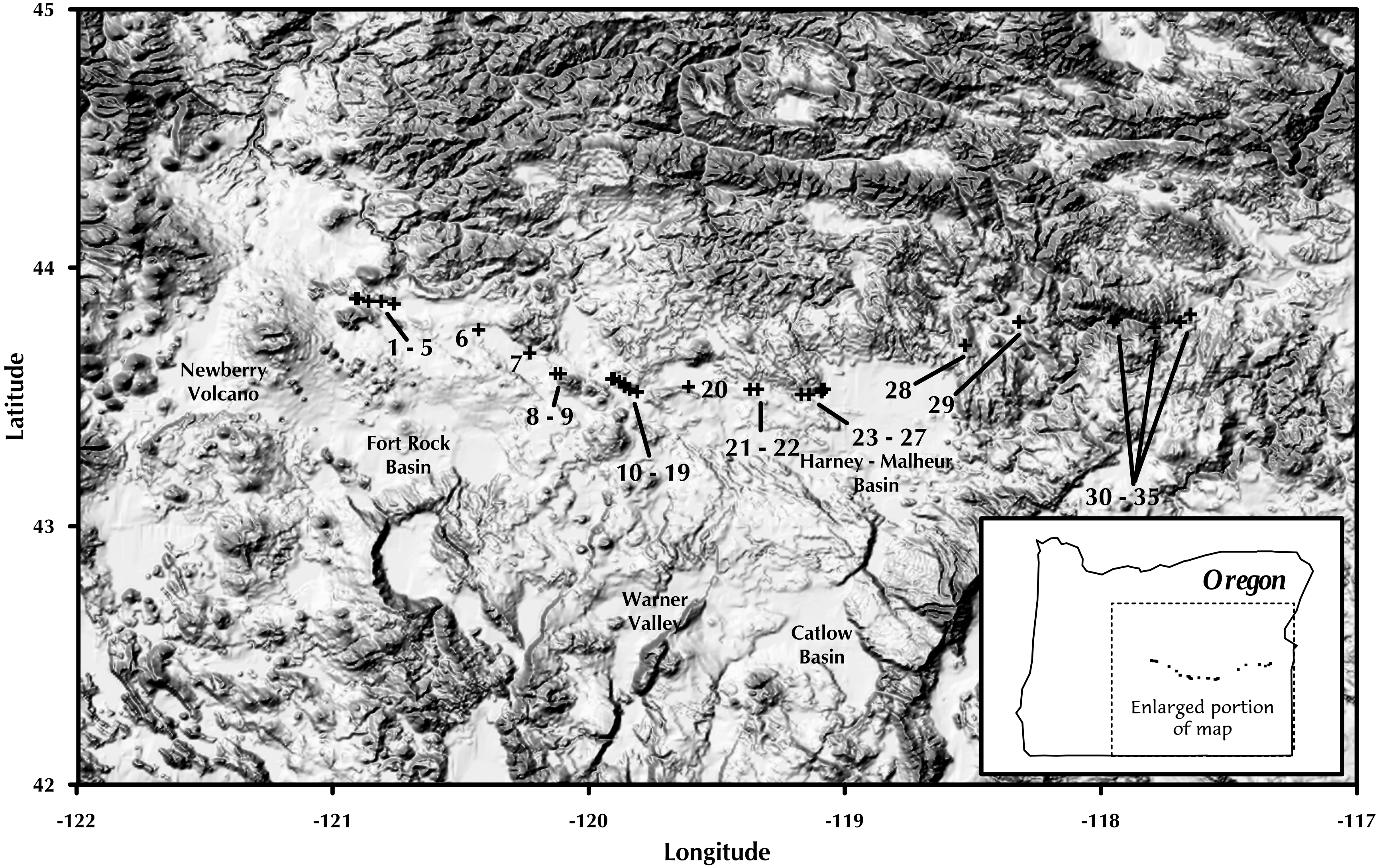

Figure 2. Location of project sites selected for obsidian characterization and hydration studies. Background map is a shaded relief digital elevation model constructed from U. S. Geological Survey 3 arc-second (1 degree) digital elevation data sets.

Analytical Methods

X-Ray Fluorescence Analysis and Characterization Studies

Introduction. Although a variety of physical, optical, petrographic, and chemical attributes are used to characterize volcanic glasses, the use of trace element abundances to "fingerprint" obsidian sources and artifacts has shown the greatest overall success. X-ray fluorescence analytical methods, with their ability to nondestructively and accurately measure trace element concentrations in obsidian, have been widely adopted for this purpose (Harbottle 1982; Rapp 1985; Williams-Thorpe 1995; Glascock et al. 1998; Herz and Garrison 1998; Lambert 1998).

Most geologic sources of obsidian are quite homogeneous in their trace element composition, yet demonstrate adequate intersource variability so that individual sources of glass can be distinguished. Because obsidian can be widely dispersed from its primary geologic source due to a variety of geologic and geomorphic processes, specimens of chemically identical glass are sometimes recovered from outcrops spread over large geographic areas (Hughes 1986a; Hughes and Smith 1993). These secondary source boundaries are often not as well documented as primary sources but must be carefully considered in obsidian procurement studies (Shackley 1998, 2002). Hughes (1986a, 1998) points out that these chemically identical obsidian outcrops must be considered as a single chemical group or chemical type and his terminology is followed here.

From small scale (household and site) to large scale (regional and interregional) levels of analysis, the spatial patterning of characterized obsidian artifacts is influenced by a diverse array of cultural, environmental, and sampling or analysis variables. The analysis and interpretation of these spatial patterns of source use can provide critical information about the prehistoric behavioral and environmental toolstone procurement variables responsible for the observed distribution of the characterized artifacts.

At the site level of analysis, patterns of source use may infer the presence of specific activity areas, of time-limited or single tool manufacturing events, or, in special cases, may point to differential access of goods and the existence of non-egalitarian social structures (Rice 1987).

At the intersite or regional level of investigation, the geographic patterning of characterized artifacts may provide information about seasonal procurement ranges, acquisition strategies, territorial or ethnic boundaries, the locations of prehistoric trails and travel routes, the curational value of particular sources or formal artifact types, cultural preferences regarding glass quality and color, the presence of trade and exchange systems, the existence of intergroup interaction, and the exchange of prestige items between elites of different groups (Hughes 1978a, 1990; Binford 1979; Ericson 1981; Skinner 1983, 1995a; Hughes 1990a; Hughes and Bettinger 1984; Bamforth 1986; Shackley 1990, 1996, 2002; Peterson et al. 1997; Dillian 2002).

In addition, the effects of environmental influences such as the geographic distribution of obsidian sources, the distance to the sources, the relative location of alternative or competing sources of lithic materials, raw material quality and abundance, toolstone size, the distribution of raw materials in secondary deposits, or the presence of potential barriers such as bodies of water or mountain ranges, must all be considered (Renfrew 1977; Skinner 1983; Beck and Jones 1990; Andrefsky 1994; Jones et al. 2003). Of particular importance can be the precision of our knowledge of obsidian source boundaries. Obsidian associated with fluvial or pluvial systems or ash-flow tuffs may be widely distributed over large geographic areas and it is critical to be able to distinguish between long distance procurement of a source and local procurement of a widely-distributed secondary source outcrop (Reid 1997).

Bias introduced during sampling by certain recovery methods, minimum physical sizes of analyzed artifacts, uneven geographic distribution of sites, and the use of small numbers of samples may also significantly affect the reconstruction of the spatial patterning of characterized artifacts (Eerkens et al. 2002). Lastly, the analytical tools used to analyze the spatial data (e.g., trend surface modeling algorithms) may affect the interpretation of the geographic patterns of obsidian use.

Sample Preparation Methods. Obsidian samples selected for X-ray fluorescence analysis are typically restricted to clean artifacts (a wash with tap water and a brush will usually suffice) with a relatively flat surface at least 10 mm in diameter and at least 1.5 mm thick. Although it is possible to analyze slightly smaller samples (7-10 mm in diameter and 0.5-1.0 mm thick), these items will show some distortion in trace element values and may not be able to be reliably characterized. This is particularly true in areas with complex source use patterns. Source assignments of samples that do not meet the minimum reliable size criteria of 10 mm diameter and 1.5 mm thickness, and/or show distorted trace element values are indicated by an asterisk in the data tables that appear in the Appendix.

Analytical Methods. Analysis of the samples was completed using a Spectrace 5000 energy dispersive X-ray fluorescence spectrometer. The system is equipped with a Si(Li) detector with a resolution of 155 eV FHWM for 5.9 keV X-rays (at 1000 counts per second) in an area 30 mm^2. Signals from the spectrometer are amplified and filtered by a time variant pulse processor and sent to a 100 MHZ Wilkinson type analog-to-digital converter. The X-ray tube employed is a Bremsstrahlung type, with a rhodium target, and 5 mil Be window. The tube is driven by a 50 kV 1 mA high voltage power supply, providing a voltage range of 4 to 50 kV. The principles of X-ray fluorescence analytical methods are reviewed in detail by Norrish and Chappell (1967), Williams (1987), and Potts and Webb (1992).

For analysis of the elements zinc (Zn), lead (Pb), thorium (Th), rubidium (Rb), strontium (Sr), yttrium (Y), zirconium (Zr), and niobium (Nb), the X-ray tube is operated at 30 kV, 0.30 mA (pulsed), with a 0.127 mm Pd filter. Analytical lines used are Zn (K-alpha), Pb (L-alpha), Th (L-alpha), Rb (K-alpha), Sr (K-alpha), Y (K-alpha), Zr (K-alpha) and Nb (K-alpha). Samples are scanned for 200 seconds live-time in an air path.

Peak intensities for the above elements are calculated as ratios to the Compton scatter peak of rhodium, and converted to parts-per-million (ppm) by weight using linear regressions derived from the analysis of twenty rock standards from the U.S. Geological Survey, the Geologic Survey of Japan, and the National Bureau of Standards. The analyte to Compton scatter peak ratio is employed to correct for variation in sample size, surface irregularities, and variation in the sample matrix.

For analysis of the elements titanium (Ti), manganese (Mn), and iron ($Fe_2O_3^T$), the X-ray tube is operated at 12 kV, 0.27 mA with a 0.127 mm aluminum filter. Samples are scanned for 200 seconds live-time in a vacuum path. Analytical lines used are Ti (K-alpha), Mn (K-alpha), and Fe (K-alpha).

Concentration values (parts per million for titanium and manganese, weight percent for iron) are calculated using linear regressions derived from the analysis of thirteen standards from the U.S. Geological Survey, the Geologic Survey of Japan and the National Bureau of Standards. However, these values are *not* corrected against the Compton scatter peak or other scatter regions, resulting in lower than normal trace element values for small samples that fall below the minimum size requirement. Iron/titanium (Fe/Ti) and iron/manganese (Fe/Mn) peak ratios are supplied for use as corrected values. To ensure comparability among samples of different sizes, source assignments in all reports are based upon these ratios, and not on the absolute concentration values.

For analysis of the element barium (Ba), the X-ray tube is operated at 50 kV, 0.25 mA with a 0.63 mm copper filter in the X-ray path. Analytical lines used are Ba (K-alpha), La (K-alpha), and Ce (K-alpha). Samples are scanned in an air path for 100 to 600 seconds live-time, depending upon trace element concentration. Trace element intensities are calculated as ratios to the Bremsstrahlung region between 25.0 and 30.98 keV, and converted to parts-per-million by weight using a polynomial fit routine derived from the analysis of sixteen rock standards from the U.S. Geological Survey and the Geologic Survey of Japan. It should be noted that the Bremsstrahlung region corrects for sample mass only and does not account for matrix effects.

All samples are scanned as unmodified rock specimens. Reported errors represent counting and fitting error uncertainty only, and do not account for instrumental precision or effects related to the analysis of unmodified obsidian. When the latter effects are considered, relative analytical uncertainty is estimated to be between three and five percent.

In traditional X-ray fluorescence trace element studies, samples are powdered and pelletized before analysis (Norrish and Chappell 1967; Potts and Webb 1992). In theory, the irregular surfaces of most obsidian artifacts should induce measurement problems related to shifts in artifact-to-detector reflection geometry (Hughes 1986a:35). Early experiments with intact obsidian flakes by Robert N. Jack, and later by Richard Hughes, however, indicate that analytical results from lenticular or biconvex obsidian surfaces are comparable to those from flat surfaces and pressed powder pellets, paving the way for the nondestructive analysis characterization of glass artifacts (Jack 1976; Hughes 1986a:35–37). The minimum optimal sample size for analysis has been found to be approximately 10 mm in diameter and 1.5–2.0 mm thick. Later experimental studies conducted by Shackley and Hampel (1993) using samples with flat and slightly irregular surface geometries have corroborated Hughes' initial observations. In a similar experiment, Jackson and Hampel (1993) determined that for accurate results the minimum size of an artifact should be about 10 mm in diameter and 1.5 mm thick. Details about the effects of sample size and surface geometry are discussed in detail by Davis et al. (1998). Agreement between the U. S. Geological Survey standard RGM-1 (Glass Mountain obsidian) values and obsidian test samples was good at 1 mm thickness and improved markedly to a thickness of 3 mm.

Correlation of Artifacts and Geologic Sources. The diagnostic trace element values used to characterize the samples are compared directly to those for known obsidian sources such as those reported in the literature (Northwest Research 2003) and with unpublished trace element data collected through analysis of geologic source samples. Artifacts are correlated to a parent obsidian source or chemical 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 on the basis of only megascopic characteristics.

Diagnostic trace elements, as the term is used here, refer to trace element abundances that show low intrasource variation and uncertainty along with distinguishable intersource variability. In addition, this refers to elements measured by X-ray fluorescence analysis with high precision and low analytical uncertainty. In short, diagnostic elements are those that allow the clearest geochemical distinction between sources. Trace elements generally refer to those elements that occur in abundances of less than about 1000 ppm in a sample. For simplicity in this report, we use the term synonymously with major and minor elements such as iron, titanium, and manganese, which may be present in somewhat larger quantities.

Obsidian Hydration Analysis

Introduction. The obsidian hydration dating method was introduced to the archaeological community in 1960 by Irving Friedman and Robert Smith of the U. S. Geological Survey (Friedman and Smith 1960). The potential of the method in archaeological chronologic studies was quickly recognized and research concerning the effect of different variables on the rate of hydration has continued to the present day by Friedman and others.

When a new surface of obsidian is exposed to the atmosphere, such as during the manufacture of glass tools, water begins to slowly diffuse from the surface into the interior of the specimen. When this hydrated layer or rind reaches a thickness of about 0.5 µm, it becomes recognizable as a birefringent rim when observed as a thin section under a microscope. Hydration rims formed on artifacts can vary in width from less than one micron for items from the early historic period to nearly 30 µm for early sites in Africa (Michels et al. 1983a; Origer 1989).

Formation of the hydration rim is affected not only by time but also by several other variables. The most important of these are chemical composition and temperature, although water vapor pressure and soil alkalinity may also play a role in some contexts. The effects of these variables have often been summarized and will not be discussed further here (Michels and Tsong 1980; Friedman and Obradovich 1981; Freter 1993; Stevenson et al., 1993, 1998; Friedman et al. 1994; see Skinner and Tremaine 1993 for additional references).

Once a hydration layer has been measured, it can be used to determine the relative ages of items or, in some circumstances, can be converted into an *estimated* absolute age. In order to transform the hydration rim value to a calendar age, the rate of the diffusion of water into the glass must be determined or estimated. The hydration rate is typically established empirically through the calibration of measured samples recovered in association with materials whose cultural age is known or whose age can be radiometrically determined, usually through radiocarbon dating methods (Meighan 1976). The hydration rate can also be determined experimentally, an approach that has shown increasing promise in recent years (Friedman and Trembour 1983; Michels et al. 1983a, 1983b; Tremaine 1989, 1993).

Sample Preparation Methods. An appropriate section of each artifact is selected for hydration slide preparation. The location of the section is determined by the morphology and the perceived potential of the location to yield information on the manufacture, use, and discard of the artifact. Two parallel cuts are made into the edge of the artifact using a lapidary saw equipped with 4-inch diameter diamond-impregnated .004" thick blades. These cuts produce a cross-section of the artifact approximately one millimeter thick which is removed from the artifact and mounted on a petrographic microscope slide with Lakeside thermoplastic cement. The mounted specimen slide is ground in a slurry of 600 grade optical-quality corundum abrasive on a plate glass lap. This initial grinding of the specimen reduces its thickness by approximately one half and removes any nicks from the edge of the specimen produced during cutting. The specimen is then inverted and ground to a final thickness of 30-50 microns, removing nicks from the other side of the specimen. The result is a thin cross-section of the surfaces of the artifact.

Analytical Methods. The prepared slide is measured using an Olympus BHT petrographic microscope fitted with a filar screw micrometer eyepiece. A Panasonic color CCTV camera is mounted on the filar eyepiece and the image is directed to a Panasonic color video monitor. The filar eyepiece is used to measure the thickness of the hydration band projected onto the high resolution monitor. The specimen is first scanned under crossed polarizers and a first-order red (gypsum) plate in order to identify the birefringent hydration layer; the hydration layer is scanned under a magnification of 500X, 750X, or 1250X. The magnification is generally selected with regard to the opacity of the obsidian and the width of the hydration layer. When a clearly defined hydration layer is identified, the section is centered in the field of view to minimize parallax effects. Four rim measurements are typically recorded for each artifact or examined surface. Narrow rinds (under approximately two microns) are usually examined under a higher magnification. Hydration rinds smaller than one micron often cannot be resolved by optical microscopy.

Hydration thicknesses are reported to the nearest 0.1 μm and represent the mean value for all readings. Standard deviation values for each measured surface indicate the variability for hydration thickness measurements recorded for each specimen. It is important to note that these values reflect only the reading uncertainty of the rim values and do not take into account the resolution limitations of the microscope or other sources of uncertainty that enter into the formation of hydration rims (Meighan 1981, 1983). Any attempts to convert rind measurements to absolute dates should be approached with great care and considerable skepticism, particularly when rates are borrowed from existing literature sources. When considered through long periods, the variables affecting the development of hydration rims are complex, and there is no assurance that artifacts recovered from similar provenances or locales have shared thermal and cultural histories.

Additional details about specific analytical methods and procedures used for the analysis of the elements reported and the measurement of hydration rims are available at the Northwest Research Obsidian Studies Laboratory World Wide Web site at *www.obsidianlab.com*.

Results of Analysis

X-Ray Fluorescence Analysis

Introduction. Forty-two geochemical source groups, 40 of which were correlated with known geologic sources, were identified among the 618 artifacts that were characterized by X-ray fluorescence analysis. The locations of the 34 sites and the identified obsidian sources are shown in figures 3, 6, and 8.

Analytical results are presented in Table A-1 in Appendix A and are summarized in Table 2 and figures 4 and 5. Descriptive information about all identified obsidian sources is outlined in Table 3.

With few exceptions, the overall obsidian procurement pattern that is evident along the project corridor is one of direct procurement from local obsidian sources. At several of the sites chosen for obsidian characterization studies, obsidian was available either at or very close to the site. This is particularly evident at sites in the project segment from the Glass Buttes vicinity to the Burns area where local obsidian was directly available for the inhabitants of most of the investigated sites. At many of the sites, other obsidian sources were located at a distance of no more than 10-20 kilometers. Farther east, obsidian nodules correlated with the Wolf Creek source are found in the river gravels and terrace deposits of the Malheur River. The local availability of the Wolf Creek obsidian is reflected in the sudden appearance of Wolf Creek glass in the analyzed collections from nearby project sites. The typical geographic patterning of increasing source use with decreasing distance to the source is illustrated in Figure 9 for several major sources.

The most distant source encountered, represented by three artifacts, is located at Beatys Butte in southeastern Oregon (Figure 3). Nodules of high-quality volcanic glass cover an area of several square kilometers along the flanks of the butte and are widely distributed in the lacustrine deposits of Pluvial Lake Catlow to the north of the source. Artifacts geochemically correlated with the Beatys Butte source are found in small quantities at sites throughout the Harney-Malheur Basin and are occasionally identified as far north as the Bear Valley area of the Malheur National Forest and as far west as the Fort Rock and Klamath basins (Skinner 1995a; Skinner et al. 1998). Other non-local artifacts present in small numbers among the analyzed samples originated from the Obsidian Cliffs, Newberry Volcano, Cougar Mountain, Double O, Big Stick, Eldorado, and Whitewater Ridge sources.

Western Portion. At the western end of the project corridor, local sources were not available for obsidian toolstone procurement. Obsidian from the Newberry Volcano area (Quartz Mountain and Newberry Volcano sources), the High Cascades (Obsidian Cliffs), Fort Rock Basin (Cougar Mountain), and Glass Buttes region (Glass Buttes and Chickahominy) are well-represented. Artifacts from Quartz Mountain, an extensive source of high-quality glass located at the eastern margin of Newberry Volcano, make up the largest proportion of the sources identified in the western segment. Obsidian originating from this source was widely used throughout north-central Oregon, particularly during the pre-Mazama period prior to the eruption of mid-Holocene obsidian flows in Newberry Caldera (Skinner 1995a). Moving east along the project transect, obsidian from the Quartz Mountain source rapidly declines as the sites approach the Glass Buttes source complex and its locally available obsidian (see figures 9A and 9B).

Central Portion. In the central portion of the project corridor, glass source material was available at or adjacent to most of the sites. Obsidian from Glass Buttes, Chickahominy, Upper Gap Lake, Squaw Mountain, Buck Spring, and Burns dominate the characterized collections. Several other sources – Brooks Canyon, Yreka Butte, Riley, Rimrock Spring, Dog Hill, and Mud Ridge – are located less than 15 kilometers from the project transect and are represented in small quantities among the characterized artifacts. West to east source use patterns, like those in the western section, show a rapid increase in artifact frequency as the project route draws closer to the sources (see Figure 9C for an example).

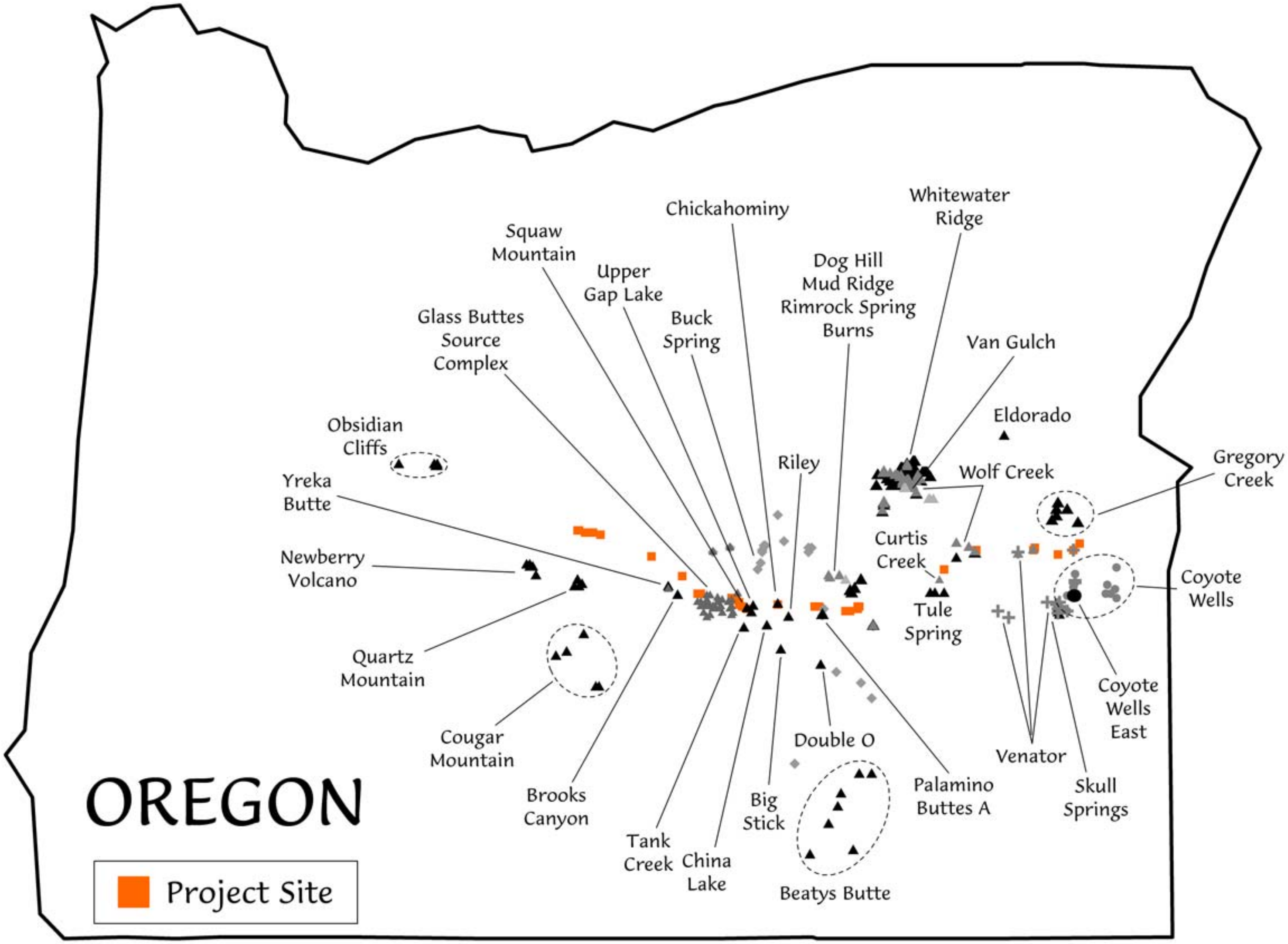

Figure 3. Locations of project archaeological sites and obsidian sources identified by trace element studies of artifacts. Source symbols mark identified outcrops of obsidian and may be very geographically widespread.

Table 2. Geologic sources of obsidian identified by trace element analysis of artifacts. Totals may include provisionally assigned sources, e.g., Newberry Volcano? Table continued on next page.

Obsidian Source	**35DS 1430**	**35DS 1432**	**35DS 1433**	**35DS 1435**	**35DS 1437**	**35DS 1440**	**35DS 1441**	**35LK 279**	**35LK 3169**	**35LK 2544**
Beatys Butte	–	–	–	–	–	–	–	–	–	–
Big Stick	–	–	–	–	–	–	–	–	–	–
Brooks Canyon	–	–	–	–	–	1	5	–	–	–
Buck Spring	–	–	–	–	–	–	1	–	–	–
Burns	–	–	–	–	–	–	–	–	–	–
Chickahominy	–	2	–	1	1	–	–	–	–	–
China Lake	–	–	–	–	–	–	–	–	–	–
Cougar Mountain	–	–	–	2	–	2	1	–	–	–
Coyote Wells	–	–	–	–	–	–	–	–	–	–
Coyote Wells East	–	–	–	–	–	–	–	–	–	–
Curtis Creek	–	–	–	–	–	–	–	–	–	–
Dog Hill	–	–	–	–	–	–	–	–	–	–
Double O	–	–	–	–	–	–	–	–	–	–
Eldorado	–	–	–	–	–	–	–	–	–	–
Glass Buttes 1	2	–	–	4	1	4	5	4	20	1
Glass Buttes 2	–	–	–	–	–	1	1	13	–	–
Glass Buttes 3	–	–	–	1	–	3	1	–	–	4
Glass Buttes 4	–	–	–	–	–	4	–	–	–	23
Glass Buttes 5	–	–	–	–	–	–	–	–	–	6
Glass Buttes 6	–	–	–	–	–	1	–	–	–	2
Glass Buttes 7	–	–	–	–	–	–	2	–	–	4
Glass Buttes 9	–	–	–	–	–	–	–	–	–	–
Gregory Creek	–	–	–	–	–	–	–	–	–	–
Mud Ridge	–	–	–	–	–	–	–	–	–	–
Newberry Volcano	–	–	2	–	–	–	–	–	–	–
Obsidian Cliffs	–	–	2	–	–	–	–	–	–	–
Palamino Buttes A	–	–	–	–	–	–	–	–	–	–
Quartz Mountain	16	2	16	12	18	3	2	–	–	–
Riley	–	–	–	–	–	–	–	–	–	–
Rimrock Spring	–	–	–	–	–	–	–	–	–	–
Skull Springs	–	–	–	–	–	–	–	–	–	–
Squaw Mountain	–	–	–	–	–	–	–	–	–	–
Tank Creek	–	–	–	–	–	–	–	–	–	–
Tule Spring	–	–	–	–	–	–	–	–	–	–
Unknown	2	–	–	–	–	–	–	–	–	–
Upper Gap Lake	–	–	–	–	–	–	–	–	–	–
Van Gulch	–	–	–	–	–	–	–	–	–	–
Venator	–	–	–	–	–	–	–	–	–	–
Whitewater Ridge	–	–	–	–	–	–	–	–	–	–
Wolf Creek	–	–	–	–	–	–	–	–	–	–
Yreka Butte	–	–	–	–	–	1	2	–	–	–
Total	**20**	**4**	**20**	**20**	**20**	**20**	**20**	**17**	**20**	**40**

Table 2 (continued). Geologic sources of obsidian identified by trace element analysis of artifacts. Totals may include provisionally assigned sources, e.g., Newberry Volcano? Table continued on next page.

Obsidian Source	35LK 3171	35HA 80	35HA 2875	35HA 2876	35HA 2877	35HA 2878	35HA 2879	35HA 2880	35HA 2885	35HA 2893
Beatys Butte	–	–	–	–	–	–	–	1	–	–
Big Stick	2	–	–	–	–	–	–	2	–	–
Brooks Canyon	–	–	–	–	–	–	–	–	–	–
Buck Spring	–	–	–	–	–	–	–	1	–	15
Burns	–	–	–	–	–	–	–	–	–	2
Chickahominy	–	–	–	–	–	–	–	1	18	–
China Lake	–	–	–	–	–	2	–	–	–	–
Cougar Mountain	–	–	–	–	–	–	–	–	–	–
Coyote Wells	–	–	–	–	–	–	–	–	–	–
Coyote Wells East	–	–	–	–	–	–	–	–	–	–
Curtis Creek	–	–	–	–	–	–	–	–	–	–
Dog Hill	–	–	–	–	–	–	–	–	–	–
Double O	–	–	–	–	–	–	–	–	2	1
Eldorado	–	–	–	–	–	–	–	–	–	–
Glass Buttes 1	–	–	–	1	–	–	–	1	–	–
Glass Buttes 2	–	–	–	–	–	–	–	–	–	–
Glass Buttes 3	7	2	2	–	1	–	1	1	–	–
Glass Buttes 4	5	11	12	19	18	18	16	4	–	–
Glass Buttes 5	1	4	–	–	–	–	1	–	–	–
Glass Buttes 6	–	1	–	–	–	–	–	–	–	–
Glass Buttes 7	4	2	–	–	–	–	1	–	–	–
Glass Buttes 9	–	–	1	–	1	–	–	–	–	–
Gregory Creek	–	–	–	–	–	–	–	–	–	–
Mud Ridge	–	–	–	–	–	–	–	–	–	–
Newberry Volcano	–	–	–	–	–	–	–	–	–	–
Obsidian Cliffs	–	–	–	–	–	–	–	–	–	–
Palamino Buttes A	–	–	–	–	–	–	–	1	–	–
Quartz Mountain	–	–	1	–	–	–	–	–	–	–
Riley	1	–	–	–	–	–	–	–	–	2
Rimrock Spring	–	–	–	–	–	–	–	1	–	–
Skull Springs	–	–	–	–	–	–	–	–	–	–
Squaw Mountain	–	–	–	–	–	–	–	2	–	–
Tank Creek	–	–	–	–	–	–	1	1	–	–
Tule Spring	–	–	–	–	–	–	–	–	–	–
Unknown	–	–	–	–	–	–	–	–	–	–
Upper Gap Lake	–	–	–	–	–	–	–	4	–	–
Van Gulch	–	–	–	–	–	–	–	–	–	–
Venator	–	–	–	–	–	–	–	–	–	–
Whitewater Ridge	–	–	–	–	–	–	–	–	–	–
Wolf Creek	–	–	–	–	–	–	–	–	–	–
Yreka Butte	–	–	–	–	–	–	–	–	–	–
Total	**20**	**20**	**16**	**20**	**20**	**20**	**20**	**20**	**20**	**20**

Table 2 (continued). Geologic sources of obsidian identified by trace element analysis of artifacts. Totals may include provisionally assigned sources, e.g., Newberry Volcano?. Table continued on next page.

Obsidian Source	35HA 2895	35HA 2899	35HA 2901	35HA 2904	35HA 2905	35HA 2906	35HA 70	35HA 2913	35ML 974	35ML 976
Beatys Butte	2	–	–	–	–	–	–	–	–	–
Big Stick	1	–	–	–	–	–	–	–	–	–
Brooks Canyon	–	–	–	–	–	–	–	–	–	–
Buck Spring	11	1	–	1	–	–	–	–	–	–
Burns	2	11	17	14	16	15	–	–	–	–
Chickahominy	–	–	–	1	–	–	–	–	–	–
China Lake	–	–	–	–	–	–	–	–	–	–
Cougar Mountain	–	–	–	–	–	–	–	–	–	–
Coyote Wells	–	–	–	–	–	–	–	–	–	–
Coyote Wells East	–	–	–	–	–	–	–	–	–	–
Curtis Creek	–	–	–	–	–	–	2	–	–	–
Dog Hill	1	–	2	1	2	2	–	–	–	–
Double O	–	–	–	–	–	–	–	–	–	–
Eldorado	–	–	–	–	–	–	–	–	–	–
Glass Buttes 1	–	–	–	–	–	–	–	–	–	–
Glass Buttes 2	–	–	–	–	–	–	–	–	–	–
Glass Buttes 3	–	–	–	–	–	–	–	–	–	–
Glass Buttes 4	–	–	–	–	–	–	–	–	–	–
Glass Buttes 5	–	–	–	–	–	–	–	–	–	–
Glass Buttes 6	–	–	–	–	–	–	–	–	–	–
Glass Buttes 7	–	–	–	–	–	–	–	–	–	–
Glass Buttes 9	–	–	–	–	–	–	–	–	–	–
Gregory Creek	–	–	–	–	–	1	1	2	18	8
Mud Ridge	–	5	–	–	1	–	–	–	–	–
Newberry Volcano	–	–	–	–	–	–	–	–	–	–
Obsidian Cliffs	–	–	–	–	–	–	–	–	–	–
Palamino Buttes A	–	–	–	–	–	–	–	–	–	–
Quartz Mountain	–	–	–	–	–	–	–	–	–	–
Riley	1	–	–	–	–	–	–	–	–	–
Rimrock Spring	–	3	–	2	–	–	–	–	–	–
Skull Springs	–	–	–	–	–	–	–	–	1	–
Squaw Mountain	–	–	1	–	–	–	–	–	–	–
Tank Creek	–	–	–	–	–	–	1	–	–	–
Tule Spring	–	–	–	–	–	1	10	–	–	–
Unknown	–	–	–	–	–	–	–	1	–	–
Upper Gap Lake	–	–	–	–	–	–	–	–	–	–
Van Gulch	–	–	–	–	–	–	1	1	–	–
Venator	1	–	–	–	–	–	–	–	–	1
Whitewater Ridge	1	–	–	1	1	1	–	–	–	–
Wolf Creek	–	–	–	–	–	–	5	6	1	–
Yreka Butte	–	–	–	–	–	–	–	–	–	–
Total	**20**	**20**	**20**	**20**	**20**	**20**	**20**	**10**	**20**	**9**

Table 2 (continued). Geologic sources of obsidian identified by trace element analysis of artifacts. Totals may include provisionally assigned sources, e.g., Newberry Volcano?.

Obsidian Source	**35ML 978**	**35ML 979**	**35ML 981**	**35ML 982**	**Artifact Total**
Beatys Butte	–	–	–	–	**3**
Big Stick	–	–	–	–	**5**
Brooks Canyon	–	–	–	–	**6**
Buck Spring	–	–	–	–	**30**
Burns	–	–	–	–	**77**
Chickahominy	–	–	–	–	**24**
China Lake	–	–	–	–	**2**
Cougar Mountain	–	–	–	–	**5**
Coyote Wells	3	8	–	–	**11**
Coyote Wells East	–	2	–	–	**2**
Curtis Creek	–	–	–	–	**2**
Dog Hill	–	–	–	–	**8**
Double O	–	–	–	–	**3**
Eldorado	–	1	–	–	**1**
Glass Buttes 1	–	–	–	–	**43**
Glass Buttes 2	–	–	–	–	**15**
Glass Buttes 3	–	–	–	–	**23**
Glass Buttes 4	–	–	–	–	**130**
Glass Buttes 5	–	–	–	–	**12**
Glass Buttes 6	–	–	–	–	**4**
Glass Buttes 7	–	–	–	–	**13**
Glass Buttes 9	–	–	–	–	**2**
Gregory Creek	15	8	1	1	**55**
Mud Ridge	–	–	–	–	**6**
Newberry Volcano	–	–	–	–	**2**
Obsidian Cliffs	–	–	–	–	**2**
Palamino Buttes A	–	–	–	–	**1**
Quartz Mountain	–	–	–	–	**70**
Riley	–	–	–	–	**4**
Rimrock Spring	–	–	–	–	**6**
Skull Springs	1	–	–	–	**2**
Squaw Mountain	–	–	–	–	**3**
Tank Creek	–	–	–	–	**3**
Tule Spring	–	–	–	–	**11**
Unknown	–	–	–	–	**3**
Upper Gap Lake	–	–	–	–	**4**
Van Gulch	–	–	–	–	**2**
Venator	1	1	–	–	**4**
Whitewater Ridge	–	–	–	–	**4**
Wolf Creek	–	–	–	–	**12**
Yreka Butte	–	–	–	–	**3**
Total	**20**	**20**	**1**	**1**	**618**

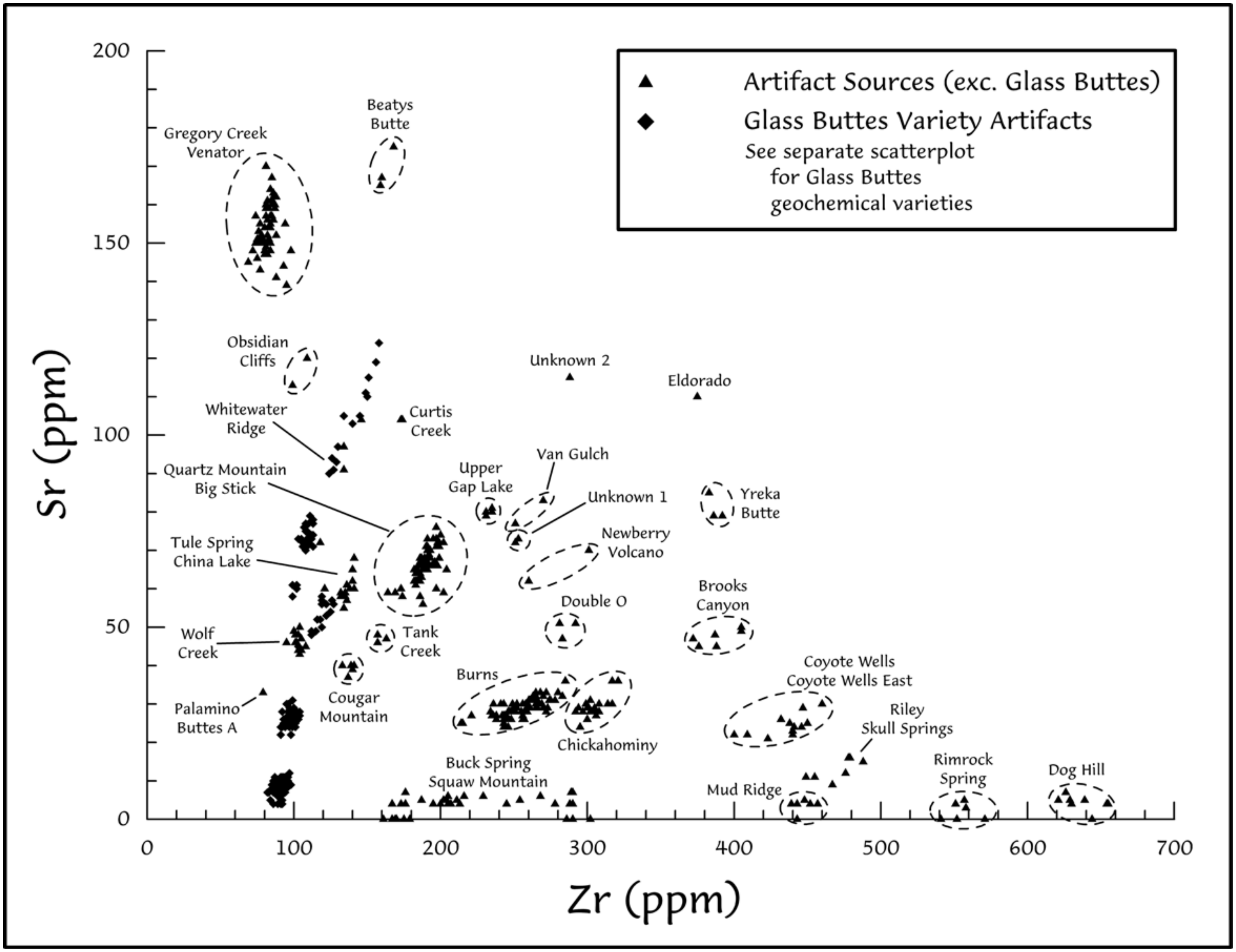

Figure 4. Scatterplot of strontium (Sr) plotted versus zirconium (Zr) for all analyzed artifacts. The different obsidian sources that are visually combined on this bivariate scatterplot are easily distinguishable on the basis of additional trace elements (see Figure 5).

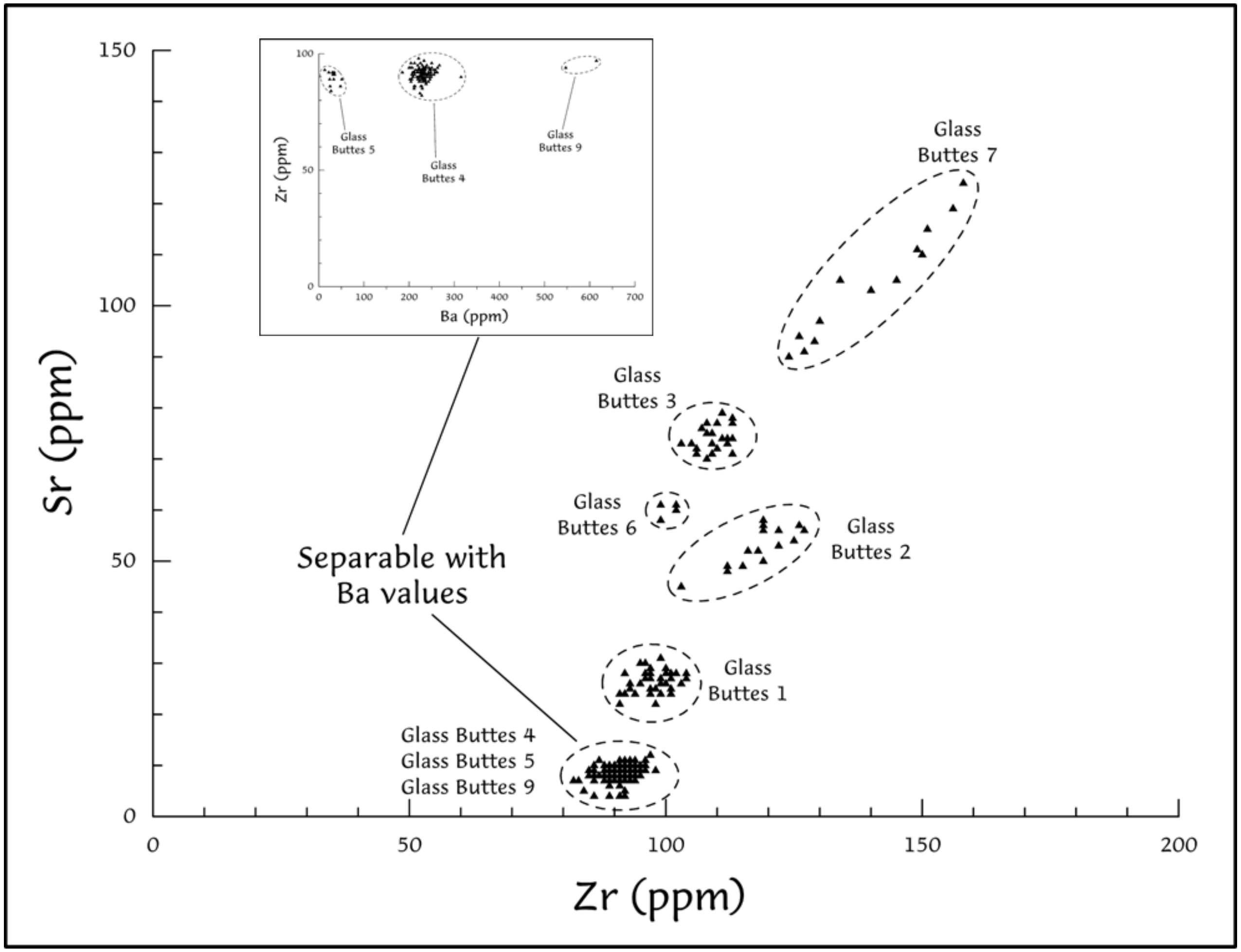

Figure 5. Scatterplot of strontium (Sr) plotted versus zirconium (Zr) and barium (Ba) plotted versus zirconium (Zr) for all artifacts correlated with the Glass Buttes geochemical source groups.

Eastern Portion. Moving eastward along the segment of the project corridor east of Burns, source use quickly shifts from Burns area glass to sources located in the Stinkingwater Mountains (Curtis Creek and Tule Spring), the Malheur River drainage (Wolf Creek and Venator), and two geochemical groups (Coyote Wells and Gregory Creek) located, respectively, not far south and north of the project corridor. The relatively sudden appearance of Coyote Wells and Gregory Creek source artifacts along the project transect is illustrated in figures 9D and 9E.

During the original obsidian studies carried out in 1998, these latter two obsidian sources were known as the Riley Mimic and Jonesboro sources and were known only from characterized artifacts. The geographic distribution of characterized artifacts matching the trace element profile of the Jonesboro and Riley Mimic sources suggested that geologic outcrops for these sources are located somewhere in the general vicinity of Jonesboro and subsequent field and geochemical studies bore out this conclusion. Artifacts correlated with the Jonesboro source had been previously identified at several sites to the north in the Malheur National Forest and the John Day Basin while Riley Mimic samples had more often found to the southwest in the Harney-Malheur Basin. The Riley Mimic chemical group draws its name from its geochemical similarities to the Riley source and is easily mistaken for obsidian from that source.

Project Obsidian Sources

Out of the 618 geochemically characterized artifact analyzed during the project, we were unable to match only three specimens with geologic sources included in our reference database. Based on their trace element composition, these three artifacts assigned to unknown sources likely originated from two different geologic sources and are numbered as such in this report, i.e., Unknown 1 and Unknown 2.

Although all identified obsidian sources are briefly described in Table 3, several of the source areas require additional description because of their unusual complexity.

Glass Buttes Obsidian Source Varieties. Ongoing joint field and geochemical research at the Glass Buttes obsidian source complex by Northwest Research and the Archaeometry Laboratory at MURR (Missouri University Research Reactor) has revealed the presence of at least nine geochemically discrete varieties of obsidian (Ambroz 1997; Ambroz et al. 2001). Given the complex geologic history of volcanism at Glass Buttes, we have long suspected that multiple geochemical source groups were present. Although details are lacking, the existence of multiple source groups has also been suggested by Godfrey-Smith et al. (1993; three different sources) and D’auria et al. (1992; five source groups).

Guided by previous geologic and geochemical studies and mapping at Glass Buttes by Berri (1982), Skinner (1983), Johnson (1984), Roche (1987), and Godfrey-Smith et al. (1993), geologic samples from the many different source outcrops have been collected and analyzed (see Figure 6). We have assigned each source group identified at the complex a separate numerical designation, with Glass Buttes 1 representing the source initially identified as the Glass Buttes obsidian source by Skinner (1983) and Hughes (1986a). Seven of the nine sources were also identified in secondary deposits located in the basin directly north of the source complex.

As part of the current investigation, 39.2 percent (N = 242) of the analyzed artifacts were correlated with the different Glass Buttes source varieties. Eight of the nine geochemical varieties of glass were present, with Glass Buttes 4 making up the dominant source among the analyzed artifacts (see Figure 5).

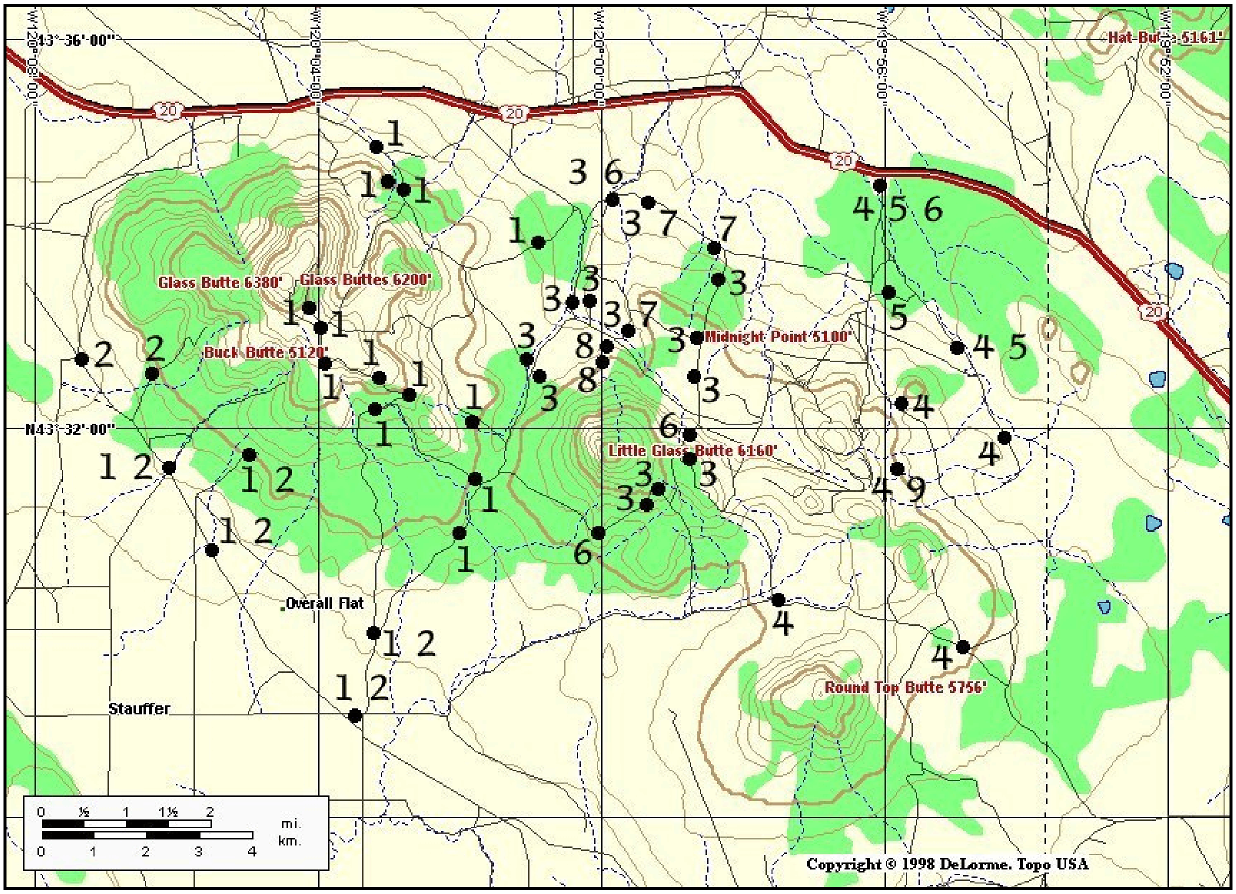

Figure 6. Glass Buttes obsidian source complex. The numbers next to the black dots (sampling locations) indicate the geochemical source variety or varieties found at that sampling locale, e.g., Glass Buttes 1. All source varieties were determined by X-ray fluorescence analysis of the source specimens.

Buck Spring Geochemical Source. Geologic deposits of the Buck Spring source group (named after the original sample collection locale), assigned to 30 of the characterized artifacts, are associated with the Rattlesnake Tuff, a widespread ash-flow tuff deposit originating from vents lying south of Harney Lake (Streck 1994; Streck and Grunder 1995; Ambroz 1997). Also known as the Double-O Ranch Tuff, Twelvemile Tuff, and the Danforth Formation, this unit covers over 9000 km^2 and stretches from the Blue Mountains in the north to the northern Great Basin in the south (see Figure 7). Nodules of obsidian collected in stream drainages or found weathering from the ashflow tuff deposits have been detected at many locations in the Ochoco National Forest northwest of Burns, at scattered locations south of Harney Lake, along the southwest shore of Harney Lake, at Wright's Point north of Harney Lake, in the Palamino Buttes area near Highway 20, and at Orejana Canyon in the northern Warner Valley. Trace element analysis of a large number of Buck Spring source samples indicates that obsidian from this source exhibits a wide range of variability in its trace element composition (see Figure 4 for an illustration). Although Ambroz (1997) postulates the existence of three different geochemical sources associated with the Rattlesnake Tuff, we distinguish two different sources using the trace elements determinable by X-ray fluorescence analysis. Of these two source groups (Buck Spring and Delintment Lake), only the Buck Spring source was found in the current investigation.

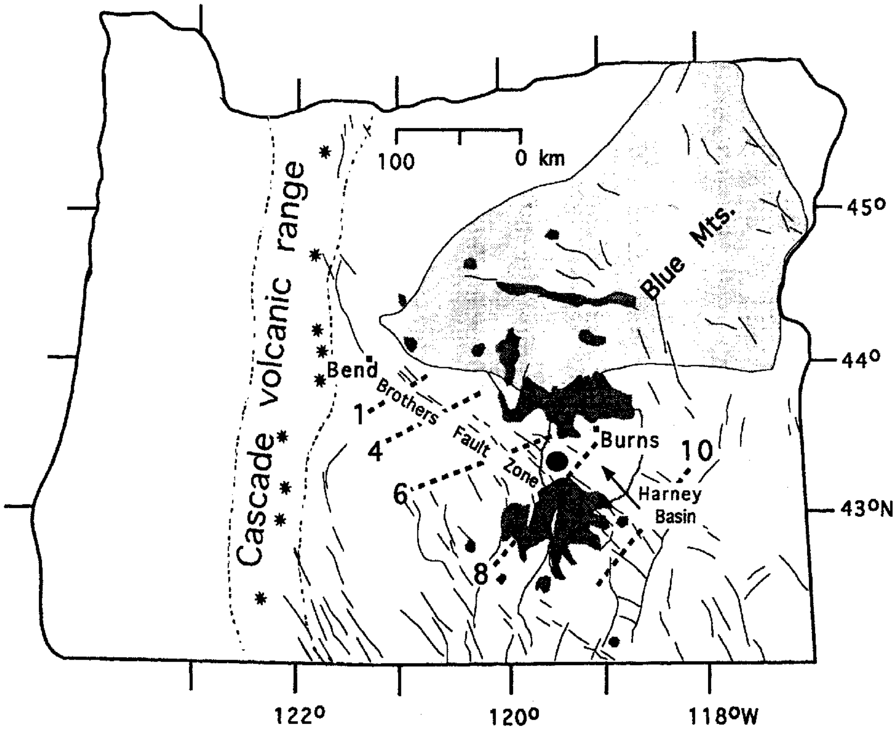

Figure 7. Outcrop pattern of the Rattlesnake Tuff in Oregon (dark areas). The dark circle in the Harney Basin indicates the probable source area for the tuff. Map is from Streck and Grunder (1997).

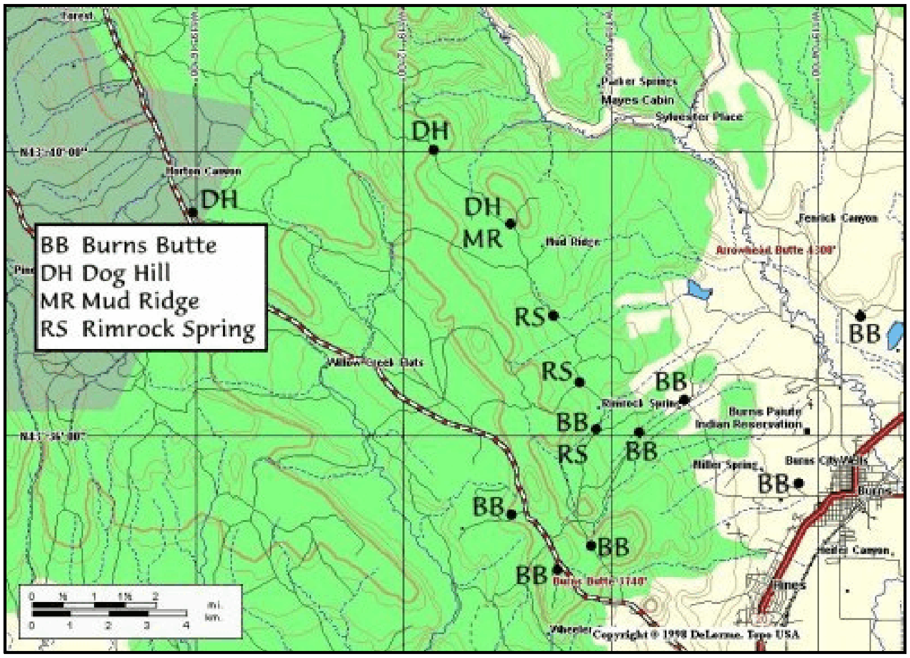

Figure 8. Locations of geochemical sources in the Burns area.

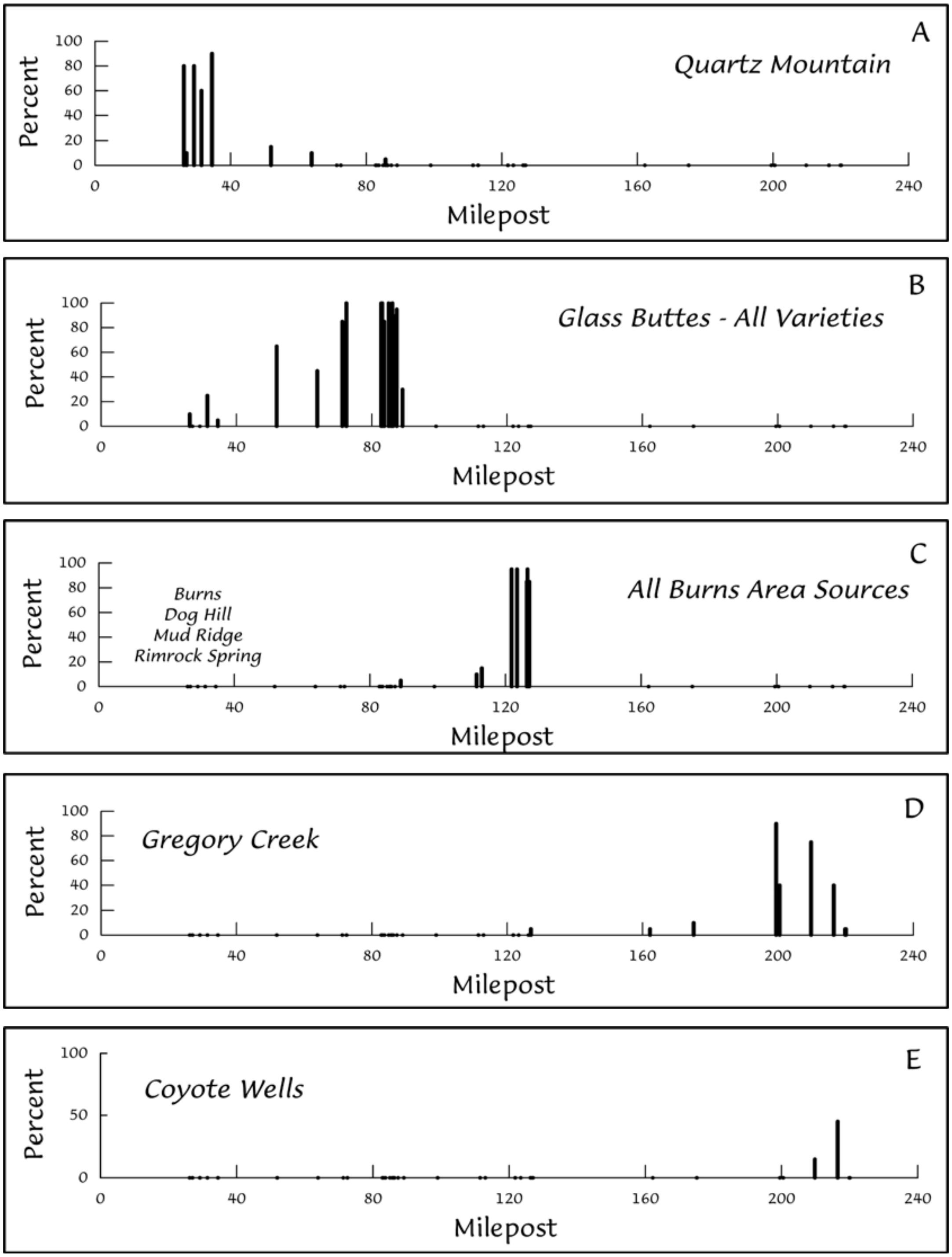

Figure 9. Histograms illustrating the percentages of major obsidian sources or groups of sources identified at sites along the project corridor. The milepost axis marks the west (zero point near Bend) to east locations of the project sites chosen for obsidian studies. Specific site numbers, milepost designations, and sample sizes are presented elsewhere in Table 1. The dots along the milepost axis indicate the locations of sites at which no artifacts were correlated with the designated sources.

Table 3. Descriptions of obsidian sources identified in the current investigation. Summaries include results of unpublished field and geochemical source research conducted by Northwest Research (2003). Table is continued on next page.

Geologic Source	Location	Description	References
Beatys Butte	Harney County, Oregon	Dense concentrations of surface nodules covering several square kilometers are found on the lower northern, eastern, and western slopes of Beatys Butte and are common in the lacustrine deposits of Pluvial Lake Catlow to the north and east of the butte. Obsidian from this source was widely used in the Steens Mountain area and the southeastern portion of the state and has been identified as far north as the Malheur National Forest and as far west as the southern Oregon coast.	Beck 1984 Hughes 1986a Lyons et al. 2001 Sappington 1981a Skinner 1983 Skinner 1995a
Big Stick	Harney County, Oregon	Surface nodules of obsidian occur approximately 30 km west of Harney Lake in the vicinity of Big Stick Road. Prehistoric use of this source is poorly known although small quantities have been reported from the Fort Rock and Harney-Malheur lake basins.	Hughes 1994 Oetting 1994
Brooks Canyon	Lake County, Oregon	Nodules of obsidian associated with rhyolites are found in Brooks Canyon and in outwash deposits to the north of the canyon mouth. Characterized artifacts have previously been only very occasionally reported, primarily in association with the Buffalo Flat site (Fort Rock Basin) and PGT-PG&E Pipeline Expansion Project (west-central Oregon).	Ambroz 1997 Hughes 1994 Oetting 1994 Skinner 1995a
Buck Spring	Harney County, Oregon	Obsidian nodules ranging from good to marginal quality are found associated with the Rattlesnake Tuff (formerly known as the Danforth Formation), an ashflow deposit covering at least 9,000 km^2 in southeastern Oregon (see Figure 7). Geologic outcrops and secondary deposits of obsidian nodules associated with this formation have been found at many locations in the Ochoco National Forest northwest of Burns and the western Harney-Malheur Basin and have also been found at outcrops located as far west as the Glass Buttes vicinity and as far southwest as the northern Warner Valley. Trace element analysis of a large number of geologic samples indicates that this source exhibits an unusually large range of geochemical variability. Despite the widespread geographic occurrence of glass, prehistoric use of Buck Spring source material appears to have been relatively limited and is restricted almost entirely to the Harney-Malheur Basin and Ochoco National Forest regions..	Ambroz 1997 Armitage 1995 Davenport 1970 Parker 1974 Piper et al. 1939 Sappington 1981a Streck 1994 Streck and Grunder 1995, 1997 Streck et al. 1999
Burns	Burns Area, Harney County, Oregon	This massive source is also known as the Burns Butte or Radar Hill source. Very large quantities of obsidian of excellent tool manufacturing quality are found at many locations in the hills north and northwest of the town of Burns and along the Silvies River drainage northeast of Burns. Characterization studies in the Burns area indicate that the obsidian was extensively used in the immediate region surrounding the sources. Although Burns obsidian is found at archaeological sites in the Malheur Lake Basin, use of the glass appears to decline rapidly with distance from the source. Artifacts correlated with the source are rarely identified outside the Harney-Malheur Basin.	Ambroz 1997 Brown 1982 Hughes 1986b Lund 1966 Lyons et al. 2001 Skinner 1983
Chickahominy	Harney County, Oregon	Abundant nodules of high quality obsidian occur as surface float and bedrock outcrops along Chickahominy Creek in the vicinity of Chickahominy Campground. Prehistoric use of obsidian from this source appears to be rather limited and artifacts correlated with the Chickahominy source are only very occasionally identified, usually from the immediate source region.	Ambroz 1997 Skinner 1983, 1995a

Table 3 (continued). Descriptions of obsidian sources identified in the current investigation. Table is continued on next page.

Geologic Source	Location	Description	References
China Lake	Harney County, Oregon	Located south of Juniper Ridge and north of China Lake in northwestern Harney County, this source of high quality obsidian was identified in 1999. Trace element studies of source material are still very preliminary. Very little is known concerning the prehistoric use of the glass – only a few artifacts from the Glass Buttes region and the Harney-Malheur Basin have been firmly correlated with the China Lake source.	—
Cougar Mountain	Fort Rock Basin, Lake County, south-central Oregon	This prominent obsidian and rhyolite dome is the source of large quantities of high quality black and occasionally gray obsidian. The dome is located at the northern edge of the Fort Rock Valley and the northern margin of Pluvial Fort Rock Lake. Small nodules of glass from Cougar Mountain are also found in lake deposits in much of this large Pleistocene lake basin. Obsidian artifacts from the source are commonly found at sites throughout the Fort Rock Basin. Prehistoric use rapidly decreases with increasing distance from the Fort Rock Basin, although glass from Cougar Mountain is occasionally encountered at sites along the Upper and Lower Deschutes River drainage, the northern margin of the Klamath Basin, and in the Western Cascades.	Allison 1979 Ambroz 1997 Atherton 1966 Bedwell 1973 Hughes 1986a, 1994 Musil and O'Neill 1997 Sappington and Toepel 1981 Skinner 1983, 1995a, 1995b Skinner and Winkler 1991, 1994
Coyote Wells	Malheur County, Oregon	First described as the Skull Springs area source by Sappington (1981a), obsidian nodules correlated with the Coyote Wells geochemical source are distributed over a wide area in north-central Malheur County. Although very few artifacts characterization studies have been carried out in the source region, obsidian artifacts correlated with Coyote Wells have been reported from as far west as the Lost Dune Site (35-HA-792) in the Malheur Basin, as far north as the Malheur National Forest, as far east as the Birch Creek site (35-ML-181) and at sites along the Malheur River and Oregon Highway 20. This source was previously known as the Riley Mimic source because of its geochemical similarities to the Riley source located to the west of the Harney-Malheur Basin.	Brooks 1992 Cole 2001 Evans and Binger 1998a Lyons et al. 2001 Sappington 1981a
Coyote Wells East	Malheur County, Oregon	Very similar in trace element composition to the Coyote Wells source, Coyote Wells East is known from a single source area located a few km east of Coyote Wells. Artifacts from this source are found in a similar range as those from Coyote Wells although they occur in considerably smaller numbers.	Lyons et al. 2001
Curtis Creek	Stinkingwater Mountains, Harney County, Oregon	This obsidian source was first identified as Unknown 2 during trace element studies of artifacts from the Indian Grade Spring Site in the Stinkingwater Mountains east of Burns. Seventy-two of the 106 characterized specimens from this site were correlated with the Unknown 2 geochemical source. Source outcrops of obsidian nodules correlated with the Unknown 2 source were finally located in the Curtis Creek drainage a few kilometers south of the Indian Grade Spring Site in 1999. Although a few artifacts from the Curtis Creek source have been found to the north of Indian Grade Spring in the Malheur National Forest, most examples are known from only a few sites in the immediate vicinity of the source.	Hughes 1990b Lyons et al. 2001

Table 3 (continued). Descriptions of obsidian sources identified in the current investigation. Table is continued on next page.

Geologic Source	Location	Description	References
Dog Hill	Harney County, Oregon	High quality glass occurs as surface float over a wide area about 15-20 km northwest of Burns, Oregon. Small nodules of obsidian from this source have also been identified in secondary gravel deposits in the Harney-Malheur Basin as far south as Wright's Point. The glass occasionally occurs in a very distinctive green color locally known as "Burns Green". The trace element composition is similar to the several other nearby sources and they may easily be confused with one another. Glass from this source is often found at archaeological sites in the Harney-Malheur Lake Basin and is occasionally reported from sites in the Malheur National Forest.	Ambroz 1997 Hughes 1986b Niem 1974 Skinner et al. 1998
Double O	Harney County, Oregon	Nodules of obsidian are found as surface float in a limited area a few kilometers west of Harney Lake. Local prehistoric source use is poorly known due to the few characterization studies in the source region. A very limited number of artifacts from this source have been identified from sites in the Burns area and in the Fort Rock Valley of south-central Oregon.	Hughes 1994 Lyons et al. 2001 Oetting 1994
Eldorado	Baker County, Oregon	Prehistoric use of this poorly mapped Whitman National Forest obsidian source is documented primarily from characterized artifacts from the Bear Valley region of the Malheur National Forest. The identification and geochemical characterization of this source in 2000 resolved a significant number of Malheur National Forest artifacts that had previously been assigned to unknown sources.	—
Glass Buttes	Glass Buttes Source Complex, Lake County, Oregon	Nine geochemically distinct sources of obsidian (Glass Buttes varieties 1 through 9) are found in association with the Glass Buttes source complex that is located immediately south of Highway 20 in northeastern Lake County (see Figure 6). The Glass Buttes 1 (or Glass Buttes A) source is the most extensive of several different geochemical source groups identified during X-Ray Fluorescence (XRF) and neutron activation analysis (NAA) studies of obsidian from the source complex. This geochemical variety is found throughout the northern half of Glass Buttes and is the same as the Glass Buttes chemical source identified by Skinner (1983) and Hughes (1986). Secondary deposits of obsidian from this and most other Glass Buttes geochemical source groups occur throughout the basin lying north of the source and in the basin located south of the complex (Sinks of Lost Creek) . Although obsidian from all of the identified Glass Buttes sources was primarily used in the immediate region surrounding the source complex, glass from the source area has been identified in archaeological sites to the north in Washington and British Columbia, Canada, and as far west as the Western Cascades of Oregon and the Portland Basin.	Ambroz 1997 Ambroz et al. 2001 Atherton 1966 Berri 1982 Carlson 1994 D'Auria et al. 1992 Godfrey-Smith et al. 1993 Hughes 1986a Johnson 1984 Johnson and Ciancanelli 1984 Roche 1987 Skinner 1983, 1995a, 1995b

Table 3 (continued). Descriptions of obsidian sources identified in the current investigation. Table is continued on next page.

Geologic Source	Location	Description	References
Gregory Creek	Malheur County, Oregon	The Gregory Creek source, first briefly reported by Sappington (1981a), is spread over an area of several square miles in the vicinity of Indian Creek and Gregory Creek. The source has also been called the Jonesboro source and is almost certainly the same as the one identified as the Sugarloaf Butte source by Nelson (1984). Artifacts correlated with the Gregory Creek source are known primarily from sites located in the Malheur National Forest and Upper John Day Basin and from sites located along Oregon Highway 20 in the Jonesboro area. Gregory Creek has also been called the Jonesboro source because of the large proportion of unknown obsidian artifacts from that source that were identified at sites along Oregon Highway 20 in the Jonesboro area.	Brooks and O'Brien 1992 Cole 2001 Evans and Binger 1998b Nelson 1984 Sappington 1981a
Mud Ridge	Burns Area, Harney County, Oregon	Nodules of glass occur as surface float about 10 km northwest of Burns, Oregon. The trace element composition is similar to the several other nearby sources and they may easily be confused with one another. The extent of prehistoric use of this source is unknown but appears to be rather limited.	Lyons et al. 2001
Newberry Volcano	Newberry Caldera, Newberry National Volcanic Monument, Deschutes County, Oregon	A composite chemical source consisting of several geochemically indistinguishable Holocene obsidian flows (Central Pumice Cone, East Lake, Game Hut, and Interlake flows) located within Newberry Caldera (Newberry National Volcanic Monument). All of the flows making up this geochemical group erupted after the Mazama ashfall of about 6,850 ^{14}C years ago, providing a unique temporal window for the prehistoric use of the glass. The rapid adoption and widespread prehistoric use of Newberry Volcano obsidian in the period following the eruption of the flows is well documented in central and north-central Oregon. Glass from this source is occasionally encountered at sites in the Western Cascades, southwest Oregon, northwest Oregon, and Washington, and has been reported from as far north as British Columbia, Canada.	Carlson 1994 Connolly 1999 Flenniken and Ozbun 1988 Friedman 1977 Friedman and Obradovich 1981 Hughes 1992 Kuehn 2002 Linneman 1990 MacLeod et al. 1995 Musil and O'Neill 1997 Skinner 1983, 1995a, 1995b Skinner and Winkler 1991, 1994 Williams 1935
Obsidian Cliffs	High Cascades, Three Sisters Wilderness Area, Lane County, Oregon	This large 95,000 yr-old glaciated obsidian-rhyolite flow is located in the central High Cascades near North Sister Volcano. Obsidian nodules from the source can be found in deposits of glacial till to the west of the source and are occasionally found in the gravels of the McKenzie and Willamette rivers in northwestern Oregon. Obsidian artifact manufacturing debris covers a large portion of the Obsidian Cliffs plateau and it is likely that this important source was used throughout much of the post-glacial period. Characterized artifacts from Obsidian Cliffs have been found at many archaeological sites in western Oregon, central and north-central Oregon, and Washington. Artifacts from the source have been reported from as far north as British Columbia, Canada.	Anttonen 1972 Carlson 1994 Hill 1992 Hughes 1992, 1993 Hughes, S. 1983 Musil and O'Neill 1997 Skinner 1983, 1986, 1995a, 1995b Skinner and Winkler 1991, 1994 South 1999 Taylor 1968 Taylor et al. 1987 White 1974, 1975 Williams 1944

Table 3 (continued). Descriptions of obsidian sources identified in the current investigation. Table is continued on next page.

Geologic Source	Location	Description	References
Palamino Buttes A	Harney County, Oregon	One of two different unknown geochemical source groups identified from a group of samples collected from secondary deposits in the immediate Palamino Buttes vicinity. The primary geologic source of this chemical type is unknown. The majority of analyzed geologic samples collected at Palamino Buttes were correlated with the Buck Spring and Delintment Lake sources, two highly variable geochemical sources associated with the Rattlesnake Formation ash-flow tuffs. This source is *not* the same as the Palamino Buttes source reported by Hughes (1994).	Hughes 1994
Quartz Mountain	Deschutes National Forest, Deschutes County, Oregon	Large quantities of high-quality glass are found associated with this Pleistocene complex of rhyolite domes and flows located in central Oregon immediately east-southeast of Newberry Volcano. Obsidian from this archaeologically significant and somewhat poorly-known source occurs in both black and variegated mahogany and black colors. Artifacts from Quartz Mountain are often identified in central Oregon archaeological sites north and west of Newberry Volcano and have been found as far north as southern Washington. Small amounts of the glass are found at sites in the northern part of the Western and High Cascades of Oregon, to the east in the Christmas Lake Basin, and as far northeast as the John Day River Basin and the Ochoco National Forest.	Ambroz 1997 Armitage 1995 Endzweig 1994 Hatch 1998 Hughes 1986a Musil and O'Neill 1997 Skinner 1983, 1995a, 1995b Skinner and Winkler 1991, 1994
Riley	Harney County, Oregon	Surface nodules of high-quality glass are located over a large area a few kilometers south of Riley, Oregon. Non-local artifacts from the Riley source are found in relatively limited quantities in the Malheur Lake Basin to the east of the source, in the Fort Rock Basin to the south, and are also reported in small quantities from several north-central Oregon archaeological sites.	Ambroz 1997 Atherton 1966 Hughes 1986a, 1994 Lyons et al. 2001 Oetting 1994 Skinner 1983, 1995a
Rimrock Spring	Harney County, Oregon	High quality glass occurs as surface float about 20 km north of Burns, Oregon. Occasionally occurs in a very distinctive green color. The trace element composition is similar to the nearby Dog Hill source and the two sources may be easily confused for one another. Glass from this source is often found at archaeological sites in the Malheur Lake Basin and is occasionally reported from sites in the Malheur National Forest.	Ambroz 1997
Skull Springs	Malheur County, Oregon	Known from several source localities in the vicinity of Skull Springs, obsidian from this geochemical group often co-occurs in geologic contexts with glass from the Venator source. The obsidian is typically purplish in color and contains numerous very small phenocrysts that are barely visible to the naked eye. Little is currently known of the prehistoric use of this source and few characterized artifacts have been correlated with the source. Artifacts originating from the Skull Springs (also known as Skull Spring) source are known primarily from sites located in the Harney-Malheur Basin and those north of the source along Oregon Highway 20 in the Jonesboro area.	Evans and Binger 1999 Cole 2001 Lyons et al. 2001 Sappington 1981a

Table 3 (continued). Descriptions of obsidian sources identified in the current investigation Table is continued on next page.

Geologic Source	Location	Description	References
Squaw Mountain	Harney County, Oregon	Also known as the Squaw Butte source, obsidian correlated with this geochemical group is found at several locations on the eastern portion of Juniper Ridge and in secondary deposits north of the ridge. Nodules of high-quality obsidian correlated with this source also co-occur with obsidian from the Upper Gap Lake source in at least one locality near Highway 20. Although a few Squaw Mountain artifacts are reported from the Fort Rock Basin, items originating from the source are uncommon and use appears to be limited largely to the immediate source area.	D'Auria et al. 1992 Godfrey-Smith et al. 1993 Hughes 1994 Oetting 1994
Tank Creek	Harney County, Oregon	Located not far east of Wagontire Mountain in the Egli Ridge area, very little is currently known about the geographic distribution of obsidian from this geochemical source. Prehistoric use is known from several sites in Harney County and from a few archaeological sites located to the west in the Fort Rock Basin.	—
Tule Spring	Stinkingwater Mountains, Harney County, Oregon	First identified only through trace element studies of artifacts from the Indian Grade Spring Site in the Stinkingwater Mountains east of Burns, this source was originally known as Unknown 1. Fifteen of the 91characterized artifacts from that site that belonged to unknown sources originated from the Tule Spring source. Obsidian from this chemical group was eventually located in 1998 and is spread over an area of several square kilometers in the Stinkingwater Mountains. Tule Spring glass is also found in secondary deposits in the Stinkingwater Creek drainage where it is crossed by Highway 20. Additional outcrops of Tule Spring obsidian were also identified along the eastern margin of the Harney-Malheur Basin in 1999. Prehistoric use of obsidian from this source is known primarily from a few local sites although a few artifacts from the source have also been identified at sites to the north in the Malheur Forest and to the west in the Harney-Malheur Basin.	Hughes 1990b Lyons et al. 2001 Skinner et al. 1998
Upper Gap Lake	Harney County, Oregon	Nodules of relatively marginal obsidian from this source co-occur in secondary deposits near Highway 20 with obsidian from the Squaw Mountain obsidian source. Glass from the source also occurs a few miles southeast of Upper Gap Lake over a large but undetermined area immediately west of Juniper Ridge. The texture of the black glass is rather grainy and of modest tool manufacturing quality. The only known artifacts originating from the Upper Gap Lake source were identified at 35-HA-2880 during the current investigation.	—
Van Gulch	Grant County, Oregon	This source is known from only a few locations in the southeast part of the Malheur National Forest. Prehistoric use of the Van Gulch obsidian has been documented through trace element studies at several locations in the Malheur National Forest although artifacts fromVan Gulch are only rarely encountered outside the immediate source region.	Skinner and Thatcher 2003

Table 3 (continued). Descriptions of obsidian sources identified in the current investigation.

Geologic Source	Location	Description	References
Venator	Harney County, Oregon	Nodules of high quality obsidian correlated with the Venator geochemical source are distributed over a very large region east of Malheur Lake and the townsite of Venator. Obsidian nodules are common in the river gravels and terrace deposits of the South Fork of the Malheur River in the area from Venator to Riverside and have also been found to the north at Horseshoe Bend in the Juntura area. Venator obsidian is also common in the highlands east of Riverside and has been found at many locations in the vicinity of Skull Springs, Coyote Wells, and Dry Creek Canyon. In at least one location, the obsidian is directly associated with a volcanic ashflow, the probable primary source of this widespread toolstone. A gray microcrystalline variety of excellent toolstone quality also co-occurs with the glassy variety at most source locations. Both the glassy and gray varieties of Venator source artifacts are commonly found at sites located throughout the Harney-Malheur Basin. Characterized artifacts from the source are also occasionally identified at sites in the Malheur National Forest and along Oregon Highway 20 to the north of the source in the Jonesboro area.	Ambroz 1997 Cole 2001 Lyons et al. 2001
Whitewater Ridge	Malheur National Forest, Grant County, Oregon	High quality obsidian correlated with the Whitewater Ridge source group is known from many different widely distributed source localities found along the southern margins and hills immediately south of Bear Valley. Obsidian from this highly variable geochemical source has also been known as the Little Bear Creek, Seneca, Whitewater Spring, Foster Spring, John Day, and Bear Valley sources. Prehistoric use of the Whitewater Ridge source was very extensive, perhaps more so than any other source in northeast Oregon. Artifacts from the source have been found throughout the Malheur National Forest and are common at many north-central Oregon sites in the John Day and Lower Deschutes river basins. Glass from Whitewater Ridge has been identified as far north as North Cascades National Park in Washington, as far west as the Oregon Cascades, as far south as the Malheur Lake Basin, and has possibly been identified in British Columbia, Canada.	Ambroz 1997 Armitage 1995 Carlson 1994 Endzweig 1994 Erlandson et al. 1991 Hughes 1995a, 1995b Lyons et al. 2001 Sappington 1981a, 1981b Skinner 1983, 1995a, 1995b Skinner and Thatcher 2003
Wolf Creek	Malheur National Forest; Grant County, Oregon	High quality glass occurs in many locations near Glass Mountain (Malheur National Forest) and immediately south and east of the Whitewater Ridge source area. Artifacts from the Wolf Creek source often co-occur with those from Whitewater Ridge, although generally in much lower frequencies. Secondary deposits of Wolf Creek obsidian have also been identified in terrace and gravel bar deposits of the Malheur River in the Drewsey area between Highway 20 and the Drewsey Grange, and a short distance east of Juntura at Horseshoe Bend.	Ambroz 1997 Lyons et al. 2001 Skinner 1995a Skinner and Thatcher 2003 Skinner et al. 1998
Yreka Butte	Deschutes and Lake counties, central Oregon	A rhyolite-obsidian dome complex located about 15 mi west-northwest of Glass Buttes. Black and mahogany nodules of glass reported from this source was characterized and found to originate from Glass Buttes, probably the result of historic transport to a cattle watering station. Artifacts from this source are only rarely encountered but have been reported from several sites in the Fort Rock Basin.	Ambroz 1997 Hughes 1994 Oetting 1994 Skinner 1995a

Burns Area Sources. Recent field work and trace element studies of obsidian collected in the Burns area suggest that at least four chemical source groups are present (see Figure 8). Three of the four sources, Dog Hill, Rimrock Spring, and Mud Ridge, are geochemically similar (elevated Zr and depleted Sr) but, at this point in still ongoing investigations, appear to be clearly distinguishable on the basis of their trace element composition. D'Auria et al. (1992) mentions the presence of five different sources in the Burns area, however, and geochemical studies by Northwest Research are still underway in a search for another possible source. Obsidian belonging to the fourth source group, Burns (Burns Butte), is available in large quantities in the immediate Burns vicinity and was the most intensively utilized of the Burns area sources during the prehistoric period. Glass artifacts from the Burns source are often encountered in artifact collections in the Burns area and elsewhere in the Harney-Malheur Basin. Prehistoric use of all the Burns area sources declines rapidly with increasing distance from the sources (see Figure 9C).

Obsidian Hydration Analysis

All 618 artifacts characterized by X-ray fluorescence analysis were prepared for obsidian hydration analysis. The analysis yielded 640 measurable hydration rims, including 39 double rims associated with cortex surfaces or artifact reuse and scavenging activities (Waechter and Origer 1993). The specimen slides are curated at the Northwest Research Obsidian Studies Laboratory under accession number 1998-56. The results are summarized in Table 5 and are reported in Table B-1 in Appendix B. Although hydration rate information is unavailable for most of the identified sources (see Table 4 for available research), additional hydration data and discussion of source production curves for several of the sources can be found in Skinner (1995b).

Table 4. Hydration rate information reported in the literature for obsidian sources identified in the current investigation.

Geologic Source	Rate	Comments	References
Burns	10.0 μm^2/ 1000 yrs [A]	This unusually rapid hydration rate is proposed by Dr. Thomas Connolly, State Museum of Anthropology, Eugene, Oregon.	[A] Thomas et al. 2002
Newberry Volcano	2.9 μm^2/ 1000 yrs [B] 3.0 μm^2/ 1000 yrs [C] 2.2 μm^2/ 1000 yrs [D] 1.5 μm^2/ 1000 yrs [E]	All flows are post-Mazama in age; maximum hydration rim measurements of artifacts correlated with the Newberry Volcano source group are approximately 5.2 - 5.3 µm [E]. Different caldera rates for different contexts are reported by Connolly and Byram [D].	[B] Friedman 1977 [C] Friedman and Obradovich 1981 [D] Connolly and Byra 1999 [E] Skinner 1995b
Obsidian Cliffs	1.56 μm^2/ 1000 + 42 yrs [F] 4.0 μm^2/ 1000 yrs [H]	With larger rims, the Bergland et al. rate yields calculated ages that are too old [F]. The 6,850 yr-old Mazama ashfall occurs at about 4.6 - 5.0 µm at archaeological sites located in Jefferson and Deschutes, Oregon, counties [F]. The Wilson rate is a provisional estimate for the Willamette Valley floor [G].	[F] Bergland et al. 1994 [G] Pettigrew 1996, 1998 [G] Skinner 1995b [H] Wilson 1995
Whitewater Ridge	2.98 μ^2/1000 yrs [I] 6.6 μ^2/1000 yrs [J]	Widely differing hydration rates proposed in the literature.	[I] Armitage 1995:262 [J] Ozbun et al. 1997

Table 5. Summary of obsidian hydration measurements for analyzed artifacts. Hydration rim values are presented in microns. The number of successfully measured rims follows the hydration rim value or range of values in parentheses; outliers or widely separated values are separated by a comma. Table continued on next page.

Obsidian Source	**35DS 1430**	**35DS 1432**	**35DS 1433**	**35DS 1435**	**35DS 1437**	**35DS 1440**	**35DS 1441**	**35LK 279**	**35LK 3169**	**35LK 2544**
Beatys Butte	–	–	–	–	–	–	–	–	–	–
Big Stick	–	–	–	–	–	–	–	–	–	–
Brooks Canyon	–	–	–	–	–	5.2 (1)	3.2-6.0 (6)	–	–	–
Buck Spring	–	–	–	–	–	–	7.9 (1)	–	–	–
Burns	–	–	–	–	–	–	–	–	–	–
Chickahominy	–	5.3-6.1 (2)	–	4.3 (1)	4.6 (1)	–	–	–	–	–
China Lake	–	–	–	–	–	–	–	–	–	–
Cougar Mountain	–	–	–	5.7-6.2 (2)	–	4.7-5.3 (2)	6.4 (1)	–	–	–
Coyote Wells	–	–	–	–	–	–	–	–	–	–
Coyote Wells East	–	–	–	–	–	–	–	–	–	–
Curtis Creek	–	–	–	–	–	–	–	–	–	–
Dog Hill	–	–	–	–	–	–	–	–	–	–
Double O	–	–	–	–	–	–	–	–	–	–
Eldorado	–	–	–	–	–	–	–	–	–	–
Glass Buttes 1	3.4-3.7 (2)	–	–	5.1-6.4 (4)	4.8 (1)	4.4-5.7 (4)	4.6-8.2 (5)	7.3-7.5, 66.2 (4)	2.1-6.2, 20.0 (21)	3.5 (1)
Glass Buttes 2	–	–	–	–	–	5.1 (1)	5.4 (1)	4.4-5.7, 8.4 (14)	–	–
Glass Buttes 3	–	–	–	6.1 (1)	–	5.4-6.1 (3)	6.0 (1)	–	–	3.0-3.8 (4)
Glass Buttes 4	–	–	–	–	–	4.6-7.0, 10.8 (4)	–	–	–	2.1-6.2 (28)
Glass Buttes 5	–	–	–	–	–	–	–	–	–	2.4-5.3 (6)
Glass Buttes 6	–	–	–	–	–	6.3 (1)	–	–	–	3.7-5.3 (2)
Glass Buttes 7	–	–	–	–	–	–	2.3-4.1 (2)	–	–	1.5-2.4 (4)
Glass Buttes 9	–	–	–	–	–	–	–	–	–	–
Gregory Creek	–	–	–	–	–	–	–	–	–	–
Mud Ridge	–	–	–	–	–	–	–	–	–	–
Newberry Volcano	–	–	3.5-4.4 (2)	–	–	–	–	–	–	–
Obsidian Cliffs	–	–	5.0-6.0 (2)	–	–	–	–	–	–	–
Palamino Buttes A	–	–	–	–	–	–	–	–	–	–
Quartz Mountain	2.4-6.2, 12.2 (18)	3.7-3.9 (2)	3.0-6.8 (15)	3.8-6.1 (11)	2.4-6.6, 9.0 (18)	4.8-6.2 (3)	5.5-6.2 (2)	–	–	–
Riley	–	–	–	–	–	–	–	–	–	–
Rimrock Spring	–	–	–	–	–	–	–	–	–	–
Skull Springs	–	–	–	–	–	–	–	–	–	–
Squaw Mountain	–	–	–	–	–	–	–	–	–	–
Tank Creek	–	–	–	–	–	–	–	–	–	–
Tule Spring	–	–	–	–	–	–	–	–	–	–
Unknown	2.8, 6.4, 14.7 (3)	–	–	–	–	–	–	–	–	–
Upper Gap Lake	–	–	–	–	–	–	–	–	–	–
Van Gulch	–	–	–	–	–	–	–	–	–	–
Venator	–	–	–	–	–	–	–	–	–	–
Whitewater Ridge	–	–	–	–	–	–	–	–	–	–
Wolf Creek	–	–	–	–	–	–	–	–	–	–
Yreka Butte	–	–	–	–	–	4.8 (1)	1.5,6.4 (2)	–	–	–
Total	**23**	**4**	**19**	**19**	**20**	**20**	**21**	**18**	**21**	**45**

Table 5 (continued) Summary of obsidian hydration measurements for analyzed artifacts. Hydration rim values are presented in microns. Table continued on next page.

Obsidian Source	35LK 3171	35HA 80	35HA 2875	35HA 2876	35HA 2877	35HA 2878	35HA 2879	35HA 2880	35HA 2885	35HA 2893
Beatys Butte	–	–	–	–	–	–	–	5.0 (1)	–	–
Big Stick	4.5-4.8 (2)	–	–	–	–	–	–	5.1, 7.1 (2)	–	–
Brooks Canyon	–	–	–	–	–	–	–	–	–	–
Buck Spring	–	–	–	–	–	–	–	8.9 (1)	–	1.7 - 9.0 (19)
Burns	–	–	–	–	–	–	–	–	–	5.3-5.7 (2)
Chickahominy	–	–	–	–	–	–	–	8.3 (1)	2.9-8.1, 16.1 (18)	–
China Lake	–	–	–	–	–	5.8-6.0 (2)	–	–	–	–
Cougar Mountain	–	–	–	–	–	–	–	–	–	–
Coyote Wells	–	–	–	–	–	–	–	–	–	–
Coyote Wells East										
Curtis Creek	–	–	–	–	–	–	–	–	–	–
Dog Hill	–	–	–	–	–	–	–	–	–	–
Double O	–	–	–	–	–	–	–	–	1.3, 4.4 (3)	3.7 (1)
Eldorado	–	–	–	–	–	–	–	–	–	–
Glass Buttes 1	–	–	–	8.0 (1)	–	–	–	NA	–	–
Glass Buttes 2	–	–	–	–	–	–	–	–	–	–
Glass Buttes 3	1.8-5.8 (8)	3.2-4.4 (2)	4.9-6.0 (2)	–	7.3 (1)	–	3.8 (1)	5.7 (1)	–	–
Glass Buttes 4	2.9, 5.0- 7.1 (5)	2.6-6.4 (11)	2.1-3.7, 5.5-8.1 (14)	3.7-7.7, 52.3 (22)	2.8, 4.8-7.5 (18)	2.8-6.4 (19)	2.6-6.0 (16)	5.9-7.9 (4)	–	–
Glass Buttes 5	6.1 (1)	2.4-6.1 (4)	–	–	–	–	3.5 (1)	–	–	–
Glass Buttes 6	–	3.9 (1)	–	–	–	–	–	–	–	–
Glass Buttes 7	2.1-2.6 (4)	2.3 -3.7 (2)	–	–	–	–	2.3 (1)	–	–	–
Glass Buttes 9	–	–	6.2 (1)	–	2.1, 7.1 (2)	–	–	–	–	–
Gregory Creek	–	–	–	–	–	–	–	–	–	–
Mud Ridge	–	–	–	–	–	–	–	–	–	–
Newberry Volcano	–	–	–	–	–	–	–	–	–	–
Obsidian Cliffs	–	–	–	–	–	–	–	–	–	–
Palamino Buttes A	–	–	–	–	–	–	–	6.1 (1)	–	–
Quartz Mountain	–	–	7.1 (1)	–	–	–	–	–	–	–
Riley	5.2 (1)	–	–	–	–	–	–	–	–	3.9-4.4 (2)
Rimrock Spring	–	–	–	–	–	–	–	6.0 (1)	–	–
Skull Springs									–	
Squaw Mountain	–	–	–	–	–	–	–	5.9-7.3 (2)	–	–
Tank Creek	–	–	–	–	–	–	4.1 (1)	6.6 (1)	–	–
Tule Spring	–	–	–	–	–	–	–	–	–	–
Unknown	–	–	–	–	–	–	–	–	–	–
Upper Gap Lake	–	–	–	–	–	–	–	3.5-5.3 (3)	–	–
Van Gulch									–	
Venator	–	–	–	–	–	–	–	–	–	–
Whitewater Ridge	–	–	–	–	–	–	–	–	–	–
Wolf Creek	–	–	–	–	–	–	–	–	–	–
Yreka Butte	–	–	–	–	–	–	–	–	–	–
Total	**21**	**20**	**18**	**23**	**21**	**21**	**20**	**18**	**21**	**24**

Table 5 (continued) Summary of obsidian hydration measurements for analyzed artifacts. Hydration rim values are presented in microns. Table continued on next page.

Obsidian Source	35HA 2895	35HA 2899	35HA 2901	35HA 2904	35HA 2905	35HA 2906	35HA 70	35HA 2913	35ML 974	35ML 976
Beatys Butte	2.3-5.1 (3)	–	–	–	–	–	–	–	–	–
Big Stick	5.5 (1)	–	–	–	–	–	–	–	–	–
Brooks Canyon	–	–	–	–	–	–	–	–	–	–
Buck Spring	2.8, 5.1-10.0 (12)	3.0 (1)	–	5.5, 8.2 (2)	–	–	–	–	–	–
Burns	5.6-7.0 (2)	3.0-8.0 (12)	4.3-7.1 (18)	3.3-8.1 (14)	3.9-7.5 (17)	2.3-7.1 (15)	–	–	–	–
Chickahominy	–	–	–	5.8 (1)	–	–	–	–	–	–
China Lake	–	–	–	–	–	–	–	–	–	–
Cougar Mountain	–	–	–	–	–	–	–	–	–	–
Coyote Wells	–	–	–	–	–	–	–	–	–	–
Coyote Wells East	–	–	–	–	–	–	–	–	–	–
Curtis Creek	–	–	–	–	–	–	2.6 (2)	–	–	–
Dog Hill	2.3, 5.3 (2)	–	5.7-6.2 (2)	3.5 (1)	3.2-3.7 (2)	5.0-6.2 (2)	–	–	–	–
Double O	–	–	–	–	–	–	–	–	–	–
Eldorado	–	–	–	–	–	–	–	–	–	–
Glass Buttes 1	–	–	–	–	–	–	–	–	–	–
Glass Buttes 2	–	–	–	–	–	–	–	–	–	–
Glass Buttes 3	–	–	–	–	–	–	–	–	–	–
Glass Buttes 4	–	–	–	–	–	–	–	–	–	–
Glass Buttes 5	–	–	–	–	–	–	–	–	–	–
Glass Buttes 6	–	–	–	–	–	–	–	–	–	–
Glass Buttes 7	–	–	–	–	–	–	–	–	–	–
Glass Buttes 9	–	–	–	–	–	–	–	–	–	–
Gregory Creek	–	–	–	–	–	3.2 (1)	1.7 (1)	3.0-3.7 (2)	2.4-4.6 (19)	2.8-5.0 (7)
Mud Ridge	–	4.6-9.1 (5)	–	–	7.3 (1)	–	–	–	–	–
Newberry Volcano	–	–	–	–	–	–	–	–	–	–
Obsidian Cliffs	–	–	–	–	–	–	–	–	–	–
Palamino Buttes A	–	–	–	–	–	–	–	–	–	–
Quartz Mountain	–	–	–	–	–	–	–	–	–	–
Riley	5.5 (1)	–	–	–	–	–	–	–	–	–
Rimrock Spring	–	4.0, 7.0-7.2 (3)	–	2.8-3.2 (2)	–	–	–	–	–	–
Skull Springs	–	–	–	–	–	–	–	–	NA	–
Squaw Mountain	–	–	6.8 (1)	–	–	–	–	–	–	–
Tank Creek	–	–	–	–	–	–	3.7 (1)	–	–	–
Tule Spring	–	–	–	–	–	2.4 (1)	2.8-3.9, 9.0 (11)	–	–	–
Unknown	–	–	–	–	–	–	–	NA	–	–
Upper Gap Lake	–	–	–	–	–	–	–	–	–	–
Van Gulch	–	–	–	–	–	–	3.9 (1)	5.0 (1)	–	–
Venator	NA	–	–	–	–	–	–	–	–	NA
Whitewater Ridge	6.2 (1)	–	–	5.1 (1)	5.5 (1)	4.0 (1)	–	–	–	–
Wolf Creek	–	–	–	–	–	–	3.7-3.9 (5)	3.6-4.6, 7.0 (6)	7.9 (1)	–
Yreka Butte	–	–	–	–	–	–	–	–	–	–
Total	**22**	**21**	**21**	**21**	**21**	**20**	**21**	**9**	**20**	**7**

Table 5 (continued) Summary of obsidian hydration measurements for analyzed artifacts. Hydration rim values are presented in microns.

Obsidian Source	35ML 978	35ML 979	35ML 981	ORE 982	Total Range (microns)	Total
Beatys Butte	–	–	–	–	**2.3, 5.0 - 5.1**	**4**
Big Stick	–	–	–	–	**4.5 - 7.1**	**5**
Brooks Canyon	–	–	–	–	**3.2 - 6.0**	**7**
Buck Spring	–	–	–	–	**1.7 - 10.0**	**36**
Burns	–	–	–	–	**2.3 - 8.1**	**80**
Chickahominy	–	–	–	–	**2.9 - 8.3, 16.1**	**24**
China Lake	–	–	–	–	**5.8 – 6.0**	**2**
Cougar Mountain	–	–	–	–	**4.7 - 6.4**	**5**
Coyote Wells	6.2-6.3 (2)	3.5-6.8 (7)	–	–	**3.5 - 6.8**	**9**
Coyote Wells East	–	3.5-4.4 (2)	–	–	**3.5 – 4.4**	**2**
Curtis Creek	–	–	–	–	**2.6**	**2**
Dog Hill	–	–	–	–	**2.3 - 6.2**	**9**
Double O	–	–	–	–	**1.3, 3.7 - 4.4**	**4**
Eldorado	–	5.1 (1)	–	–	**5.1**	**1**
Glass Buttes 1	–	–	–	–	**2.1 - 8.2, 20.0, 66.2**	**44**
Glass Buttes 2	–	–	–	–	**4.4 - 5.7, 8.4**	**16**
Glass Buttes 3	–	–	–	–	**1.8 - 7.3**	**24**
Glass Buttes 4	–	–	–	–	**2.1 - 8.1, 10.8, 52.3**	**142**
Glass Buttes 5	–	–	–	–	**2.4 - 6.1**	**12**
Glass Buttes 6	–	–	–	–	**3.7 – 6.3**	**4**
Glass Buttes 7	–	–	–	–	**1.5 - 4.1**	**13**
Glass Buttes 9	–	–	–	–	**2.1, 6.2 - 7.1**	**3**
Gregory Creek	2.2-5.1 (16)	3.1-5.1 (7)	3.6 (1)	3.7 (1)	**1.7 - 5.1**	**55**
Mud Ridge	–	–	–	–	**4.6 - 9.1**	**6**
Newberry Volcano	–	–	–	–	**3.5 - 4.4**	**2**
Obsidian Cliffs	–	–	–	–	**5.0 - 6.0**	**2**
Palamino Buttes A	–	–	–	–	**6.1**	**1**
Quartz Mountain	–	–	–	–	**2.4 - 9.0, 12.2**	**70**
Riley	–	–	–	–	**3.9 - 5.5**	**4**
Rimrock Spring	–	–	–	–	**2.8 - 4.0, 6.0 - 7.2**	**6**
Skull Springs	6.1 (1)	–	–	–	**6.1**	**1**
Squaw Mountain	–	–	–	–	**5.9 - 7.3**	**3**
Tank Creek	–	–	–	–	**3.7 – 6.6**	**3**
Tule Spring	–	–	–	–	**2.4 - 3.9, 9.0**	**12**
Unknown	–	–	–	–	**2.8, 6.4, 14.7**	**3**
Upper Gap Lake	–	–	–	–	**3.5 - 5.3**	**3**
Van Gulch	–	–	–	–	**3.9 – 5.0**	**2**
Venator	3.9 (1)	4.1 (1)	–	–	**3.9 - 4.1**	**2**
Whitewater Ridge	–	–	–	–	**4.0 - 6.2**	**4**
Wolf Creek	–	–	–	–	**3.6 - 4.6, 7.0 - 7.9**	**12**
Yreka Butte	–	–	–	–	**1.5, 4.8 - 6.4**	**3**
Total	**20**	**18**	**1**	**1**	–	**640**

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Appendix A

Results of X-Ray Fluorescence Analysis

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-DS-1430	1	1139-7	79	24	148	67	44	191	11	766	254	NM	1.45	60.5	60.7	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	2	1139-22	57	25	133	62	44	184	11	803	289	NM	1.54	55.1	61.6	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	3	1139-47	45	25	96	28	58	102	12	256	155	1107	0.34	31.6	48.1	Glass Buttes 1
			± 7	3	4	7	3	7	2	95	47	19	0.11			
35-DS-1430	4	1139-54	73	25	133	64	46	185	11	742	267	NM	1.60	62.6	68.6	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	5	1139-55	79	24	139	67	46	189	11	673	230	NM	1.33	62.8	63.4	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	6	1139-58	79	26	149	69	47	192	9	555	195	NM	0.99	59.0	58.1	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	7	1139-60	65	24	133	62	42	182	9	661	264	NM	1.49	59.2	71.9	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	8	1139-61	58	21	118	73	42	253	13	2155	361	984	2.41	65.2	35.7	Unknown 1
			± 6	2	3	7	3	7	1	98	48	13	0.11			
35-DS-1430	9	1139-62	84	25	148	66	46	198	11	665	208	NM	1.16	63.1	56.7	Quartz Mountain
			± 7	3	4	7	3	7	2	96	47	NM	0.11			
35-DS-1430	10	1139-63	75	29	146	65	43	190	14	654	228	NM	1.24	60.0	61.4	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	11	1139-64	67	26	143	67	42	187	8	547	236	NM	1.28	59.2	75.2	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	12	1139-65	49	26	140	63	42	187	11	417	175	NM	0.76	53.6	60.2	Quartz Mountain
			± 8	3	4	7	3	7	2	95	47	NM	0.11			
35-DS-1430	13	1139-66	61	25	139	67	45	186	7	600	254	NM	1.39	58.0	73.9	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	14	1139-67	52	20	118	77	40	251	11	1723	322	1015	1.86	58.0	34.7	Unknown 1
			± 7	2	3	7	3	7	2	97	47	14	0.11			
35-DS-1430	15	1139-68	73	27	145	72	46	199	12	522	171	NM	0.82	58.9	52.1	Quartz Mountain
			± 8	3	4	7	3	7	2	95	47	NM	0.11			
35-DS-1430	16	1139-69	71	28	142	68	47	189	8	710	229	NM	1.22	58.2	55.5	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			

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.

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-DS-1430	17	1139-70	41	19	92	31	54	99	12	324	227	1155	0.52	27.6	55.3	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	16	0.11			
35-DS-1430	18	1139-71	68	28	139	65	45	191	8	674	267	NM	1.52	59.7	72.0	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	19	1139-72	67	26	138	65	44	184	8	674	280	NM	1.46	54.1	69.3	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1430	20	1139-73	78	29	152	71	48	197	6	561	219	NM	1.10	56.1	63.6	Quartz Mountain
			± 7	3	4	7	3	7	2	96	47	NM	0.11			
35-DS-1432	21	1139-2	58	18	116	36	56	317	14	1144	389	883	1.95	48.7	54.3	Chickahominy *
			± 7	2	3	7	3	7	2	97	48	13	0.11			
35-DS-1432	22	1139-3	67	21	114	30	55	308	17	913	310	890	1.50	49.3	52.8	Chickahominy
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-DS-1432	23	1139-4	64	27	130	61	42	183	7	568	256	NM	1.43	59.2	80.2	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1432	24	1139-5	86	32	155	68	48	191	10	347	149	NM	0.67	59.8	64.1	Quartz Mountain
			± 8	4	4	7	3	7	2	95	47	NM	0.11			
35-DS-1433	25	1139-1	72	27	136	68	42	187	9	543	223	NM	1.09	54.3	65.1	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	26	1139-36	64	22	130	66	44	185	6	513	217	NM	1.19	61.2	74.7	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	27	1139-49	69	25	142	66	45	194	9	574	261	NM	1.48	59.8	82.0	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	28	1139-50	43	12	79	120	21	109	9	713	282	NM	0.99	37.6	45.9	Obsidian Cliffs
			± 6	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	29	1139-51	71	23	144	66	45	190	9	632	248	NM	1.37	58.9	69.4	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	30	1139-52	86	32	164	72	48	202	6	504	239	NM	1.28	58.0	81.0	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	31	1139-53	38	11	83	113	17	99	10	623	299	NM	1.03	36.5	54.2	Obsidian Cliffs
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	32	1139-54	57	25	145	70	43	301	18	1442	360	NM	2.00	54.6	44.4	Newberry Volcano
			± 7	2	3	7	3	7	2	97	47	NM	0.11			

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.

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-DS-1433	33	1139-55	80	27	147	71	48	190	11	591	245	NM	1.37	59.9	74.1	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	34	1139-56	62	28	141	66	45	191	11	703	271	NM	1.59	61.2	72.2	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	35	1139-57	92	39	162	74	49	200	9	452	188	NM	0.95	59.8	68.7	Quartz Mountain
			± 8	3	4	7	3	7	2	96	47	NM	0.11			
35-DS-1433	36	1139-58	76	27	161	72	43	198	10	461	221	NM	1.20	60.2	83.2	Quartz Mountain
			± 7	3	4	7	3	7	2	96	47	NM	0.11			
35-DS-1433	37	1139-59	78	29	133	66	44	185	6	404	201	NM	1.01	57.9	80.5	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	38	1139-60	85	27	145	70	43	193	9	527	262	NM	1.39	56.2	84.0	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	39	1139-61	70	27	144	66	47	196	9	591	262	NM	1.49	59.8	80.0	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	40	1139-62	69	24	121	59	38	164	8	390	164	NM	0.77	59.4	65.4	Quartz Mountain *
			± 8	3	4	7	3	7	2	95	47	NM	0.11			
35-DS-1433	41	1139-63	73	27	157	73	44	195	9	558	232	NM	1.32	62.1	75.8	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	42	1139-64	40	19	117	62	38	260	15	1132	291	920	1.61	56.7	45.7	Newberry Volcano?
			± 7	3	3	7	3	7	2	97	47	14	0.11			
35-DS-1433	43	1139-65	74	28	137	66	42	187	7	572	239	NM	1.41	63.4	78.5	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1433	44	1139-66	68	27	141	65	43	188	10	594	280	NM	1.57	58.1	83.9	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	45	1139-3	70	24	147	68	45	193	11	888	254	NM	1.45	60.4	52.5	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	46	1139-11	75	25	142	71	45	191	13	564	212	NM	1.09	57.8	62.5	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	47	1139-62	67	24	141	67	44	189	11	514	184	NM	1.03	65.8	64.8	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	48	1139-73	52	15	89	27	53	99	10	396	253	1129	0.57	26.3	49.6	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	17	0.11			

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.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations											Ratios		Geochemical Source
			Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	
35-DS-1435	49	1139-89	72	27	138	68	44	186	9	547	225	NM	1.23	60.4	72.3	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	50	1139-92	64	22	118	36	54	321	16	911	317	920	1.48	47.3	52.1	Chickahominy
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-DS-1435	51	1139-93	79	17	92	37	54	137	14	289	227	NM	0.75	38.2	84.9	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	52	1139-95	37	19	92	29	53	100	11	386	270	1205	0.68	28.2	59.1	Glass Buttes 1
			± 7	2	3	7	3	7	2	96	47	15	0.11			
35-DS-1435	53	1139-96	64	26	128	58	41	174	9	524	247	NM	1.29	56.0	78.6	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	54	1139-97	69	26	139	63	47	186	9	661	217	NM	1.22	62.5	59.9	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	55	1139-98	49	14	82	27	55	97	13	413	293	1174	0.56	21.7	46.9	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-DS-1435	56	1139-99	50	19	81	25	53	97	9	389	222	1128	0.50	27.4	44.8	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	16	0.11			
35-DS-1435	57	1139-100	69	33	150	66	45	191	9	705	226	NM	1.16	56.7	53.4	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	58	1139-101	69	20	103	39	55	140	10	821	304	1284	1.23	41.9	48.6	Cougar Mountain
			± 7	2	3	7	3	7	2	97	47	16	0.11			
35-DS-1435	59	1139-102	67	29	142	66	46	194	9	725	254	NM	1.39	58.1	61.4	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	60	1139-103	78	36	153	73	46	197	6	555	200	NM	1.06	61.1	62.3	Quartz Mountain
			± 7	3	4	7	3	7	2	96	47	NM	0.11			
35-DS-1435	61	1139-104	65	29	148	70	44	191	8	647	273	NM	1.54	58.8	76.0	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	62	1139-105	70	27	135	64	42	186	8	923	286	NM	1.75	62.8	60.5	Quartz Mountain
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-DS-1435	63	1139-106	72	31	147	67	44	189	8	706	267	NM	1.50	58.7	67.8	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1435	64	1139-107	43	19	107	78	32	113	6	506	253	1330	0.70	31.3	46.8	Glass Buttes 3
			± 7	3	3	7	3	7	2	96	47	17	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-DS-1437	65	1139-17	32	17	84	26	51	99	12	242	243	NM	0.53	25.9	73.7	Glass Buttes 1
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-DS-1437	66	1139-24	56	29	135	62	43	186	7	441	222	NM	1.15	57.3	83.1	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	67	1139-39	69	26	138	64	41	183	9	627	275	NM	1.58	59.6	80.0	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	68	1139-44	76	26	141	65	42	188	11	715	225	NM	1.24	60.3	56.0	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	69	1139-135	70	24	135	64	43	186	8	649	304	NM	1.71	57.3	83.6	Quartz Mountain
			± 6	2	3	7	3	7	1	96	47	NM	0.11			
35-DS-1437	70	1139-144	75	29	143	67	42	196	11	460	187	NM	0.98	61.5	69.0	Quartz Mountain
			± 7	3	4	7	3	7	2	96	47	NM	0.11			
35-DS-1437	71	1139-145	67	28	144	68	45	189	10	693	271	NM	1.46	56.4	67.3	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	72	1139-146	62	24	142	66	46	190	10	598	273	NM	1.53	58.4	81.3	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	73	1139-149	70	39	109	30	56	299	20	974	307	1381	1.28	43.0	42.7	Chickahominy
			± 7	2	3	7	3	7	2	97	47	15	0.11			
35-DS-1437	74	1139-150	73	27	149	66	42	191	8	680	249	NM	1.40	60.1	66.0	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	75	1139-151	65	27	133	65	42	182	6	672	260	NM	1.57	63.3	74.3	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	76	1139-152	67	30	122	59	37	169	8	689	220	NM	1.23	61.9	57.8	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	77	1139-153	51	23	136	62	42	184	8	641	228	NM	1.20	57.6	60.4	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	78	1139-154	76	30	142	67	41	189	11	668	275	NM	1.55	58.5	73.9	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	79	1139-155	76	33	147	66	45	194	9	498	236	NM	1.33	60.8	84.9	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	80	1139-156	55	23	136	60	40	173	7	429	221	NM	1.14	57.1	84.9	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			

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.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-DS-1437	81	1139-157	63	28	141	65	43	183	10	637	272	NM	1.55	59.5	77.6	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	82	1139-158	93	30	157	76	41	197	10	545	213	NM	1.20	63.4	71.1	Quartz Mountain
			± 7	3	4	7	3	7	2	96	47	NM	0.11			
35-DS-1437	83	1139-159	67	20	132	62	40	183	12	485	231	NM	1.16	54.9	76.4	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1437	84	1139-159	74	22	137	64	46	183	7	565	237	NM	1.23	56.7	70.2	Quartz Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1440	85	1139-1	34	20	104	8	58	85	14	430	242	229	0.46	23.2	38.4	Glass Buttes 4?
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-DS-1440	86	1139-73	64	28	139	65	45	188	9	678	256	NM	1.43	59.2	67.7	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1440	87	1139-74	90	27	92	79	71	392	18	1471	548	1280	2.39	40.6	51.5	Yreka Butte
			± 7	2	3	7	3	7	2	98	48	15	0.11			
35-DS-1440	88	1139-75	44	22	128	8	71	93	13	314	315	234	0.49	17.7	53.7	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	14	0.11			
35-DS-1440	89	1139-76	31	17	101	75	26	109	10	543	300	1240	0.81	28.9	49.5	Glass Buttes 3
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-DS-1440	90	1139-77	33	22	117	61	28	99	8	413	249	1097	0.50	24.0	42.8	Glass Buttes 6
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-DS-1440	91	1139-78	41	21	98	28	55	102	12	445	258	1164	0.64	28.3	49.0	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-DS-1440	92	1139-79	34	18	103	73	26	103	7	434	257	1282	0.66	29.1	51.4	Glass Buttes 3
			± 7	3	3	7	3	7	2	96	47	16	0.11			
35-DS-1440	93	1139-80	71	18	101	40	57	139	12	437	257	NM	1.04	43.9	77.0	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1440	94	1139-81	72	29	157	68	45	199	9	424	218	NM	1.09	56.1	82.7	Quartz Mountain
			± 7	3	4	7	3	7	2	96	47	NM	0.11			
35-DS-1440	95	1139-82	35	15	107	77	29	110	7	542	310	1355	0.84	28.8	51.2	Glass Buttes 3
			± 6	3	3	7	3	7	2	96	47	15	0.11			
35-DS-1440	96	1139-83	38	16	124	10	72	93	12	355	318	232	0.48	17.4	47.7	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			

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.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-DS-1440	97	1139-84	70	18	97	40	54	133	13	199	229	NM	0.75	37.7	119.8	Cougar Mountain
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-DS-1440	98	1139-85	37	16	93	30	54	95	14	221	232	NM	0.52	26.8	78.4	Glass Buttes 1
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-DS-1440	99	1139-87	66	31	141	70	46	193	12	598	288	NM	1.64	58.4	86.5	Quartz Mountain
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1440	100	1139-87	46	19	127	10	72	92	15	370	373	185	0.60	17.4	55.0	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-DS-1440	101	1139-88	45	16	73	57	47	126	12	483	226	1398	0.73	37.0	50.5	Glass Buttes 2
			± 7	2	3	7	3	7	2	96	47	17	0.11			
35-DS-1440	102	1139-90	39	16	93	27	52	97	15	203	170	NM	0.36	29.7	63.1	Glass Buttes 1
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-DS-1440	103	1139-91	69	19	110	50	72	405	25	1175	301	1087	1.38	47.1	38.1	Brooks Canyon
			± 7	3	3	7	3	7	2	97	47	17	0.11			
35-DS-1440	104	1139-92	52	18	98	28	56	104	15	377	262	1087	0.65	28.0	57.7	Glass Buttes 1
			± 6	3	3	7	3	7	2	96	47	16	0.11			
35-DS-1441	105	1139-87	94	27	134	ND	101	170	38	817	642	15	0.92	14.0	37.5	Buck Spring
			± 7	3	3	ND	3	7	2	96	48	13	0.11			
35-DS-1441	106	1139-95	41	20	85	27	51	97	13	353	236	NM	0.49	25.1	48.4	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1441	107	1139-99	68	20	103	40	58	141	15	367	278	NM	1.03	39.6	90.1	Cougar Mountain
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1441	108	1139-124	88	25	84	85	69	383	17	1125	362	NM	1.58	43.5	45.3	Yreka Butte
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-DS-1441	109	1139-176	81	27	102	49	71	405	22	1387	328	NM	1.62	49.6	37.6	Brooks Canyon
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-DS-1441	110	1139-178	69	28	140	66	43	186	9	532	251	NM	1.45	61.3	86.4	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1441	111	1139-179	73	28	149	71	45	199	10	567	250	NM	1.42	60.6	79.7	Quartz Mountain
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-DS-1441	112	1139-180	42	12	82	28	57	92	12	483	364	NM	0.67	19.7	47.1	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-DS-1441	113	1139-181	29	16	90	29	51	97	10	495	234	NM	0.60	30.2	41.8	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1441	114	1139-182	34	12	70	52	45	116	9	593	250	1310	0.76	33.9	42.8	Glass Buttes 2
			± 7	3	3	7	3	7	2	96	47	16	0.11			
35-DS-1441	115	1139-183	88	25	87	79	70	386	16	1522	525	NM	2.43	43.2	50.7	Yreka Butte
			± 7	2	3	7	3	7	2	98	48	NM	0.11			
35-DS-1441	116	1139-184	62	22	98	45	66	388	19	1340	311	NM	1.57	51.1	37.7	Brooks Canyon
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-DS-1441	117	1139-185	37	19	79	24	48	92	8	223	204	NM	0.42	26.5	65.7	Glass Buttes 1
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-DS-1441	118	1139-186	42	17	108	74	28	113	7	584	294	NM	0.76	28.2	43.8	Glass Buttes 3
			± 6	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1441	119	1139-187	56	22	92	48	65	387	19	1887	390	NM	2.02	50.3	34.3	Brooks Canyon
			± 6	2	3	7	3	7	2	98	48	NM	0.11			
35-DS-1441	120	1139-188	49	22	90	103	28	140	7	1174	344	NM	1.42	41.7	39.3	Glass Buttes 7
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-DS-1441	121	1139-189	41	21	85	105	21	134	11	740	204	NM	0.77	44.4	35.3	Glass Buttes 7
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-DS-1441	122	1139-190	73	22	92	47	64	372	19	1498	331	NM	1.62	49.0	34.9	Brooks Canyon
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-DS-1441	123	1139-191	60	20	89	45	62	376	18	1311	319	NM	1.57	49.9	38.7	Brooks Canyon
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-DS-1441	124	1139-192	47	18	89	26	53	103	13	325	238	NM	0.52	25.8	54.5	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-279	125	1139-2	54	17	77	53	47	122	11	787	286	NM	0.96	35.8	40.2	Glass Buttes 2
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-279	126	1139-3	33	19	65	45	41	103	12	268	149	1214	0.29	29.9	41.1	Glass Buttes 2? *
			± 8	3	3	7	3	7	2	95	47	17	0.11			
35-LK-279	127	1139-5	36	16	82	24	51	92	11	591	298	NM	0.76	27.5	43.0	Glass Buttes 1
			± 6	2	3	7	3	7	1	96	47	NM	0.11			
35-LK-279	128	1139-6	36	11	90	25	50	93	15	298	153	NM	0.30	29.7	38.3	Glass Buttes 1 *
			± 8	4	3	7	3	7	2	95	47	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-LK-279	129	1139-7	44	17	75	48	48	112	11	280	153	NM	0.31	30.7	42.0	Glass Buttes 2
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-LK-279	130	1139-8	40	16	79	56	54	119	13	389	170	NM	0.38	30.9	35.8	Glass Buttes 2
			± 8	3	3	7	3	7	2	95	47	NM	0.11			
35-LK-279	131	1139-9	45	6	74	49	49	112	14	384	170	NM	0.35	29.0	34.0	Glass Buttes 2 *
			± 7	4	3	7	3	7	2	95	47	NM	0.11			
35-LK-279	132	1139-10	42	13	77	57	49	119	13	419	181	NM	0.40	29.5	34.5	Glass Buttes 2 *
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-LK-279	133	1139-11	50	17	84	56	56	127	14	403	177	NM	0.40	30.3	35.8	Glass Buttes 2 *
			± 8	3	4	7	3	7	2	95	47	NM	0.11			
35-LK-279	134	1139-12	57	18	76	52	48	118	10	401	211	NM	0.47	27.9	41.6	Glass Buttes 2 *
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-279	135	1139-13	43	10	76	56	52	122	8	251	147	NM	0.29	30.9	44.2	Glass Buttes 2 *
			± 8	4	4	7	3	7	2	95	47	NM	0.11			
35-LK-279	136	1139-14	65	13	75	49	47	115	10	431	265	NM	0.61	26.2	48.2	Glass Buttes 2
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-279	137	1139-15	40	21	74	58	48	119	10	276	141	NM	0.29	32.7	40.3	Glass Buttes 2 *
			± 9	4	4	7	3	7	2	95	47	NM	0.11			
35-LK-279	138	1139-16	41	18	94	28	55	101	11	426	265	NM	0.63	27.0	50.3	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-279	139	1139-17	33	17	91	28	51	97	13	350	189	NM	0.40	28.1	41.4	Glass Buttes 1 *
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-LK-279	140	1139-18	44	16	84	54	49	125	5	389	179	NM	0.43	32.1	39.8	Glass Buttes 2 *
			± 8	3	3	7	3	7	2	95	47	NM	0.11			
35-LK-279	141	1139-19	39	13	77	50	53	119	10	307	155	NM	0.34	31.7	40.5	Glass Buttes 2 *
			± 9	4	4	7	3	7	2	95	47	NM	0.11			
35-LK-3169	142	1139-13	39	20	90	27	53	96	12	428	314	NM	0.78	26.6	60.1	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	143	1139-18	32	11	80	26	52	95	10	303	265	NM	0.63	27.1	69.6	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	144	1139-25	39	14	93	27	53	99	16	451	267	NM	0.70	29.3	52.2	Glass Buttes 1
			± 6	3	3	7	3	7	2	96	47	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-LK-3169	145	1139-27	32	17	85	25	54	97	10	450	333	NM	0.86	27.2	62.7	Glass Buttes 1
			± 6	2	3	7	3	7	1	96	47	NM	0.11			
35-LK-3169	146	1139-29	40	19	91	28	52	96	7	354	299	NM	0.70	25.6	65.5	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	147	1139-41	38	15	86	25	54	98	11	412	316	NM	0.78	26.6	62.8	Glass Buttes 1
			± 6	2	3	7	3	7	1	96	47	NM	0.11			
35-LK-3169	148	1139-43	43	19	96	27	55	104	14	407	307	NM	0.73	25.9	59.9	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	149	1139-48	38	20	89	24	52	101	14	360	306	NM	0.72	25.5	65.8	Glass Buttes 1
			± 6	2	3	7	3	7	1	96	47	NM	0.11			
35-LK-3169	150	1139-52	50	17	90	27	57	104	11	479	335	NM	0.86	27.0	58.9	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	151	1139-53	42	17	90	26	55	103	11	301	326	NM	0.80	25.9	85.7	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	152	1139-54	29	19	94	28	50	100	8	224	177	NM	0.37	28.6	58.4	Glass Buttes 1
			± 9	3	4	7	3	7	2	95	47	NM	0.11			
35-LK-3169	153	1139-55	39	20	84	25	50	101	17	257	236	NM	0.56	27.9	72.6	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	154	1139-56	40	20	87	26	55	100	15	303	314	NM	0.74	25.5	80.3	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	155	1139-57	45	19	87	27	52	101	14	330	301	NM	0.72	26.0	71.8	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	156	1139-58	46	19	91	24	58	97	13	315	278	NM	0.64	25.9	67.7	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	157	1139-59	44	12	88	24	50	99	13	383	347	NM	0.80	24.4	68.9	Glass Buttes 1
			± 6	2	3	7	3	7	1	96	47	NM	0.11			
35-LK-3169	158	1139-60	37	14	84	27	53	96	13	247	254	NM	0.58	26.4	78.2	Glass Buttes 1
			± 6	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	159	1139-61	44	19	83	24	52	91	14	307	276	NM	0.60	24.6	65.6	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3169	160	1139-62	41	18	96	30	54	96	8	340	214	NM	0.46	26.5	47.2	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-LK-3169	161	1139-63	35	12	85	24	50	94	11	233	260	NM	0.58	25.9	82.7	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-2544	162	1139-43	36	13	104	71	31	113	9	552	311	NM	0.82	28.3	49.7	Glass Buttes 3
			± 6	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-2544	163	1139-45	56	15	118	9	68	89	16	151	185	228	0.18	16.2	50.1	Glass Buttes 4 *
			± 7	3	4	7	3	7	2	95	47	13	0.11			
35-LK-2544	164	1139-46	44	18	118	9	67	91	20	278	418	236	0.65	16.3	76.7	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-LK-2544	165	1139-47	37	17	105	71	27	109	6	445	296	NM	0.76	27.9	56.7	Glass Buttes 3
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-2544	166	1139-48	55	19	122	8	67	94	13	608	413	238	0.79	19.6	43.3	Glass Buttes 4
			± 6	2	3	7	3	7	2	96	47	13	0.11			
35-LK-2544	167	1139-49	29	17	107	73	28	112	9	481	334	NM	0.87	27.3	59.4	Glass Buttes 3
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-LK-2544	168	1139-50	43	14	76	115	30	151	10	1064	297	NM	1.29	45.0	39.4	Glass Buttes 7
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-LK-2544	169	1139-51	53	20	142	4	82	91	22	227	417	31	0.55	14.2	80.5	Glass Buttes 5
			± 6	3	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	170	1139-52	44	22	119	10	70	90	17	266	366	208	0.56	16.6	70.4	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	12	0.11			
35-LK-2544	171	1139-53	42	17	131	4	73	89	19	278	391	24	0.54	15.1	65.8	Glass Buttes 5
			± 6	3	3	9	3	7	2	95	47	14	0.11			
35-LK-2544	172	1160-60	31	18	93	22	49	98	10	502	291	NM	0.56	21.8	38.6	Glass Buttes 1
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-2544	173	1139-61	37	20	117	9	66	91	14	302	395	231	0.58	15.9	64.9	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	174	1139-62	52	19	127	8	72	94	17	342	401	233	0.63	16.8	62.1	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	175	1139-63	31	20	117	60	31	102	12	459	353	1132	0.75	22.5	54.5	Glass Buttes 6
			± 6	2	3	7	3	7	2	96	47	15	0.11			
35-LK-2544	176	1139-64	45	21	128	10	72	90	14	328	349	229	0.53	16.9	55.6	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			

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.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-LK-2544	177	1139-65	47	18	137	4	73	89	16	97	219	33	0.23	15.3	85.7	Glass Buttes 5 *
			± 7	3	4	10	3	7	2	95	47	13	0.11			
35-LK-2544	178	1139-66	29	22	101	71	27	106	8	496	314	NM	0.85	28.9	56.7	Glass Buttes 3
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-2544	179	1139-67	37	11	85	110	26	150	7	1082	321	NM	1.39	44.2	41.8	Glass Buttes 7
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-LK-2544	180	1139-68	44	18	127	5	74	84	14	312	462	27	0.70	15.7	74.3	Glass Buttes 5
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-LK-2544	181	1139-69	53	23	135	4	73	86	15	338	441	48	0.62	14.8	61.4	Glass Buttes 5
			± 6	2	3	8	3	7	2	95	47	13	0.11			
35-LK-2544	182	1139-7	35	23	115	58	32	99	8	456	353	NM	0.73	22.0	53.7	Glass Buttes 6
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-2544	183	1139-9	56	20	141	4	77	92	17	293	425	34	0.62	15.4	70.4	Glass Buttes 5
			± 6	3	3	8	3	7	2	95	47	13	0.11			
35-LK-2544	184	1139-12	49	18	117	8	69	86	13	267	404	226	0.58	15.4	72.4	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	12	0.11			
35-LK-2544	185	1139-13	44	14	88	119	27	156	7	924	264	NM	1.11	45.0	39.4	Glass Buttes 7
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-LK-2544	186	1139-14	42	19	121	8	68	91	17	354	424	207	0.67	16.6	63.3	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-LK-2544	187	1139-15	54	20	133	9	73	98	17	342	376	221	0.52	15.2	52.2	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	188	1139-16	40	23	119	10	65	86	16	272	336	228	0.50	16.9	63.2	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	189	1139-17	43	20	127	9	70	93	18	284	309	214	0.44	16.6	54.3	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	190	1139-18	39	15	120	10	72	92	16	299	338	208	0.48	16.1	55.7	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	191	1139-19	45	20	123	8	71	88	18	307	319	230	0.53	18.8	59.4	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	192	1139-20	45	22	116	9	72	95	13	264	275	239	0.40	17.8	54.2	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-LK-2544	193	1139-21	43	17	129	9	72	92	14	304	411	212	0.63	16.2	68.7	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	194	1139-22	49	18	133	8	73	92	16	314	389	229	0.56	15.5	60.2	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	195	1139-23	49	21	142	12	79	97	16	309	354	233	0.57	17.6	62.1	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-LK-2544	196	1139-24	46	22	111	9	64	85	15	214	296	211	0.39	15.7	63.5	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	197	1139-25	37	20	91	124	32	158	9	964	290	NM	1.21	43.6	41.0	Glass Buttes 7
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-LK-2544	198	1139-26	61	20	125	8	68	92	12	339	420	210	0.66	16.5	65.0	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	199	1139-27	57	21	123	9	67	89	16	389	373	228	0.63	18.1	54.7	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-LK-2544	200	1139-28	51	18	133	9	72	94	11	247	311	200	0.44	16.5	61.8	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-LK-2544	201	1139-29	40	21	136	9	72	96	15	283	383	204	0.59	16.6	69.4	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-LK-3171	202	1139-1	39	22	136	9	72	93	11	388	359	235	0.57	17.3	50.1	Glass Buttes 4
			± 7	2	3	7	3	7	2	95	47	13	0.11			
35-LK-3171	203	1139-14	90	17	117	9	65	467	24	1109	592	1152	2.19	34.3	62.5	Riley
			± 7	3	3	7	3	7	2	97	48	14	0.11			
35-LK-3171	204	1139-31	33	18	121	9	69	88	10	287	403	224	0.63	16.5	72.5	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-LK-3171	205	1139-41	33	15	108	74	28	111	6	549	322	NM	0.87	28.4	52.2	Glass Buttes 3
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3171	206	1139-43	49	22	124	7	69	91	16	276	366	232	0.54	16.1	65.9	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	12	0.11			
35-LK-3171	207	1139-44	31	13	91	90	25	124	5	824	343	NM	1.14	33.9	45.2	Glass Buttes 7
			± 6	3	3	7	3	7	2	97	47	NM	0.11			
35-LK-3171	208	1139-45	32	16	109	77	26	108	8	406	316	NM	0.77	26.3	62.9	Glass Buttes 3
			± 6	3	3	7	3	7	2	96	47	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-LK-3171	209	1139-46	31	19	105	73	26	109	9	565	315	NM	0.85	28.8	50.0	Glass Buttes 3
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3171	210	1139-48	38	20	113	77	25	113	8	639	286	NM	0.80	30.3	41.8	Glass Buttes 3
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-3171	211	1139-49	51	22	121	7	68	91	13	336	381	212	0.58	16.4	58.3	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-LK-3171	212	1139-50	37	16	99	72	26	106	8	570	303	NM	0.81	28.7	47.3	Glass Buttes 3
			± 6	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-3171	213	1139-51	42	25	112	8	67	89	15	339	364	231	0.58	17.4	58.2	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-LK-3171	214	1139-52	28	14	97	71	23	106	8	544	290	NM	0.79	29.7	48.7	Glass Buttes 3
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-LK-3171	215	1139-53	40	15	98	93	27	129	8	802	308	NM	1.08	36.6	44.1	Glass Buttes 7
			± 6	3	3	7	3	7	2	97	47	NM	0.11			
35-LK-3171	216	1139-54	36	19	111	79	30	111	10	468	267	NM	0.71	29.4	50.6	Glass Buttes 3
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-LK-3171	217	1139-55	60	34	101	58	43	186	15	820	348	1366	1.07	31.7	42.9	Big Stick
			± 6	2	3	7	3	7	2	97	47	14	0.11			
35-LK-3171	218	1139-56	76	36	120	65	48	204	18	858	316	1527	0.98	32.5	37.8	Big Stick
			± 7	3	3	7	3	7	2	96	47	16	0.11			
35-LK-3171	219	1139-57	50	17	99	91	28	127	9	896	336	NM	1.16	35.4	42.4	Glass Buttes 7
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-LK-3171	220	1139-58	43	23	142	7	79	93	15	332	412	13	0.60	15.4	60.5	Glass Buttes 5
			± 6	2	3	7	3	7	2	95	47	17	0.11			
35-LK-3171	221	1139-59	26	21	99	94	26	126	9	736	278	NM	0.98	37.8	44.0	Glass Buttes 7
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-80	222	1139-14	51	17	86	105	27	145	8	1209	338	NM	1.51	44.9	40.3	Glass Buttes 7
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-80	223	1139-24	33	17	103	76	25	107	10	662	335	NM	0.98	30.4	48.8	Glass Buttes 3
			± 6	2	3	7	3	7	1	97	47	NM	0.11			
35-HA-80	224	1139-38	36	19	113	10	63	86	11	246	245	213	0.34	17.8	50.7	Glass Buttes 4 *
			± 7	3	3	7	3	7	2	95	47	14	0.11			

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	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-80	225	1139-39	43	27	118	7	63	83	14	247	276	224	0.41	18.0	58.8	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-HA-80	226	1139-40	62	19	132	9	72	91	12	277	360	235	0.50	15.6	62.1	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-80	227	1139-41	45	24	130	9	71	93	12	340	363	248	0.57	17.2	57.2	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-80	228	1139-42	43	20	122	11	63	91	10	216	278	206	0.37	16.4	61.0	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-80	229	1139-43	40	20	126	9	66	93	15	369	346	255	0.50	16.2	47.1	Glass Buttes 4
			± 7	2	3	7	3	7	2	95	47	13	0.11			
35-HA-80	230	1139-44	50	21	132	6	74	89	15	267	376	51	0.55	15.9	69.2	Glass Buttes 5
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-80	231	1139-45	37	14	96	97	22	130	9	681	246	NM	0.83	37.7	40.8	Glass Buttes 7
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-80	232	1139-46	43	18	133	10	71	94	10	353	373	231	0.57	16.7	55.2	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-80	233	1139-47	46	19	120	8	67	89	16	288	317	202	0.47	16.9	56.3	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-80	234	1139-48	50	21	140	5	74	92	13	332	405	22	0.61	16.1	61.8	Glass Buttes 5
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-80	235	1139-49	51	22	128	8	68	91	16	366	377	234	0.54	15.8	51.1	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	13	0.11			
35-HA-80	236	1139-50	49	22	118	9	68	86	17	376	392	211	0.63	17.1	56.4	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-HA-80	237	1139-51	35	22	118	10	66	89	15	424	394	233	0.68	18.1	53.7	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-80	238	1139-52	26	16	111	61	30	102	8	544	374	1053	0.82	22.8	50.2	Glass Buttes 6
			± 7	2	3	7	3	7	2	96	47	13	0.11			
35-HA-80	239	1139-53	23	17	102	70	26	108	8	788	351	NM	1.01	29.5	42.1	Glass Buttes 3
			± 7	2	3	7	3	7	1	97	47	NM	0.11			
35-HA-80	240	1139-54	42	17	129	7	74	86	14	262	358	25	0.56	17.2	71.5	Glass Buttes 5
			± 7	3	3	7	3	7	2	95	47	14	0.11			

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	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-80	241	1139-55	61	23	142	6	75	91	16	237	361	35	0.51	15.7	73.0	Glass Buttes 5
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2875	242	1139-1	29	16	95	73	25	105	10	467	232	NM	0.58	29.5	42.8	Glass Buttes 3
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2875	243	1139-2	40	19	101	11	58	94	14	438	345	547	0.65	20.3	50.2	Glass Buttes 9
			± 6	2	3	7	3	7	1	95	47	14	0.11			
35-HA-2875	244	1139-3	41	21	122	9	69	91	14	285	307	249	0.49	18.1	58.7	Glass Buttes 4 *
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2875	245	1139-4	83	31	162	73	45	191	5	451	173	775	0.95	66.4	68.7	Quartz Mountain? *
			± 8	3	4	7	3	7	2	96	47	18	0.11			
35-HA-2875	246	1139-6	47	20	130	10	71	95	14	362	395	219	0.60	16.3	56.1	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2875	247	1139-7	47	19	124	9	66	90	11	256	303	209	0.40	15.8	55.8	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2875	248	1139-8	50	18	120	9	65	89	14	375	424	230	0.69	16.9	61.0	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2875	249	1139-12	46	21	128	10	69	94	10	345	386	222	0.56	15.7	55.3	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2875	250	1139-13	23	19	106	75	28	108	9	640	316	NM	0.85	28.6	44.2	Glass Buttes 3
			± 7	2	3	7	3	7	2	96	47	NM	0.11			
35-HA-2875	251	1139-14	47	18	124	11	66	92	13	396	404	248	0.65	17.0	55.3	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2875	252	1139-15	50	18	121	8	67	90	10	288	321	217	0.49	17.3	58.4	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2875	253	1139-22	47	20	124	10	74	89	15	376	386	227	0.60	16.6	53.9	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	12	0.11			
35-HA-2875	254	1139-23	36	14	117	10	66	88	16	201	208	224	0.25	17.1	47.5	Glass Buttes 4 *
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-HA-2875	255	1139-24	48	20	119	8	69	88	14	317	258	204	0.33	16.5	39.2	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-HA-2875	256	1139-25	61	21	123	10	66	89	13	424	288	236	0.36	15.2	31.4	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	14	0.11			

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.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2875	257	1139-26	39	23	123	10	68	92	13	363	285	231	0.41	17.1	40.5	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2880	258	1139-1	58	14	97	79	42	231	9	1048	393	1453	1.61	40.2	49.4	Upper Gap Lake
			± 6	3	3	7	3	7	2	97	48	14	0.11			
35-HA-2880	259	1139-9	44	20	96	80	44	231	8	905	345	1445	1.49	43.4	53.1	Upper Gap Lake
			± 7	3	3	7	3	7	2	97	47	14	0.11			
35-HA-2880	260	1139-15	36	17	85	26	51	93	13	370	317	NM	0.69	23.8	62.4	Glass Buttes 1
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2880	261	1139-16	50	18	101	80	45	235	8	852	297	1590	1.26	44.0	48.0	Upper Gap Lake
			± 7	2	3	7	3	7	2	97	47	14	0.11			
35-HA-2880	262	1139-18	32	20	141	33	35	79	12	313	364	397	0.44	13.8	49.7	Palamino Buttes A
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2880	263	1139-20	155	22	109	7	110	289	27	537	206	389	1.25	68.0	74.4	Squaw Mountain
			± 7	2	3	7	3	7	2	96	47	13	0.11			
35-HA-2880	264	1139-22	40	18	123	9	66	93	17	342	408	227	0.60	15.6	58.9	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-HA-2880	265	1139-24	106	26	137	7	103	176	39	464	415	23	0.51	13.4	38.5	Buck Spring
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2880	266	1139-26	44	19	121	9	70	92	16	341	382	257	0.56	16.0	56.0	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2880	267	1139-28	146	27	121	3	85	558	51	752	346	NM	2.35	66.7	97.9	Rimrock Spring
			± 7	3	3	7	3	7	2	96	48	NM	0.11			
35-HA-2880	268	1139-29	35	22	127	165	17	159	9	921	340	926	1.09	33.1	39.1	Beatys Butte
			± 7	3	3	7	3	7	2	96	47	13	0.11			
35-HA-2880	269	1139-30	51	35	103	56	42	188	19	842	367	1407	1.18	32.4	45.7	Big Stick
			± 7	2	3	7	3	7	1	97	47	14	0.11			
35-HA-2880	270	1139-31	33	14	107	72	28	110	10	622	319	1201	0.80	26.8	43.1	Glass Buttes 3
			± 6	3	3	7	3	7	2	96	47	13	0.11			
35-HA-2880	271	1139-36	46	34	108	46	42	157	15	610	329	1491	0.94	29.8	50.6	Tank Creek
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-HA-2880	272	1139-40	152	24	109	7	117	290	25	458	225	377	1.40	67.7	96.5	Squaw Mountain
			± 7	2	3	7	3	7	2	96	47	13	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2880	273	1139-41	48	37	109	60	45	197	12	733	273	1629	0.86	34.5	39.3	Big Stick
			± 6	2	3	7	3	7	2	96	47	17	0.11			
35-HA-2880	274	1139-42	47	16	98	81	46	235	11	963	373	1556	1.64	43.4	54.5	Upper Gap Lake
			± 7	3	3	7	3	7	2	97	47	14	0.11			
35-HA-2880	275	1139-43	56	19	122	10	76	96	16	342	329	250	0.51	17.4	51.6	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2880	276	1139-44	53	22	119	10	67	90	16	415	318	315	0.51	18.1	42.8	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2880	277	1139-45	76	36	115	28	57	305	19	999	350	1398	1.42	40.7	45.9	Chickahominy
			± 7	2	3	7	3	7	2	97	47	16	0.11			
35-HA-2876	278	1139-32	62	23	119	9	68	88	17	353	448	222	0.66	15.4	62.7	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2876	279	1139-33	36	17	120	8	66	89	15	348	418	219	0.68	17.1	65.2	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2876	280	1139-34	46	20	121	9	70	92	12	361	434	235	0.67	16.2	62.4	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2876	281	1139-35	52	17	112	9	66	89	13	322	414	230	0.64	16.3	66.3	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2876	282	1139-39	48	20	119	10	68	92	14	355	402	243	0.58	15.5	55.7	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-HA-2876	283	1139-40	65	23	140	11	73	96	13	296	362	225	0.47	14.6	55.2	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2876	284	1139-41	39	16	124	7	73	92	12	283	347	208	0.53	17.0	63.7	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2876	285	1139-42	31	16	99	22	46	91	10	513	307	NM	0.62	22.2	41.1	Glass Buttes 1
			± 6	2	3	7	3	7	1	96	47	NM	0.11			
35-HA-2876	286	1139-43	41	16	124	8	70	92	15	292	416	229	0.63	16.1	72.0	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-HA-2876	287	1139-44	39	20	123	8	69	92	12	394	375	218	0.59	17.0	51.2	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	12	0.11			
35-HA-2876	288	1139-45	36	21	123	9	69	90	13	357	376	222	0.56	16.1	53.3	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2876	289	1139-46	47	18	126	8	68	90	16	407	378	233	0.58	16.7	48.9	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2876	290	1139-47	49	20	127	8	70	93	17	414	405	223	0.66	17.1	53.3	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2876	291	1139-48	43	20	120	10	66	91	17	362	422	255	0.69	17.0	63.1	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2876	292	1139-49	41	22	122	11	68	91	18	533	406	238	0.86	21.8	53.6	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2876	293	1139-50	47	17	123	8	71	92	11	356	401	262	0.63	16.7	59.3	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2876	294	1139-51	44	18	117	7	67	89	15	349	427	236	0.67	16.4	64.1	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-HA-2876	295	1139-52	41	20	120	8	70	89	13	354	405	220	0.65	17.0	61.5	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-HA-2876	296	1139-53	41	21	130	11	69	91	12	357	398	228	0.59	15.9	56.1	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2876	297	1139-54	56	22	126	9	72	93	14	287	376	219	0.56	16.2	65.8	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2877	298	1139-2	46	17	120	8	68	87	16	334	407	237	0.64	16.6	64.1	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2877	299	1139-3	46	15	127	8	73	89	13	380	367	222	0.55	16.5	50.1	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-HA-2877	300	1139-4	48	23	127	9	67	92	12	354	362	212	0.60	18.1	57.7	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	12	0.11			
35-HA-2877	301	1139-6	45	21	126	8	67	90	11	371	365	249	0.58	17.2	52.9	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2877	302	1139-7	40	19	114	9	67	90	11	377	413	238	0.64	16.4	57.1	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2877	303	1139-10	35	17	118	9	67	89	15	296	375	206	0.54	15.7	61.8	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	12	0.11			
35-HA-2877	304	1139-11	46	18	124	9	70	93	18	379	425	235	0.65	16.1	57.7	Glass Buttes 4
			± 7	3	3	7	3	7	1	95	47	13	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2877	305	1139-14	52	17	136	9	72	92	15	362	362	219	0.56	17.0	53.1	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2877	306	1139-16	46	20	123	8	71	94	15	314	406	207	0.62	16.2	65.7	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2877	307	1139-18	34	20	122	7	68	90	14	358	388	226	0.63	17.4	59.5	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	12	0.11			
35-HA-2877	308	1139-19	36	16	104	72	27	110	9	668	329	NM	0.93	29.7	46.2	Glass Buttes 3
			± 6	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2877	309	1139-23	38	17	110	7	63	82	12	262	255	228	0.36	17.7	49.6	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2877	310	1139-30	40	23	114	9	66	90	14	323	376	238	0.55	16.1	58.4	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-HA-2877	311	1139-31	49	19	121	10	69	90	8	288	350	244	0.47	15.0	56.1	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2877	312	1139-32	54	24	127	9	72	93	15	329	374	248	0.60	17.3	61.5	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2877	313	1139-33	40	18	124	8	69	93	12	332	429	258	0.63	15.5	63.4	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2877	314	1139-34	45	17	113	12	59	97	12	426	352	615	0.66	20.1	51.9	Glass Buttes 9
			± 6	3	3	7	3	7	2	96	47	13	0.11			
35-HA-2877	315	1139-35	51	16	132	9	72	92	15	202	259	234	0.31	15.5	56.4	Glass Buttes 4
			± 7	3	4	7	3	7	2	95	47	14	0.11			
35-HA-2877	316	1139-36	48	26	142	9	77	96	16	232	274	212	0.39	17.3	59.4	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-HA-2877	317	1139-38	48	21	133	8	75	94	10	385	363	236	0.59	17.7	52.2	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2878	318	1139-1	45	19	123	8	67	91	17	213	204	225	0.24	17.0	43.7	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2878	319	1139-2	42	23	121	9	70	93	13	384	378	233	0.58	16.7	51.8	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2878	320	1139-4	59	19	117	9	68	88	14	340	471	237	0.65	14.4	64.0	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2878	321	1139-5	45	20	119	8	64	94	17	360	394	250	0.62	16.7	57.7	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-HA-2878	322	1139-6	45	19	123	10	73	94	12	261	302	263	0.42	16.5	56.6	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	12	0.11			
35-HA-2878	323	1139-7	49	23	135	8	68	95	14	332	343	267	0.51	16.6	53.0	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2878	324	1139-11	43	18	130	7	72	94	15	275	330	203	0.47	16.3	59.5	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2878	325	1139-33	44	19	136	8	69	95	17	366	366	229	0.56	16.7	52.4	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2878	326	1139-34	30	13	129	62	27	140	6	766	210	1307	0.95	51.6	40.9	China Lake
			± 7	2	3	7	3	7	2	97	47	14	0.11			
35-HA-2878	327	1139-35	27	14	135	65	29	140	7	956	215	1421	1.05	55.0	36.3	China Lake
			± 6	3	3	7	3	7	2	97	47	15	0.11			
35-HA-2878	328	1139-36	47	19	117	7	63	88	12	313	368	237	0.59	17.4	63.4	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	12	0.11			
35-HA-2878	329	1139-37	39	19	121	8	68	90	12	281	359	225	0.54	16.5	64.9	Glass Buttes 4
			± 7	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2878	330	1139-38	46	19	122	10	71	91	11	334	359	239	0.57	17.4	57.9	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2878	331	1139-39	50	22	120	10	64	88	13	342	412	234	0.64	16.5	62.8	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	12	0.11			
35-HA-2878	332	1139-40	34	15	117	9	68	93	13	387	398	222	0.66	17.6	57.4	Glass Buttes 4
			± 6	3	3	7	3	7	1	95	47	12	0.11			
35-HA-2878	333	1139-41	51	18	135	7	72	94	13	377	344	238	0.57	18.2	51.6	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2878	334	1139-42	47	23	120	7	67	93	12	387	415	232	0.67	17.0	58.2	Glass Buttes 4
			± 7	3	3	7	3	7	1	95	47	12	0.11			
35-HA-2878	335	1139-43	37	15	116	7	67	88	12	331	413	243	0.62	16.0	63.3	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	12	0.11			
35-HA-2878	336	1139-44	42	20	122	8	70	89	14	364	430	246	0.68	16.5	62.0	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2878	337	1139-45	45	19	124	11	71	92	16	314	313	226	0.47	17.4	52.5	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	338	1139-1	55	18	132	10	76	94	15	284	351	244	0.54	17.1	64.9	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	339	1139-2	46	37	117	47	47	163	16	716	323	1390	0.97	31.4	44.6	Tank Creek
			± 7	2	3	7	3	7	2	97	47	14	0.11			
35-HA-2879	340	1139-4	44	13	97	111	29	149	8	631	225	NM	0.82	41.6	43.5	Glass Buttes 7
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2879	341	1139-5	41	23	126	9	71	89	14	371	411	233	0.67	17.0	60.0	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2879	342	1139-7	33	19	121	9	66	92	13	351	438	211	0.68	16.2	64.3	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2879	343	1139-8	40	17	121	9	66	88	18	327	331	231	0.52	17.7	54.9	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	344	1139-11	40	21	120	8	68	90	17	280	373	239	0.54	15.8	64.9	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	345	1139-12	40	21	122	8	65	90	13	420	394	220	0.68	18.2	54.3	Glass Buttes 4
			± 6	2	3	7	3	7	1	95	47	13	0.11			
35-HA-2879	346	1139-13	48	21	143	5	81	92	17	243	414	30	0.60	15.5	81.8	Glass Buttes 5
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	347	1139-15	39	18	120	9	70	92	11	345	385	224	0.61	17.0	59.6	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	12	0.11			
35-HA-2879	348	1139-20	41	19	122	9	70	91	13	321	350	242	0.52	16.4	55.2	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	349	1139-21	43	20	129	9	67	93	16	295	309	245	0.51	18.8	59.5	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	350	1139-22	41	24	128	9	69	91	17	312	352	234	0.54	17.0	59.1	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	351	1139-23	35	21	121	8	70	91	16	362	430	244	0.67	16.4	62.1	Glass Buttes 4
			± 7	2	3	7	3	7	1	95	47	12	0.11			
35-HA-2879	352	1139-24	42	16	120	11	70	87	15	322	367	238	0.56	16.6	58.8	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	14	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2879	353	1139-25	48	17	127	11	69	93	11	229	298	236	0.44	17.3	66.2	Glass Buttes 4
			± 6	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	354	1139-26	51	21	129	7	73	93	14	357	406	229	0.60	15.9	57.2	Glass Buttes 4
			± 6	2	3	7	3	7	2	95	47	13	0.11			
35-HA-2879	355	1139-27	60	19	131	10	71	92	12	252	310	229	0.42	15.8	58.1	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-HA-2879	356	1139-28	31	16	99	74	28	112	11	599	316	NM	0.90	30.0	49.5	Glass Buttes 3
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-HA-2879	357	1139-29	52	17	120	10	66	92	13	306	302	219	0.42	16.5	49.1	Glass Buttes 4
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2899	358	1139-1	65	21	133	29	49	265	30	1037	291	NM	1.37	48.7	42.7	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2899	359	1139-4	51	24	132	25	44	243	30	1159	308	NM	1.63	53.7	45.3	Burns
			± 6	2	3	7	3	7	1	97	47	NM	0.11			
35-HA-2899	360	1139-5	144	28	119	ND	89	571	52	726	332	NM	2.11	63.1	91.3	Rimrock Spring
			± 7	3	3	ND	3	7	2	96	47	NM	0.11			
35-HA-2899	361	1139-6	46	16	125	26	45	257	32	1203	308	NM	1.65	54.6	44.2	Burns
			± 6	3	3	7	3	7	1	97	47	NM	0.11			
35-HA-2899	362	1139-10	98	24	120	4	75	439	49	547	270	7	1.82	69.7	104.4	Mud Ridge
			± 7	2	3	7	3	7	2	95	47	69	0.11			
35-HA-2899	363	1139-12	58	20	129	36	45	285	33	550	160	NM	0.70	56.2	42.9	Burns
			± 7	3	4	7	3	7	2	95	47	NM	0.11			
35-HA-2899	364	1139-13	54	18	134	32	47	283	32	958	271	NM	1.33	51.7	45.0	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2899	365	1139-14	67	22	134	28	45	247	30	1010	298	NM	1.32	45.8	42.5	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2899	366	1139-15	43	19	131	31	45	278	30	1098	284	NM	1.43	52.4	42.2	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2899	367	1139-17	108	24	123	4	79	457	50	631	278	12	1.80	66.4	89.8	Mud Ridge
			± 7	3	3	7	3	7	2	95	47	15	0.11			
35-HA-2899	368	1139-27	50	21	129	30	47	269	28	1096	292	NM	1.51	53.3	44.6	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2899	369	1139-31	98	28	122	4	73	452	49	550	291	0	1.61	56.7	92.2	Mud Ridge
			± 7	3	3	8	3	7	2	95	47	12	0.11			
35-HA-2899	370	1139-33	46	22	127	26	44	246	32	1078	296	NM	1.56	54.0	46.6	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2899	371	1139-34	133	28	116	ND	87	552	50	679	341	NM	2.24	64.6	103.1	Rimrock Spring
			± 7	3	3	ND	3	7	2	96	47	NM	0.11			
35-HA-2899	372	1139-36	98	21	123	5	76	448	49	632	251	3	1.70	71.5	85.2	Mud Ridge
			± 7	3	3	7	3	7	2	95	47	12	0.11			
35-HA-2899	373	1139-37	43	22	132	30	46	258	30	1089	305	NM	1.51	50.7	44.8	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2899	374	1139-38	137	25	118	4	90	551	53	585	309	NM	1.93	62.8	103.2	Rimrock Spring
			± 7	3	3	9	3	7	2	95	47	NM	0.11			
35-HA-2899	375	1139-39	96	22	136	ND	103	179	41	587	595	10	0.76	12.7	43.2	Buck Spring
			± 7	3	3	ND	3	7	2	95	48	17	0.11			
35-HA-2899	376	1139-40	91	27	117	ND	79	443	50	531	263	0	1.69	67.2	100.4	Mud Ridge
			± 7	3	3	ND	3	7	2	95	47	12	0.11			
35-HA-2899	377	1139-41	42	20	132	28	44	246	31	1018	269	NM	1.42	55.3	45.1	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2901	378	1139-36	45	23	130	26	41	243	28	1091	305	NM	1.57	52.4	46.2	Burns
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-HA-2901	379	1139-46	52	19	124	33	42	265	27	1147	300	NM	1.61	54.7	45.0	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2901	380	1139-47	147	24	100	6	103	268	23	217	149	387	0.77	67.7	112.7	Squaw Mountain
			± 7	3	3	7	3	7	2	96	47	13	0.11			
35-HA-2901	381	1139-48	55	17	122	31	45	265	30	1104	315	NM	1.58	50.8	46.0	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2901	382	1139-50	51	21	129	26	45	246	32	1079	298	NM	1.50	51.6	44.9	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2901	383	1139-51	209	40	141	ND	110	644	36	631	335	50	1.86	55.4	93.1	Dog Hill
			± 8	3	3	ND	3	7	2	95	47	13	0.11			
35-HA-2901	384	1139-52	44	19	118	31	43	260	30	1187	314	NM	1.65	53.1	44.6	Burns
			± 7	2	3	7	3	7	2	97	47	NM	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2901	385	1139-54	200	44	140	5	101	629	40	474	272	56	1.30	50.5	87.5	Dog Hill
			± 9	3	4	8	3	7	2	95	47	14	0.11			
35-HA-2901	386	1139-55	57	16	125	27	47	238	29	786	269	NM	1.13	44.9	47.1	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2901	387	1139-56	46	22	129	31	43	274	29	1122	309	NM	1.58	52.0	45.3	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2901	388	1139-58	42	23	130	30	47	256	30	1161	307	NM	1.59	52.7	44.0	Burns
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2901	389	1139-59	51	17	122	28	45	257	29	1225	330	NM	1.73	52.4	45.2	Burns
			± 6	2	3	7	3	7	1	97	47	NM	0.11			
35-HA-2901	390	1139-60	42	20	124	30	45	241	29	1082	305	NM	1.54	51.5	45.8	Burns
			± 6	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2901	391	1139-61	47	19	127	27	45	245	29	1118	290	NM	1.57	55.8	45.2	Burns
			± 6	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2901	392	1139-62	44	22	133	30	45	243	31	1154	292	NM	1.52	53.6	42.6	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2901	393	1139-63	49	22	123	31	41	261	32	1109	300	NM	1.56	53.2	45.3	Burns
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-HA-2901	394	1139-64	44	25	121	28	45	247	32	690	197	NM	0.94	55.9	45.3	Burns
			± 8	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2901	395	1139-65	77	22	120	30	45	259	26	1058	302	NM	1.43	48.6	43.6	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2901	396	1139-66	55	21	121	31	43	266	29	1207	317	NM	1.69	53.8	44.9	Burns
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2901	397	1139-67	51	19	120	29	42	261	28	1055	278	NM	1.44	53.9	44.1	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2893	398	1139-1	54	22	132	28	44	272	31	1006	288	NM	1.38	49.7	44.4	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2893	399	1139-2	115	25	110	4	102	245	35	613	594	NM	1.08	17.6	57.2	Buck Spring
			± 7	3	3	7	3	7	2	95	48	NM	0.11			
35-HA-2893	400	1139-3	122	27	122	6	101	229	41	906	545	NM	0.87	15.8	32.1	Buck Spring
			± 7	3	3	7	3	7	2	96	48	NM	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2893	401	1139-4	84	15	110	11	63	455	26	1033	552	1136	2.03	34.5	62.4	Riley
			± 7	3	3	7	3	7	2	97	48	14	0.11			
35-HA-2893	402	1139-5	129	26	112	5	106	254	36	427	450	NM	0.77	17.4	59.4	Buck Spring
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-HA-2893	403	1139-7	105	25	96	ND	102	286	34	523	573	NM	1.16	19.6	71.6	Buck Spring
			± 7	3	3	ND	3	7	2	95	48	NM	0.11			
35-HA-2893	404	1139-8	98	25	121	4	99	205	40	600	608	NM	0.95	15.2	51.8	Buck Spring
			± 7	2	3	7	3	7	2	95	48	NM	0.11			
35-HA-2893	405	1139-10	107	23	122	4	103	213	39	607	538	NM	0.84	15.6	46.1	Buck Spring
			± 7	3	3	9	3	7	2	95	47	NM	0.11			
35-HA-2893	406	1139-11	103	27	118	4	101	195	41	1182	644	NM	1.02	15.3	28.7	Buck Spring
			± 6	2	3	10	3	7	2	96	48	NM	0.11			
35-HA-2893	407	1139-12	108	23	123	12	68	476	27	1308	580	1185	2.16	34.7	52.5	Riley
			± 7	3	3	7	3	7	2	97	48	14	0.11			
35-HA-2893	408	1139-14	38	20	127	27	43	221	30	887	287	NM	1.46	52.8	53.1	Burns
			± 6	2	3	7	3	7	1	96	47	NM	0.11			
35-HA-2893	409	1139-15	88	27	130	ND	105	169	38	811	651	NM	0.97	14.4	39.6	Buck Spring
			± 6	2	3	ND	3	7	1	96	48	NM	0.11			
35-HA-2893	410	1139-17	119	24	127	5	102	211	41	903	616	NM	1.02	16.0	37.2	Buck Spring
			± 7	2	3	7	3	7	2	96	48	NM	0.11			
35-HA-2893	411	1139-20	53	19	161	51	40	292	20	1697	317	865	1.99	62.9	37.5	Double O
			± 6	3	3	7	3	7	1	98	47	13	0.11			
35-HA-2893	412	1139-21	88	31	130	ND	98	167	36	466	442	NM	0.57	13.6	41.9	Buck Spring
			± 7	3	3	ND	3	7	2	95	47	NM	0.11			
35-HA-2893	413	1139-30	101	27	137	ND	106	175	46	517	553	NM	0.69	12.6	44.9	Buck Spring
			± 7	3	3	ND	3	7	2	95	48	NM	0.11			
35-HA-2893	414	1139-35	110	24	98	4	100	288	35	546	580	NM	1.20	20.0	70.9	Buck Spring
			± 7	3	3	8	3	7	2	95	48	NM	0.11			
35-HA-2893	415	1139-39	110	25	120	5	102	204	39	635	617	NM	0.95	15.1	49.4	Buck Spring
			± 7	3	3	7	3	7	2	95	48	NM	0.11			
35-HA-2893	416	1139-40	107	27	97	ND	100	290	34	751	605	NM	1.34	21.1	57.7	Buck Spring
			± 7	2	3	ND	3	7	2	96	48	NM	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2893	417	1139-69	95	30	132	4	107	173	41	801	598	NM	0.77	12.8	32.4	Buck Spring
			± 7	2	3	9	3	7	2	96	48	NM	0.11			
35-HA-2904	418	1139-1	47	15	125	26	43	238	28	901	257	NM	1.30	53.8	46.8	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2904	419	1139-19	50	17	123	29	48	260	32	1105	313	NM	1.63	52.6	47.3	Burns
			± 6	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2904	420	1139-32	45	22	126	26	39	256	29	1121	296	NM	1.55	53.6	44.5	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2904	421	1139-53	70	35	112	26	57	300	22	1129	426	1361	1.72	39.1	48.8	Chickahominy
			± 7	2	3	7	3	7	2	97	48	14	0.11			
35-HA-2904	422	1139-61	121	22	114	ND	80	541	52	688	403	NM	2.55	60.6	115.5	Rimrock Spring
			± 7	3	3	ND	3	7	2	96	48	NM	0.11			
35-HA-2904	423	1139-65	30	23	114	91	23	134	11	413	150	1742	0.54	48.9	45.2	Whitewater Ridge
			± 7	3	3	7	3	7	2	96	47	17	0.11			
35-HA-2904	424	1139-66	51	20	114	27	46	235	30	642	197	NM	0.84	50.2	43.6	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2904	425	1139-68	137	25	119	5	89	557	55	446	228	NM	1.36	65.0	96.7	Rimrock Spring
			± 8	3	4	7	3	7	2	95	47	NM	0.11			
35-HA-2904	426	1139-70	48	21	120	29	47	266	32	1053	290	NM	1.53	54.2	46.7	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2904	427	1139-71	52	17	121	30	42	265	27	1213	332	NM	1.69	51.0	44.7	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2904	428	1139-72	55	23	127	31	47	264	28	1209	328	NM	1.73	52.9	46.0	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2904	429	1139-73	48	17	128	32	43	270	34	1156	316	NM	1.67	53.4	46.4	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2904	430	1139-74	51	18	122	31	45	266	29	1181	310	NM	1.68	54.9	45.7	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2904	431	1139-75	135	33	111	4	83	630	48	957	444	NM	2.74	58.4	89.8	Dog Hill
			± 7	3	3	7	3	7	2	96	48	NM	0.11			
35-HA-2904	432	1139-76	51	22	134	30	44	252	31	856	239	NM	1.16	52.8	44.2	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2904	433	1139-77	90	29	133	4	103	176	39	732	604	NM	0.82	13.5	37.6	Buck Spring
			± 7	2	3	8	3	7	2	96	48	NM	0.11			
35-HA-2904	434	1139-78	46	21	129	28	47	248	30	1160	296	NM	1.55	53.8	43.1	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2904	435	1139-79	40	18	130	28	47	250	31	1142	322	NM	1.57	49.5	44.4	Burns
			± 6	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2904	436	1139-80	65	25	124	32	48	265	29	891	265	NM	1.13	45.5	41.4	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2904	437	1139-81	48	22	121	33	46	268	34	1142	311	NM	1.61	52.5	45.3	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2906	438	1139-58	43	18	120	31	42	265	31	1131	328	NM	1.60	49.1	45.5	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2906	439	1139-65	53	21	131	28	44	251	35	1110	315	NM	1.58	51.0	45.9	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2906	440	1139-66	36	19	131	57	31	136	10	713	286	1087	1.10	40.8	50.4	Tule Spring
			± 6	2	3	7	3	7	2	96	47	13	0.11			
35-HA-2906	441	1139-67	55	27	88	167	24	85	12	207	413	2494	0.63	16.1	98.1	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-HA-2906	442	1139-68	26	23	123	97	26	134	9	853	242	1729	1.01	45.9	39.2	Whitewater Ridge
			± 7	2	3	7	3	7	2	97	47	15	0.11			
35-HA-2906	443	1139-74	48	19	124	31	46	263	29	1055	288	NM	1.49	53.5	45.7	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2906	444	1139-71	42	17	121	31	44	275	28	1039	282	NM	1.49	54.6	46.2	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2906	445	1139-73	48	22	124	28	45	247	28	1110	309	NM	1.57	51.7	45.6	Burns
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-HA-2906	446	1139-75	50	25	109	30	43	249	32	521	158	NM	0.67	55.6	43.9	Burns
			± 7	3	3	7	3	7	2	95	47	NM	0.11			
35-HA-2906	447	1139-76	134	33	105	7	88	626	47	941	415	NM	2.63	60.3	87.6	Dog Hill
			± 7	2	3	7	3	7	2	96	48	NM	0.11			
35-HA-2906	448	1139-78	41	23	137	27	46	256	27	869	246	NM	1.20	52.7	45.0	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2906	449	1139-80	50	21	130	33	44	280	30	1143	312	NM	1.61	52.6	45.4	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2906	450	1139-81	48	22	128	33	46	272	34	1148	310	NM	1.57	51.7	44.2	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2906	451	1139-82	154	39	119	4	92	655	50	883	374	NM	2.40	62.3	85.6	Dog Hill
			± 7	2	3	8	3	7	2	96	48	NM	0.11			
35-HA-2906	452	1139-83	35	18	118	28	43	259	30	948	268	NM	1.35	53.0	46.0	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2906	453	1139-84	53	19	128	29	44	250	30	1139	278	NM	1.46	54.7	41.4	Burns
			± 6	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2906	454	1139-85	49	20	135	27	47	243	31	1056	303	NM	1.39	47.2	42.7	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2906	455	1139-86	47	20	131	24	42	243	34	1033	294	NM	1.49	52.3	46.6	Burns
			± 6	2	3	7	3	7	2	96	47	NM	0.11			
35-HA-2906	456	1139-87	40	21	124	29	46	259	30	1194	325	NM	1.63	50.4	43.9	Burns
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2906	457	1139-89	34	17	129	28	45	258	30	1023	285	NM	1.48	53.7	46.6	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2913	458	1139-1	39	17	136	44	28	105	10	457	253	1021	0.69	31.0	51.1	Wolf Creek
			± 6	3	3	7	3	7	2	96	47	13	0.11			
35-HA-2913	459	1139-2	62	19	113	83	37	270	14	889	204	1235	1.15	63.9	42.2	Van Gulch
			± 7	3	3	7	3	7	2	96	47	16	0.11			
35-HA-2913	460	1139-3	37	19	144	47	28	105	11	763	218	1038	0.82	43.5	36.3	Wolf Creek
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-HA-2913	461	1139-4	69	19	103	115	42	288	18	1338	281	1307	1.51	55.8	36.6	Unknown 2
			± 7	3	3	7	3	7	2	97	47	15	0.11			
35-HA-2913	462	1139-8	51	22	83	156	23	86	15	167	498	2338	0.75	15.4	139.9	Gregory Creek
			± 6	3	3	7	3	7	2	96	47	18	0.11			
35-HA-2913	463	1139-9	34	18	127	48	27	103	7	650	253	1116	0.84	36.7	43.1	Wolf Creek
			± 6	2	3	7	3	7	2	96	47	14	0.11			
35-HA-2913	464	1139-11	49	26	83	156	24	82	10	203	577	2197	0.92	15.7	140.7	Gregory Creek
			± 6	2	3	7	3	7	2	96	48	15	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2913	465	1139-12	34	18	132	50	28	104	16	198	124	1056	0.31	41.4	57.4	Wolf Creek
			± 7	3	4	7	3	7	2	95	47	17	0.11			
35-HA-2913	466	1139-14	32	18	135	46	30	102	8	529	238	1037	0.75	35.9	47.7	Wolf Creek
			± 6	3	3	7	3	7	2	96	47	13	0.11			
35-HA-2913	467	1139-16	39	17	140	45	27	108	10	405	188	1079	0.61	39.9	51.0	Wolf Creek
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-ML-978	468	1139-15	50	27	87	160	24	85	12	192	449	2214	0.75	17.1	122.3	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	21	0.11			
35-ML-978	469	1139-31	50	23	77	150	24	84	13	320	589	2173	0.98	16.2	97.5	Gregory Creek
			± 6	2	3	7	3	7	1	97	48	15	0.11			
35-ML-978	470	1139-35	48	22	82	154	26	83	14	296	454	2330	0.74	16.8	81.8	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	16	0.11			
35-ML-978	471	1139-36	53	28	88	160	26	85	18	236	388	2359	0.56	15.8	79.6	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-ML-978	472	1139-38	40	16	80	148	22	84	12	140	315	2090	0.45	16.5	104.9	Gregory Creek
			± 8	3	3	7	3	7	2	95	47	21	0.11			
35-ML-978	473	1139-39	155	20	112	16	74	479	33	1096	605	582	2.14	32.9	62.0	Skull Springs
			± 8	3	3	7	3	7	2	96	48	14	0.11			
35-ML-978	474	1139-55	51	26	79	155	22	77	12	231	486	2264	0.71	14.9	98.5	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	18	0.11			
35-ML-978	475	1139-56	67	28	108	141	27	88	11	427	372	832	0.71	20.1	55.3	Venator
			± 7	3	3	7	3	7	2	95	47	16	0.11			
35-ML-978	476	1139-57	89	24	121	24	63	441	32	1088	374	841	1.51	40.1	44.9	Coyote Wells
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-ML-978	477	1139-58	46	25	81	149	25	81	13	247	378	2268	0.65	18.3	85.8	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-ML-978	478	1139-59	107	21	121	24	64	446	30	936	331	828	1.38	42.1	47.6	Coyote Wells
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-ML-978	479	1139-60	46	23	85	152	19	88	15	425	417	2223	0.82	20.1	63.3	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	18	0.11			
35-ML-978	480	1139-61	63	28	83	159	28	83	10	250	459	2120	0.69	15.6	90.2	Gregory Creek
			± 6	3	3	7	3	7	2	96	47	18	0.11			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

			Trace Element Concentrations											Ratios		
Site	Specimen No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-ML-978	481	1139-62	44	26	80	157	26	74	12	292	504	2393	0.75	15.0	83.2	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-ML-978	482	1139-63	45	27	84	151	23	83	13	177	400	2238	0.64	17.0	115.3	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	17	0.11			
35-ML-978	483	1139-64	98	22	121	23	64	440	30	1175	398	851	1.62	39.9	44.4	Coyote Wells
			± 7	3	3	7	3	7	2	97	48	15	0.11			
35-ML-978	484	1139-65	45	26	81	150	23	80	11	275	597	2343	0.92	15.1	105.9	Gregory Creek
			± 6	2	3	7	3	7	2	97	48	17	0.11			
35-ML-978	485	1139-66	49	24	81	147	25	82	14	278	440	2272	0.73	17.2	85.7	Gregory Creek
			± 6	2	3	7	3	7	2	96	47	17	0.11			
35-ML-978	486	1139-67	64	26	86	163	25	86	13	303	485	2295	0.86	17.8	91.2	Gregory Creek
			± 6	2	3	7	3	7	2	96	47	18	0.11			
35-ML-978	487	1139-68	60	29	85	159	27	81	17	244	387	2334	0.64	17.6	86.0	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-ML-974	488	1139-3	62	24	86	161	23	82	9	440	562	2234	1.00	17.4	73.3	Gregory Creek
			± 6	2	3	7	3	7	2	97	48	17	0.11			
35-ML-974	489	1139-21	54	25	84	157	26	85	15	255	562	2259	0.91	16.1	113.2	Gregory Creek
			± 7	3	3	7	3	7	1	97	48	16	0.11			
35-ML-974	490	1139-22	37	19	132	46	29	101	9	544	256	1066	0.85	36.6	51.8	Wolf Creek
			± 6	2	3	7	3	7	1	96	47	13	0.11			
35-ML-974	491	1139-23	40	25	83	154	22	80	8	314	626	2146	1.04	16.0	104.8	Gregory Creek
			± 6	2	3	7	3	7	2	97	48	15	0.11			
35-ML-974	492	1139-25	42	26	82	148	22	72	10	277	542	2391	0.75	13.9	87.4	Gregory Creek
			± 7	2	3	7	3	7	2	96	48	16	0.11			
35-ML-974	493	1139-26	55	24	85	160	24	87	11	528	499	2285	0.97	19.4	60.3	Gregory Creek
			± 7	2	3	7	3	7	2	97	48	17	0.11			
35-ML-974	494	1139-27	153	22	113	15	73	488	31	1469	732	546	2.72	33.8	58.6	Skull Springs
			± 7	3	3	7	3	7	2	97	48	14	0.11			
35-ML-974	495	1139-28	70	26	93	164	24	84	15	246	456	2265	0.71	16.0	92.7	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	18	0.11			
35-ML-974	496	1139-29	44	24	83	155	23	84	11	306	578	2208	0.96	16.3	100.3	Gregory Creek
			± 6	2	3	7	3	7	1	97	48	17	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-ML-974	497	1139-30	72	29	84	162	25	86	13	234	372	2375	0.55	16.2	78.4	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	18	0.11			
35-ML-974	498	1139-31	54	26	82	151	24	79	13	400	435	2166	0.77	18.1	63.3	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-ML-974	499	1139-32	48	22	78	152	22	82	12	209	495	2368	0.75	15.4	113.6	Gregory Creek
			± 6	2	3	7	3	7	2	96	47	17	0.11			
35-ML-974	500	1139-33	48	27	80	145	22	69	9	316	399	2428	0.61	16.3	64.6	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	23	0.11			
35-ML-974	501	1139-34	42	22	76	150	23	82	13	279	533	2289	0.85	15.8	97.0	Gregory Creek
			± 7	2	3	7	3	7	2	96	48	18	0.11			
35-ML-974	502	1139-35	49	24	80	153	26	76	15	291	380	2403	0.54	15.5	63.0	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	20	0.11			
35-ML-974	503	1139-36	52	24	78	153	26	76	12	303	543	2474	0.83	15.2	88.0	Gregory Creek
			± 6	2	3	7	3	7	2	97	48	17	0.11			
35-ML-974	504	1139-37	52	21	83	154	25	80	14	377	547	2396	1.03	18.5	87.7	Gregory Creek
			± 6	2	3	7	3	7	2	97	48	20	0.11			
35-ML-974	505	1139-38	45	25	81	148	25	80	16	375	526	2299	0.96	18.0	82.3	Gregory Creek
			± 6	2	3	7	3	7	2	97	48	19	0.11			
35-ML-974	506	1139-39	49	21	87	154	22	83	15	314	446	2188	0.71	16.4	73.9	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-ML-974	507	1139-40	50	27	83	154	21	83	14	258	479	2388	0.74	15.8	92.7	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	22	0.11			
35-HA-70	508	1139-11	41	20	123	104	29	174	11	1055	279	1592	1.34	50.1	41.2	Curtis Creek
			± 7	2	3	7	3	7	2	97	47	16	0.11			
35-HA-70	509	1139-40	60	19	109	72	41	251	15	1230	291	1256	1.69	59.4	44.2	Van Gulch
			± 6	3	3	7	3	7	2	97	47	13	0.11			
35-HA-70	510	1139-41	55	39	112	48	45	157	16	631	308	1455	0.94	32.4	49.3	Tank Creek
			± 6	2	3	7	3	7	2	96	47	15	0.11			
35-HA-70	511	1139-44	37	20	131	55	30	134	11	546	215	1132	0.80	42.8	48.7	Tule Spring
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-HA-70	512	1139-45	34	14	130	44	26	103	10	344	189	999	0.57	37.8	56.7	Wolf Creek
			± 7	3	3	7	3	7	2	95	47	16	0.11			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

Site	Specimen No.	Catalog No.	Trace Element Concentrations											Ratios		Geochemical Source
			Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	
35-HA-70	513	1139-46	40	15	136	58	34	132	14	586	217	1098	0.87	45.9	49.3	Tule Spring
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-HA-70	514	1139-48	37	24	139	59	34	135	14	591	227	1200	0.84	41.8	47.2	Tule Spring
			± 7	2	3	7	3	7	2	96	47	15	0.11			
35-HA-70	515	1139-49	46	24	145	60	33	141	16	717	258	1171	0.97	40.8	44.7	Tule Spring
			± 6	2	3	7	3	7	2	96	47	14	0.11			
35-HA-70	516	1139-50	39	22	146	68	31	141	14	446	180	1149	0.65	44.8	49.1	Tule Spring
			± 7	3	4	7	3	7	2	96	47	17	0.11			
35-HA-70	517	1139-51	30	18	138	48	28	101	14	380	205	1111	0.69	40.2	60.8	Wolf Creek
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-HA-70	518	1139-52	30	20	126	43	29	104	8	257	165	1129	0.46	37.7	62.1	Wolf Creek
			± 7	3	3	7	3	7	2	95	47	14	0.11			
35-HA-70	519	1139-53	44	24	124	104	31	173	13	968	267	1558	1.24	49.2	41.8	Curtis Creek
			± 7	3	3	7	3	7	2	97	47	16	0.11			
35-HA-70	520	1139-54	43	18	131	58	34	135	13	556	230	1105	0.78	38.8	47.0	Tule Spring
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-HA-70	521	1139-55	34	23	124	60	30	121	8	496	205	1093	0.72	41.5	48.5	Tule Spring
			± 7	3	3	7	3	7	2	96	47	16	0.11			
35-HA-70	522	1139-56	35	17	139	61	31	136	13	483	203	1125	0.75	43.5	51.6	Tule Spring
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-HA-70	523	1139-57	41	19	131	59	33	132	14	659	275	1078	1.02	39.8	50.8	Tule Spring
			± 7	2	3	7	3	7	2	96	47	13	0.11			
35-HA-70	524	1139-58	52	24	90	157	26	84	9	224	486	2301	0.75	15.8	107.4	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-HA-70	525	1139-59	40	24	135	49	27	100	10	362	216	1014	0.63	34.4	58.3	Wolf Creek
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-HA-70	526	1139-60	36	25	139	60	31	138	14	534	207	1127	0.78	43.9	48.6	Tule Spring
			± 7	3	3	7	3	7	2	96	47	15	0.11			
35-HA-70	527	1139-61	29	19	127	46	23	95	11	382	207	1133	0.67	38.3	58.5	Wolf Creek
			± 7	2	3	7	3	7	2	96	47	14	0.11			
35-HA-2885	528	1139-2	66	35	105	27	56	306	19	1151	386	NM	1.64	41.6	45.7	Chickahominy
			± 7	3	3	7	3	7	2	97	47	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2885	529	1139-5	83	37	107	29	52	300	22	1195	428	NM	1.73	39.1	46.3	Chickahominy
			± 7	2	3	7	3	7	2	97	48	NM	0.11			
35-HA-2885	530	1139-6	54	39	104	29	57	294	18	994	389	NM	1.55	39.2	50.0	Chickahominy
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2885	531	1139-7	64	41	113	30	59	317	22	852	309	NM	1.30	43.2	49.4	Chickahominy
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2885	532	1139-8	61	22	161	47	39	283	17	1259	226	767	1.24	60.5	32.3	Double O
			± 7	3	4	7	3	7	2	97	47	14	0.11			
35-HA-2885	533	1139-9	71	41	115	30	57	308	19	906	321	NM	1.33	42.2	47.5	Chickahominy
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2885	534	1139-10	37	18	161	51	36	281	14	1637	269	864	1.82	70.2	35.8	Double O
			± 6	2	3	7	3	7	2	97	47	14	0.11			
35-HA-2885	535	1139-68	71	37	111	28	53	297	21	1158	376	NM	1.66	43.5	46.1	Chickahominy
			± 6	2	3	7	3	7	2	97	48	NM	0.11			
35-HA-2885	536	1139-69	72	37	118	30	57	314	19	1024	377	NM	1.48	38.9	46.5	Chickahominy
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2885	537	1139-70	69	37	104	28	54	292	19	1051	404	NM	1.63	39.4	49.7	Chickahominy
			± 7	2	3	7	3	7	2	97	48	NM	0.11			
35-HA-2885	538	1139-71	71	35	117	28	55	304	19	1133	419	NM	1.71	39.7	48.5	Chickahominy
			± 6	2	3	7	3	7	1	97	48	NM	0.11			
35-HA-2885	539	1139-72	70	38	117	28	57	308	20	1043	394	NM	1.58	39.3	48.6	Chickahominy
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2885	540	1139-73	62	38	110	24	57	295	22	1080	432	NM	1.79	40.0	53.0	Chickahominy
			± 6	2	3	7	3	7	1	97	48	NM	0.11			
35-HA-2885	541	1139-74	64	39	104	29	54	301	22	1096	379	NM	1.64	42.7	48.1	Chickahominy
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2885	542	1139-75	57	38	110	28	55	302	22	1101	394	NM	1.72	42.7	50.1	Chickahominy
			± 7	2	3	7	3	7	2	97	48	NM	0.11			
35-HA-2885	543	1139-76	58	40	112	29	59	305	21	1088	415	NM	1.74	40.8	51.3	Chickahominy
			± 7	3	3	7	3	7	2	97	48	NM	0.11			
35-HA-2885	544	1139-77	77	37	114	29	56	301	22	1094	420	NM	1.69	39.1	49.5	Chickahominy
			± 7	3	3	7	3	7	2	97	48	NM	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2885	545	1139-78	60	37	109	31	56	302	22	1191	429	NM	1.82	40.9	48.9	Chickahominy
			± 7	2	3	7	3	7	1	97	48	NM	0.11			
35-HA-2885	546	1139-79	66	40	113	28	56	308	21	1134	405	NM	1.72	41.3	48.5	Chickahominy
			± 7	2	3	7	3	7	2	97	48	NM	0.11			
35-HA-2885	547	1139-80	64	36	112	28	56	303	23	1299	414	NM	1.82	42.5	44.8	Chickahominy
			± 7	2	3	7	3	7	1	97	48	NM	0.11			
35-ML-976	548	1139-1	54	29	83	156	25	82	11	275	533	2195	0.81	15.2	94.6	Gregory Creek
			± 6	2	3	7	3	7	2	96	48	18	0.11			
35-ML-976	549	1139-2	41	19	76	147	23	80	13	268	583	2262	0.93	15.6	109.5	Gregory Creek
			± 7	2	3	7	3	7	1	97	48	16	0.11			
35-ML-976	550	1139-4	47	24	83	157	24	81	17	258	605	2335	0.92	14.9	112.3	Gregory Creek
			± 6	2	3	7	3	7	1	97	48	17	0.11			
35-ML-976	551	1139-5	57	33	83	160	26	81	14	248	505	2439	0.73	14.7	94.8	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	22	0.11			
35-ML-976	552	1139-8	41	30	80	154	23	84	12	165	253	2065	0.37	18.1	76.9	Gregory Creek
			± 8	3	3	7	3	7	2	95	47	20	0.11			
35-ML-976	553	1139-9	50	26	103	155	25	94	14	1013	656	983	1.54	22.0	48.9	Venator
			± 6	2	3	7	3	7	1	97	48	13	0.11			
35-ML-976	554	1139-30	51	23	89	159	23	87	10	616	438	1995	0.80	18.7	43.5	Gregory Creek
			± 7	3	3	7	3	7	2	97	47	19	0.11			
35-ML-976	555	1139-31	52	23	80	151	27	75	14	317	469	2420	0.64	14.3	67.5	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-ML-976	556	1139-32	42	26	76	143	26	77	11	222	313	2265	0.40	15.2	63.4	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	20	0.11			
35-ML-979	557	1139-10	84	20	112	21	59	423	31	684	283	772	0.96	36.3	46.4	Coyote Wells
			± 8	3	3	7	3	7	2	96	47	15	0.11			
35-ML-979	558	1139-30	119	21	103	29	61	447	30	1304	600	1148	2.18	33.7	53.1	Coyote Wells East
			± 7	3	3	7	3	7	2	97	48	15	0.11			
35-ML-979	559	1139-31	88	15	109	22	58	400	24	717	282	751	1.04	39.4	47.8	Coyote Wells *
			± 8	3	3	7	3	7	2	96	47	15	0.11			
35-ML-979	560	1139-40	56	24	79	151	23	76	13	115	493	2306	0.72	15.0	186.3	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			

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NA = Not available; ND = Not detected; NM = Not measured.; * = Small sample.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-ML-979	561	1139-43	105	28	120	25	61	438	32	667	232	800	0.81	39.8	40.8	Coyote Wells *
			± 8	3	4	7	3	7	2	96	47	17	0.11			
35-ML-979	562	1139-47	48	16	101	139	26	95	17	304	373	945	0.68	19.4	74.0	Venator
			± 7	3	3	7	3	7	2	95	47	15	0.11			
35-ML-979	563	1139-48	51	25	82	150	25	74	12	126	465	2544	0.62	14.0	151.1	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	20	0.11			
35-ML-979	564	1139-52	61	29	73	146	26	75	8	84	291	2483	0.37	15.4	137.5	Gregory Creek *
			± 7	3	3	7	3	7	2	95	47	23	0.11			
35-ML-979	565	1139-55	88	23	108	22	60	409	30	1149	405	876	1.64	39.6	45.9	Coyote Wells
			± 7	3	3	7	3	7	2	97	47	14	0.11			
35-ML-979	566	1139-60	42	23	77	152	24	78	14	127	564	2284	0.79	14.0	186.6	Gregory Creek
			± 6	2	3	7	3	7	1	96	48	15	0.11			
35-ML-979	567	1139-64	59	27	88	162	26	88	14	146	572	2418	0.86	14.9	177.4	Gregory Creek
			± 6	2	3	7	3	7	2	96	48	19	0.11			
35-ML-979	568	1139-65	46	24	80	150	25	77	12	130	513	2587	0.70	14.0	163.9	Gregory Creek
			± 6	2	3	7	3	7	2	96	47	18	0.11			
35-ML-979	569	1139-66	108	24	124	25	65	450	34	952	369	905	1.36	36.8	46.2	Coyote Wells
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-ML-979	570	1139-67	117	23	108	30	65	460	32	1457	597	1165	2.26	35.0	49.2	Coyote Wells East
			± 7	3	3	7	3	7	2	97	48	14	0.11			
35-ML-979	571	1139-68	134	17	109	16	76	478	33	1209	643	671	2.30	32.9	60.2	Coyote Wells?
			± 7	3	3	7	3	7	2	97	48	14	0.11			
35-ML-979	572	1139-69	79	19	116	22	61	440	33	1256	488	859	1.94	37.7	49.2	Coyote Wells
			± 7	3	3	7	3	7	2	97	48	14	0.11			
35-ML-979	573	1139-70	45	29	88	170	30	81	11	190	482	2290	0.71	15.1	117.8	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	22	0.11			
35-ML-979	574	1139-71	80	26	110	26	62	432	36	679	255	829	0.94	40.3	45.8	Coyote Wells
			± 8	3	3	7	3	7	2	96	47	15	0.11			
35-ML-979	575	1139-72	46	23	79	151	23	76	17	112	445	2409	0.59	14.1	160.4	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	21	0.11			
35-ML-979	576	1139-76	182	28	102	110	71	375	17	755	278	1350	1.61	60.1	68.1	Eldorado
			± 8	3	3	7	3	7	2	97	47	21	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-ML-981	577	1139-44	42	27	83	144	24	93	15	126	340	2259	0.52	17.0	129.5	Gregory Creek?
			± 7	3	3	7	3	7	2	95	47	19	0.11			
35-ML-982	578	1139-2	46	22	86	161	23	85	14	145	478	2219	0.76	16.2	160.0	Gregory Creek
			± 7	3	3	7	3	7	2	96	47	19	0.11			
35-HA-2895	579	1139-6	137	25	101	ND	108	302	34	726	558	120	1.32	22.6	58.5	Buck Spring
			± 7	3	3	ND	3	7	2	96	48	12	0.11			
35-HA-2895	580	1139-9	166	35	110	4	94	654	54	768	382	52	2.40	60.9	98.0	Dog Hill
			± 7	3	3	8	3	7	2	96	48	13	0.11			
35-HA-2895	581	1139-10	55	21	129	24	49	246	33	1129	326	NM	1.56	48.3	44.5	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2895	582	1139-40	116	19	98	4	94	278	32	650	599	124	1.29	20.6	64.1	Buck Spring
			± 7	3	3	8	3	7	2	96	48	12	0.11			
35-HA-2895	583	1139-55	89	24	124	5	100	202	40	738	663	76	1.02	14.9	45.7	Buck Spring
			± 7	2	3	7	3	7	2	96	48	12	0.11			
35-HA-2895	584	1139-67	88	23	127	4	101	167	39	688	566	31	0.79	14.0	38.8	Buck Spring
			± 7	2	3	7	3	7	2	95	48	13	0.11			
35-HA-2895	585	1139-70	56	41	116	59	45	202	18	926	355	1625	1.16	33.2	40.9	Big Stick
			± 6	2	3	7	3	7	2	97	47	14	0.11			
35-HA-2895	586	1139-75	108	26	123	4	101	207	38	650	608	76	0.95	15.3	48.2	Buck Spring
			± 7	2	3	8	3	7	2	96	48	13	0.11			
35-HA-2895	587	1139-86	36	21	125	72	26	118	9	651	239	1629	0.85	39.8	43.5	Whitewater Ridge
			± 6	2	3	7	3	7	2	97	47	14	0.11			
35-HA-2895	588	1139-96	111	24	115	4	96	200	37	642	561	83	0.94	16.5	48.2	Buck Spring
			± 7	3	3	9	3	7	2	95	48	12	0.11			
35-HA-2895	589	1139-106	112	20	122	6	103	216	37	716	631	77	1.02	15.6	46.7	Buck Spring
			± 7	3	3	7	3	7	2	96	48	12	0.11			
35-HA-2895	590	1139-109	94	21	115	5	89	187	36	489	437	91	0.64	15.3	44.3	Buck Spring
			± 7	3	3	7	3	7	2	95	47	13	0.11			
35-HA-2895	591	1139-113	34	24	133	167	16	160	11	806	357	1004	1.04	29.7	42.3	Beatys Butte
			± 6	2	3	7	3	7	2	96	47	14	0.11			
35-HA-2895	592	1139-137	39	20	127	25	46	214	29	931	300	NM	1.43	49.1	49.5	Burns
			± 6	2	3	7	3	7	1	96	47	NM	0.11			

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Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2895	593	1139-138	99	26	128	ND	98	161	37	560	500	18	0.65	13.5	39.7	Buck Spring
			± 7	3	3	ND	3	7	2	95	47	13	0.11			
35-HA-2895	594	1139-142	96	25	115	6	100	205	39	665	619	109	1.01	15.8	49.8	Buck Spring
			± 7	2	3	7	3	7	2	96	48	12	0.11			
35-HA-2895	595	1139-153	112	26	99	4	98	290	35	684	625	124	1.36	20.6	63.7	Buck Spring
			± 7	2	3	7	3	7	1	96	48	13	0.11			
35-HA-2895	596	1139-190	92	16	111	11	60	449	28	1250	632	1095	2.38	34.7	60.2	Riley
			± 7	3	3	7	3	7	2	97	48	13	0.11			
35-HA-2895	597	1139-191	46	22	99	148	29	98	16	599	603	885	1.20	19.1	64.7	Venator
			± 6	2	3	7	3	7	1	96	48	13	0.11			
35-HA-2895	598	1139-192	40	21	135	175	17	168	15	678	311	1061	0.85	29.0	41.7	Beatys Butte
			± 7	3	3	7	3	7	2	96	47	14	0.11			
35-HA-2905	599	1139-62	50	22	120	30	45	267	31	1218	339	NM	1.73	50.9	45.6	Burns
			± 6	2	3	7	3	7	1	97	47	NM	0.11			
35-HA-2905	600	1139-80	48	20	125	27	45	242	28	1155	309	NM	1.65	54.1	45.9	Burns
			± 6	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2905	601	1139-83	40	21	129	26	44	248	32	1039	275	NM	1.42	53.9	44.3	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2905	602	1139-84	53	20	136	31	47	263	31	903	243	NM	1.11	49.6	40.3	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2905	603	1139-85	51	20	135	28	46	255	31	1178	313	NM	1.58	51.2	43.2	Burns
			± 7	3	3	7	3	7	2	97	47	NM	0.11			
35-HA-2905	604	1139-87	44	17	120	32	46	263	27	947	265	NM	1.34	53.4	45.9	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2905	605	1139-88	56	21	128	29	44	270	28	1302	342	NM	1.72	50.0	42.4	Burns
			± 6	2	3	7	3	7	1	97	47	NM	0.11			
35-HA-2905	606	1139-91	93	26	116	4	74	443	49	595	278	15	1.86	68.6	98.1	Mud Ridge
			± 7	2	3	ND	3	7	2	95	47	13	0.11			
35-HA-2905	607	1139-92	131	36	110	5	87	639	46	1031	432	34	2.74	60.2	83.5	Dog Hill
			± 8	2	3	7	3	7	2	96	48	13	0.11			
35-HA-2905	608	1139-93	170	23	107	30	39	236	27	1196	325	NM	1.74	53.7	46.7	Burns
			± 7	2	3	7	3	7	2	97	47	NM	0.11			

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.

Table A-1. Results of XRF Studies: FTV Western Fiber Build Project Sites, Deschutes, Lake, Harney, and Malheur Counties, Oregon

	Specimen		Trace Element Concentrations											Ratios		
Site	No.	Catalog No.	Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	$Fe_2O_3^T$	Fe:Mn	Fe:Ti	Geochemical Source
35-HA-2905	609	1139-94	44	22	132	29	45	250	30	1146	280	505	1.51	56.0	42.5	Burns
			± 7	2	3	7	3	7	2	96	47	13	0.11			
35-HA-2905	610	1139-95	50	16	123	29	42	273	28	1105	285	650	1.43	52.1	41.9	Burns
			± 8	3	3	7	3	7	2	96	47	13	0.11			
35-HA-2905	611	1139-96	118	21	102	28	40	234	25	1265	335	NM	1.75	52.2	44.4	Burns
			± 7	2	3	7	3	7	2	97	47	NM	0.11			
35-HA-2905	612	1139-103	134	30	106	5	87	621	46	1055	441	44	2.79	59.9	83.0	Dog Hill
			± 9	3	3	7	3	7	2	96	48	13	0.11			
35-HA-2905	613	1139-104	44	19	128	27	43	244	30	1167	304	500	1.53	51.3	42.2	Burns
			± 11	4	4	7	3	7	2	96	47	13	0.11			
35-HA-2905	614	1139-105	145	23	107	25	39	215	28	1154	289	NM	1.60	56.9	44.6	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
35-HA-2905	615	1139-106	40	19	122	104	23	146	9	845	228	1596	0.90	44.5	35.6	Whitewater Ridge
			± 8	3	3	7	3	7	2	97	47	14	0.11			
35-HA-2905	616	1139-107	52	19	138	29	46	252	31	1132	273	572	1.41	53.9	40.3	Burns
			± 8	3	3	7	3	7	2	96	47	13	0.11			
35-HA-2905	617	1139-108	122	21	107	27	41	236	27	1276	339	NM	1.77	52.2	44.6	Burns
			± 7	2	3	7	3	7	1	97	47	NM	0.11			
35-HA-2905	618	1139-109	71	23	140	31	51	265	36	772	221	NM	1.01	51.3	43.2	Burns
			± 7	3	3	7	3	7	2	96	47	NM	0.11			
NA	RGM-1	RGM-1	35	24	148	104	22	217	7	1616	287	761	1.88	67.1	37.4	RGM-1 Reference Standard
			± 6	2	3	7	3	7	1	97	47	13	0.11			

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.

Appendix B

Results of Obsidian Hydration Analysis

Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-DS-1430	1	1139-7	SCU 12	Surface	DEB	Quartz Mountain	4.5 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1430	2	1139-22	SCU 43	Surface	EMP	Quartz Mountain	4.5 ± 0.1	12.2 ± 0.1	--
35-DS-1430	3	1139-47	SCU 88	Surface	DEB	Glass Buttes 1	3.4 ± 0.1	NM ± NM	--
35-DS-1430	4	1139-54	SCU 98	Surface	DEB	Quartz Mountain	4.6 ± 0.1	NM ± NM	--
35-DS-1430	5	1139-55	SCU 99	Surface	DEB	Quartz Mountain	4.6 ± 0.1	NM ± NM	--
35-DS-1430	6	1139-58	SCP 1	Surface	PPT	Quartz Mountain	5.1 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1430	7	1139-60	SCU 47	Surface	EMP	Quartz Mountain	6.2 ± 0.2	NM ± NM	DFV
35-DS-1430	8	1139-61	SCU 48	Surface	EMP	Unknown 1	14.7 ± 0.2	6.4 ± 0.1	Larger rim on ventral surface
35-DS-1430	9	1139-62	SCU 9	Surface	DEB	Quartz Mountain	5.4 ± 0.0	2.4 ± 0.1	--
35-DS-1430	10	1139-63	SCU 37	Surface	DEB	Quartz Mountain	4.4 ± 0.1	NM ± NM	REC; DFV
35-DS-1430	11	1139-64	SCU 45	Surface	DEB	Quartz Mountain	4.6 ± 0.1	3.5 ± 0.1	--
35-DS-1430	12	1139-65	SCU 73	Surface	DEB	Quartz Mountain	4.4 ± 0.1	NM ± NM	--
35-DS-1430	13	1139-66	SCU 40	Surface	DEB	Quartz Mountain	4.3 ± 0.1	NM ± NM	--
35-DS-1430	14	1139-67	SCU 54	Surface	DEB	Unknown 1	2.8 ± 0.1	NM ± NM	REC
35-DS-1430	15	1139-68	SCU 13	Surface	DEB	Quartz Mountain	NA ± NA	NM ± NM	NVH
35-DS-1430	16	1139-69	SCU 42	Surface	DEB	Quartz Mountain	5.3 ± 0.1	NM ± NM	--
35-DS-1430	17	1139-70	SCU 90	Surface	DEB	Glass Buttes 1	3.7 ± 0.1	NM ± NM	--
35-DS-1430	18	1139-71	SCU 74	Surface	DEB	Quartz Mountain	5.1 ± 0.1	NM ± NM	--
35-DS-1430	19	1139-72	SCU 84	Surface	DEB	Quartz Mountain	4.6 ± 0.1	NM ± NM	--
35-DS-1430	20	1139-73	SCU 43	Surface	DEB	Quartz Mountain	5.5 ± 0.1	NM ± NM	DFV
35-DS-1432	21	1139-2	SCP 2	Surface	EMP	Chickahominy *	5.3 ± 0.1	NM ± NM	--
35-DS-1432	22	1139-3	SCP 3	Surface	DEB	Chickahominy	6.1 ± 0.1	NM ± NM	--
35-DS-1432	23	1139-4	SCP 4	Surface	DEB	Quartz Mountain	3.7 ± 0.1	NM ± NM	--
35-DS-1432	24	1139-5	SCP 5	Surface	DEB	Quartz Mountain	3.9 ± 0.1	NM ± NM	--
35-DS-1433	25	1139-1	SCU 1	Surface	DEB	Quartz Mountain	4.6 ± 0.1	NM ± NM	REC

[A] BIF = Biface; COR = Core; CRE = Crescent; DEB = Debitage; EMP = Edge Modified Piece; PPT = Projectile Point; SCR = Scraper; UFT = Utilized Flake Tool

[B] See text for explanation of comment abbreviations

NA = Not Available; NM = Not Measured; * = Small sample

Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims Rim 1	Hydration Rims Rim 2	Comments[B]
35-DS-1433	26	1139-36	SCU 44	Surface	DEB	Quartz Mountain	4.0 ± 0.1	NM ± NM	--
35-DS-1433	27	1139-49	SCP 1	Surface	DEB	Quartz Mountain	3.9 ± 0.1	NM ± NM	NVH on BRE
35-DS-1433	28	1139-50	SCP 2	Surface	EMP	Obsidian Cliffs	6.0 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1433	29	1139-51	SCU 8	Surface	DEB	Quartz Mountain	NA ± NA	NM ± NM	REC; UNR
35-DS-1433	30	1139-52	SCU 16	Surface	DEB	Quartz Mountain	3.5 ± 0.1	NM ± NM	DFV
35-DS-1433	31	1139-53	SCU 16	Surface	DEB	Obsidian Cliffs	5.0 ± 0.1	NM ± NM	--
35-DS-1433	32	1139-54	SCU 22	Surface	DEB	Newberry Volcano	3.5 ± 0.1	NM ± NM	--
35-DS-1433	33	1139-55	SCU 22	Surface	DEB	Quartz Mountain	3.6 ± 0.1	NM ± NM	DFV
35-DS-1433	34	1139-56	SCU 28	Surface	DEB	Quartz Mountain	6.8 ± 0.1	NM ± NM	--
35-DS-1433	35	1139-57	SCU 34	Surface	DEB	Quartz Mountain	4.2 ± 0.1	NM ± NM	--
35-DS-1433	36	1139-58	SCU 42	Surface	DEB	Quartz Mountain	3.0 ± 0.1	NM ± NM	--
35-DS-1433	37	1139-59	SCU 56	Surface	DEB	Quartz Mountain	5.0 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1433	38	1139-60	SCU 60	Surface	DEB	Quartz Mountain	3.9 ± 0.1	NM ± NM	--
35-DS-1433	39	1139-61	SCU 60	Surface	DEB	Quartz Mountain	3.1 ± 0.1	NM ± NM	--
35-DS-1433	40	1139-62	SCU 62	Surface	DEB	Quartz Mountain *	4.6 ± 0.1	NM ± NM	DFV
35-DS-1433	41	1139-63	SCU 12	Surface	DEB	Quartz Mountain	4.0 ± 0.1	NM ± NM	--
35-DS-1433	42	1139-64	SCU 20	Surface	DEB	Newberry Volcano?	4.4 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1433	43	1139-65	SCU 20	Surface	DEB	Quartz Mountain	3.1 ± 0.1	NM ± NM	--
35-DS-1433	44	1139-66	SCU 58	Surface	DEB	Quartz Mountain	4.5 ± 0.1	NM ± NM	--
35-DS-1435	45	1139-3	SCU 22	Surface	DEB	Quartz Mountain	4.1 ± 0.1	NM ± NM	REC
35-DS-1435	46	1139-11	SCU 33	Surface	EMP	Quartz Mountain	4.5 ± 0.1	NM ± NM	DFV
35-DS-1435	47	1139-62	SCU 54	Surface	EMP	Quartz Mountain	4.5 ± 0.1	NM ± NM	--
35-DS-1435	48	1139-73	SCU 63	Surface	DEB	Glass Buttes 1	6.3 ± 0.1	NM ± NM	--
35-DS-1435	49	1139-89	SCU 110	Surface	DEB	Quartz Mountain	4.6 ± 0.1	NM ± NM	PAT
35-DS-1435	50	1139-92	SCP 2	Surface	BIF	Chickahominy	4.3 ± 0.1	NM ± NM	Same rim on BRE

[A] BIF = Biface; COR = Core; CRE = Crescent; DEB = Debitage; EMP = Edge Modified Piece; PPT = Projectile Point; SCR = Scraper; UFT = Utilized Flake Tool

[B] See text for explanation of comment abbreviations

NA = Not Available; NM = Not Measured; * = Small sample

Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-DS-1435	51	1139-93	SCP 3	Surface	BIF	Cougar Mountain	5.7 ± 0.1	NM ± NM	--
35-DS-1435	52	1139-95	SCU 34	Surface	DEB	Glass Buttes 1	5.3 ± 0.1	NM ± NM	--
35-DS-1435	53	1139-96	SCU 34	Surface	DEB	Quartz Mountain	3.8 ± 0.1	NM ± NM	--
35-DS-1435	54	1139-97	SCU 40	Surface	DEB	Quartz Mountain	5.0 ± 0.1	NM ± NM	--
35-DS-1435	55	1139-98	SCU 42	Surface	DEB	Glass Buttes 1	5.1 ± 0.1	NM ± NM	--
35-DS-1435	56	1139-99	SCU 42	Surface	DEB	Glass Buttes 1	6.4 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1435	57	1139-100	SCU 51	Surface	DEB	Quartz Mountain	5.6 ± 0.1	NM ± NM	--
35-DS-1435	58	1139-101	SCU 51	Surface	DEB	Cougar Mountain	6.2 ± 0.1	NM ± NM	--
35-DS-1435	59	1139-102	SCU 58	Surface	DEB	Quartz Mountain	5.3 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1435	60	1139-103	SCU 55	Surface	DEB	Quartz Mountain	NA ± NA	NM ± NM	REC; UNR
35-DS-1435	61	1139-104	SCU 84	Surface	DEB	Quartz Mountain	5.5 ± 0.1	NM ± NM	--
35-DS-1435	62	1139-105	SCU 76	Surface	DEB	Quartz Mountain	6.1 ± 0.1	NM ± NM	BEV
35-DS-1435	63	1139-106	SCU 49	Surface	DEB	Quartz Mountain	4.6 ± 0.1	NM ± NM	--
35-DS-1435	64	1139-107	SCU 46	Surface	DEB	Glass Buttes 3	6.1 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1437	65	1139-17	SCU 32	Surface	DEB	Glass Buttes 1	4.8 ± 0.1	NM ± NM	--
35-DS-1437	66	1139-24	SCU 39	Surface	BIF	Quartz Mountain	4.7 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1437	67	1139-39	SCU 53	Surface	BIF	Quartz Mountain	4.7 ± 0.1	NM ± NM	REC; BEV
35-DS-1437	68	1139-44	SCU 57	Surface	DEB	Quartz Mountain	6.6 ± 0.1	NM ± NM	--
35-DS-1437	69	1139-135	SCU 175	Surface	EMP	Quartz Mountain	4.2 ± 0.1	NM ± NM	--
35-DS-1437	70	1139-144	SCP 1	Surface	SCR	Quartz Mountain	5.3 ± 0.1	NM ± NM	--
35-DS-1437	71	1139-145	SCP 2	Surface	DEB	Quartz Mountain	4.6 ± 0.1	NM ± NM	--
35-DS-1437	72	1139-146	SCP 3	Surface	BIF	Quartz Mountain	2.4 ± 0.1	NM ± NM	DFV
35-DS-1437	73	1139-149	MCP 1	Surface	PPT	Chickahominy	4.6 ± 0.1	NM ± NM	--
35-DS-1437	74	1139-150	MCP 2	Surface	BIF	Quartz Mountain	4.7 ± 0.1	NM ± NM	--
35-DS-1437	75	1139-151	SCU 172	Surface	DEB	Quartz Mountain	6.1 ± 0.1	NM ± NM	DFV

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[B] See text for explanation of comment abbreviations

NA = Not Available; NM = Not Measured; * = Small sample

Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims Rim 1	Hydration Rims Rim 2	Comments[B]
35-DS-1437	76	1139-152	SCU 133	Surface	DEB	Quartz Mountain	6.0 ± 0.1	NM ± NM	--
35-DS-1437	77	1139-153	SCU 87	Surface	DEB	Quartz Mountain	NA ± NA	NM ± NM	NVH
35-DS-1437	78	1139-154	SCU 69	Surface	DEB	Quartz Mountain	3.3 ± 0.1	NM ± NM	--
35-DS-1437	79	1139-155	SCU 62	Surface	DEB	Quartz Mountain	4.1 ± 0.1	9.0 ± 0.0	HV
35-DS-1437	80	1139-156	SCU 62	Surface	DEB	Quartz Mountain	3.9 ± 0.1	NM ± NM	--
35-DS-1437	81	1139-157	SCU 53	Surface	DEB	Quartz Mountain	4.2 ± 0.1	NM ± NM	--
35-DS-1437	82	1139-158	SCU 53	Surface	DEB	Quartz Mountain	3.7 ± 0.1	NM ± NM	--
35-DS-1437	83	1139-159	SCU 5	Surface	DEB	Quartz Mountain	4.6 ± 0.1	NM ± NM	--
35-DS-1437	84	1139-159	SCU 40	Surface	DEB	Quartz Mountain	3.4 ± 0.1	NM ± NM	--
35-DS-1440	85	1139-1	SCU 4	Surface	DEB	Glass Buttes 4?	6.9 ± 0.1	NM ± NM	--
35-DS-1440	86	1139-73	SCU 6	Surface	DEB	Quartz Mountain	5.7 ± 0.1	NM ± NM	--
35-DS-1440	87	1139-74	SCU 10	Surface	DEB	Yreka Butte	4.8 ± 0.1	NM ± NM	--
35-DS-1440	88	1139-75	SCU 10	Surface	DEB	Glass Buttes 4	7.0 ± 0.1	NM ± NM	--
35-DS-1440	89	1139-76	SCU 26	Surface	DEB	Glass Buttes 3	5.8 ± 0.1	NM ± NM	--
35-DS-1440	90	1139-77	SCU 32	Surface	DEB	Glass Buttes 6	6.3 ± 0.1	NM ± NM	--
35-DS-1440	91	1139-78	SCU 28	Surface	DEB	Glass Buttes 1	5.7 ± 0.1	NM ± NM	--
35-DS-1440	92	1139-79	SCU 27	Surface	DEB	Glass Buttes 3	6.1 ± 0.1	NM ± NM	--
35-DS-1440	93	1139-80	SCU 27	Surface	DEB	Cougar Mountain	4.7 ± 0.1	NM ± NM	--
35-DS-1440	94	1139-81	SCU 14	Surface	DEB	Quartz Mountain	6.2 ± 0.1	NM ± NM	--
35-DS-1440	95	1139-82	SCU 18	Surface	DEB	Glass Buttes 3	5.4 ± 0.1	NM ± NM	--
35-DS-1440	96	1139-83	SCU 11	Surface	DEB	Glass Buttes 4	10.8 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1440	97	1139-84	SCU 11	Surface	DEB	Cougar Mountain	5.3 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1440	98	1139-85	SCU 16	Surface	DEB	Glass Buttes 1	4.4 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1440	99	1139-87	SCU 23	Surface	DEB	Quartz Mountain	4.8 ± 0.1	NM ± NM	--
35-DS-1440	100	1139-87	SCU 12	Surface	DEB	Glass Buttes 4	4.6 ± 0.1	NM ± NM	--

[A] BIF = Biface; COR = Core; CRE = Crescent; DEB = Debitage; EMP = Edge Modified Piece; PPT = Projectile Point; SCR = Scraper; UFT = Utilized Flake Tool

[B] See text for explanation of comment abbreviations

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Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type^A	Artifact Source	Hydration Rims		Comments^B
							Rim 1	Rim 2	
35-DS-1440	101	1139-88	SCU 29	Surface	DEB	Glass Buttes 2	5.1 ± 0.1	NM ± NM	--
35-DS-1440	102	1139-90	SCU 32	Surface	DEB	Glass Buttes 1	5.1 ± 0.1	NM ± NM	--
35-DS-1440	103	1139-91	SCU 21	Surface	DEB	Brooks Canyon	5.2 ± 0.1	NM ± NM	--
35-DS-1440	104	1139-92	SCU 21	Surface	DEB	Glass Buttes 1	5.3 ± 0.1	NM ± NM	--
35-DS-1441	105	1139-87	SCU 39	Surface	EMP	Buck Spring	7.9 ± 0.1	NM ± NM	REC
35-DS-1441	106	1139-95	SCU 40	Surface	EMP	Glass Buttes 1	6.4 ± 0.1	NM ± NM	--
35-DS-1441	107	1139-99	SCU 42	Surface	DEB	Cougar Mountain	6.4 ± 0.1	NM ± NM	--
35-DS-1441	108	1139-124	SCU 55	Surface	EMP	Yreka Butte	6.4 ± 0.1	NM ± NM	--
35-DS-1441	109	1139-176	SCU 88	Surface	DEB	Brooks Canyon	4.0 ± 0.1	NM ± NM	--
35-DS-1441	110	1139-178	SCP 1	Surface	PPT	Quartz Mountain	5.5 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1441	111	1139-179	MCP 1	Surface	PPT	Quartz Mountain	6.2 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1441	112	1139-180	SCU 5	Surface	DEB	Glass Buttes 1	7.3 ± 0.1	NM ± NM	--
35-DS-1441	113	1139-181	SCU 9	Surface	DEB	Glass Buttes 1	8.2 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1441	114	1139-182	SCU 21	Surface	DEB	Glass Buttes 2	5.4 ± 0.1	NM ± NM	--
35-DS-1441	115	1139-183	SCU 35	Surface	DEB	Yreka Butte	1.5 ± 0.1	NM ± NM	--
35-DS-1441	116	1139-184	SCU 49	Surface	DEB	Brooks Canyon	5.4 ± 0.0	NM ± NM	DFV
35-DS-1441	117	1139-185	SCU 49	Surface	DEB	Glass Buttes 1	4.6 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1441	118	1139-186	SCU 69	Surface	DEB	Glass Buttes 3	6.0 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1441	119	1139-187	SCU 69	Surface	DEB	Brooks Canyon	6.0 ± 0.1	3.2 ± 0.1	Smaller rim on dorsal surface
35-DS-1441	120	1139-188	SCU 71	Surface	DEB	Glass Buttes 7	4.1 ± 0.1	NM ± NM	--
35-DS-1441	121	1139-189	SCU 71	Surface	DEB	Glass Buttes 7	2.3 ± 0.1	NM ± NM	DFV
35-DS-1441	122	1139-190	SCU 73	Surface	DEB	Brooks Canyon	5.5 ± 0.1	NM ± NM	Same rim on BRE
35-DS-1441	123	1139-191	SCU 54	Surface	DEB	Brooks Canyon	5.5 ± 0.1	NM ± NM	--
35-DS-1441	124	1139-192	SCU 54	Surface	DEB	Glass Buttes 1	7.3 ± 0.1	NM ± NM	--
35-LK-279	125	1139-2	SCU 2	Surface	DEB	Glass Buttes 2	4.7 ± 0.1	NM ± NM	--

[A] BIF = Biface; COR = Core; CRE = Crescent; DEB = Debitage; EMP = Edge Modified Piece; PPT = Projectile Point; SCR = Scraper; UFT = Utilized Flake Tool

[B] See text for explanation of comment abbreviations

NA = Not Available; NM = Not Measured; * = Small sample

Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-LK-279	126	1139-3	SCU 5	Surface	DEB	Glass Buttes 2? *	5.7 ± 0.1	NM ± NM	--
35-LK-279	127	1139-5	SCU 12	Surface	DEB	Glass Buttes 1	7.3 ± 0.1	NM ± NM	--
35-LK-279	128	1139-6	SCU 14	Surface	DEB	Glass Buttes 1 *	66.2 ± 6.4	NM ± NM	HV
35-LK-279	129	1139-7	SCU 1	Surface	DEB	Glass Buttes 2	5.0 ± 0.1	NM ± NM	--
35-LK-279	130	1139-8	SCU 1	Surface	DEB	Glass Buttes 2	5.1 ± 0.1	NM ± NM	REC
35-LK-279	131	1139-9	SCU 1	Surface	DEB	Glass Buttes 2 *	5.5 ± 0.1	NM ± NM	--
35-LK-279	132	1139-10	SCU 1	Surface	DEB	Glass Buttes 2 *	5.7 ± 0.1	NM ± NM	--
35-LK-279	133	1139-11	SCU 1	Surface	DEB	Glass Buttes 2 *	4.4 ± 0.1	NM ± NM	--
35-LK-279	134	1139-12	SCU 2	Surface	DEB	Glass Buttes 2 *	4.9 ± 0.1	NM ± NM	--
35-LK-279	135	1139-13	SCU 5	Surface	DEB	Glass Buttes 2 *	4.5 ± 0.1	NM ± NM	REC
35-LK-279	136	1139-14	SCU 8	Surface	DEB	Glass Buttes 2	5.3 ± 0.1	NM ± NM	--
35-LK-279	137	1139-15	SCU 8	Surface	DEB	Glass Buttes 2 *	4.6 ± 0.1	NM ± NM	--
35-LK-279	138	1139-16	SCU 12	Surface	DEB	Glass Buttes 1	7.5 ± 0.1	NM ± NM	DFV
35-LK-279	139	1139-17	SCU 12	Surface	DEB	Glass Buttes 1 *	7.3 ± 0.1	NM ± NM	--
35-LK-279	140	1139-18	SCU 12	Surface	DEB	Glass Buttes 2 *	8.4 ± 0.1	5.5 ± 0.1	--
35-LK-279	141	1139-19	SCU 8	Surface	DEB	Glass Buttes 2 *	4.4 ± 0.1	NM ± NM	--
35-LK-3169	142	1139-13	SCU 23	Surface	DEB	Glass Buttes 1	5.3 ± 0.1	NM ± NM	--
35-LK-3169	143	1139-18	SCU 29	Surface	DEB	Glass Buttes 1	4.6 ± 0.1	NM ± NM	--
35-LK-3169	144	1139-25	SCU 46	Surface	DEB	Glass Buttes 1	20.0 ± 0.1	6.2 ± 0.1	Larger rim located on dorsal surface
35-LK-3169	145	1139-27	SCU 49	Surface	DEB	Glass Buttes 1	5.3 ± 0.1	NM ± NM	--
35-LK-3169	146	1139-29	SCU 52	Surface	DEB	Glass Buttes 1	3.7 ± 0.1	NM ± NM	--
35-LK-3169	147	1139-41	SCU 73	Surface	DEB	Glass Buttes 1	5.0 ± 0.1	NM ± NM	--
35-LK-3169	148	1139-43	SCU 79	Surface	BIF	Glass Buttes 1	4.3 ± 0.1	NM ± NM	--
35-LK-3169	149	1139-48	SP 1	0-10	DEB	Glass Buttes 1	2.2 ± 0.1	NM ± NM	--
35-LK-3169	150	1139-52	SP 1	0-10	DEB	Glass Buttes 1	2.4 ± 0.1	NM ± NM	--

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Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims Rim 1	Hydration Rims Rim 2	Comments[B]
35-LK-3169	151	1139-53	SP 1	10-20	DEB	Glass Buttes 1	2.2 ± 0.0	NM ± NM	Same rim on BRE
35-LK-3169	152	1139-54	SP 1	50-60	DEB	Glass Buttes 1	2.1 ± 0.1	NM ± NM	REC
35-LK-3169	153	1139-55	SCU 8	Surface	DEB	Glass Buttes 1	2.8 ± 0.1	NM ± NM	--
35-LK-3169	154	1139-56	SCU 22	Surface	DEB	Glass Buttes 1	3.7 ± 0.1	NM ± NM	--
35-LK-3169	155	1139-57	SCU 43	Surface	DEB	Glass Buttes 1	4.5 ± 0.1	NM ± NM	--
35-LK-3169	156	1139-58	SCU 64	Surface	DEB	Glass Buttes 1	4.2 ± 0.1	NM ± NM	--
35-LK-3169	157	1139-59	SCU 73	Surface	DEB	Glass Buttes 1	4.6 ± 0.1	NM ± NM	--
35-LK-3169	158	1139-60	SCU 58	Surface	DEB	Glass Buttes 1	5.2 ± 0.1	NM ± NM	--
35-LK-3169	159	1139-61	SCU 16	Surface	DEB	Glass Buttes 1	4.4 ± 0.1	NM ± NM	--
35-LK-3169	160	1139-62	SCU 27	Surface	DEB	Glass Buttes 1	4.1 ± 0.1	NM ± NM	Same rim on BRE
35-LK-3169	161	1139-63	SCU 10	Surface	DEB	Glass Buttes 1	4.0 ± 0.1	NM ± NM	--
35-LK-2544	162	1139-43	SCU 57	Surface	DEB	Glass Buttes 3	3.8 ± 0.1	NM ± NM	--
35-LK-2544	163	1139-45	SCU 73	Surface	DEB	Glass Buttes 4 *	4.1 ± 0.1	2.1 ± 0.1	Smaller rim on BRE
35-LK-2544	164	1139-46	SCP 1	Surface	BIF	Glass Buttes 4	3.8 ± 0.1	NM ± NM	--
35-LK-2544	165	1139-47	SCP 2	Surface	EMP	Glass Buttes 3	3.7 ± 0.1	NM ± NM	--
35-LK-2544	166	1139-48	SCP 3	Surface	PPT	Glass Buttes 4	2.9 ± 0.1	NM ± NM	Same rim on BRE
35-LK-2544	167	1139-49	MCP 1	Surface	BIF	Glass Buttes 3	3.0 ± 0.1	NM ± NM	NVH on BRE
35-LK-2544	168	1139-50	SP 1	0-10	DEB	Glass Buttes 7	1.5 ± 0.1	NM ± NM	--
35-LK-2544	169	1139-51	SP 1	0-10	DEB	Glass Buttes 5	5.3 ± 0.1	NM ± NM	--
35-LK-2544	170	1139-52	SP 1	20-30	DEB	Glass Buttes 4	5.3 ± 0.1	NM ± NM	--
35-LK-2544	171	1139-53	SP 1	50-60	DEB	Glass Buttes 5	3.1 ± 0.1	NM ± NM	NVH on ventral surface
35-LK-2544	172	1160-60	SCU 1	Surface	DEB	Glass Buttes 1	3.5 ± 0.1	NM ± NM	DFV
35-LK-2544	173	1139-61	SCU 3	Surface	DEB	Glass Buttes 4	3.7 ± 0.1	NM ± NM	--
35-LK-2544	174	1139-62	SCU 11	Surface	DEB	Glass Buttes 4	3.6 ± 0.1	NM ± NM	--
35-LK-2544	175	1139-63	SCU 16	Surface	DEB	Glass Buttes 6	3.7 ± 0.1	NM ± NM	--

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Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-LK-2544	176	1139-64	SCU 16	Surface	DEB	Glass Buttes 4	3.7 ± 0.1	2.7 ± 0.0	Smaller rim located on worked edge
35-LK-2544	177	1139-65	SCU 33	Surface	DEB	Glass Buttes 5 *	2.4 ± 0.1	NM ± NM	--
35-LK-2544	178	1139-66	SCU 43	Surface	DEB	Glass Buttes 3	3.0 ± 0.1	NM ± NM	--
35-LK-2544	179	1139-67	SCU 47	Surface	DEB	Glass Buttes 7	2.3 ± 0.1	NM ± NM	--
35-LK-2544	180	1139-68	SCU 47	Surface	DEB	Glass Buttes 5	3.1 ± 0.1	NM ± NM	--
35-LK-2544	181	1139-69	SCU 41	Surface	DEB	Glass Buttes 5	3.5 ± 0.1	NM ± NM	--
35-LK-2544	182	1139-7	SCU 8	Surface	DEB	Glass Buttes 6	5.3 ± 0.1	NM ± NM	--
35-LK-2544	183	1139-9	SCU 13	Surface	DEB	Glass Buttes 5	5.0 ± 0.1	NM ± NM	--
35-LK-2544	184	1139-12	SP 1	0-10	BIF	Glass Buttes 4	3.7 ± 0.1	NM ± NM	Same rim on BRE
35-LK-2544	185	1139-13	SP 1	0-10	DEB	Glass Buttes 7	2.3 ± 0.1	NM ± NM	--
35-LK-2544	186	1139-14	SCU 5	Surface	DEB	Glass Buttes 4	3.2 ± 0.1	NM ± NM	--
35-LK-2544	187	1139-15	SCU 2	Surface	DEB	Glass Buttes 4	6.2 ± 0.1	3.5 ± 0.1	Smaller rim on ventral surface
35-LK-2544	188	1139-16	SCU 2	Surface	DEB	Glass Buttes 4	3.2 ± 0.1	NM ± NM	--
35-LK-2544	189	1139-17	SCU 2	Surface	DEB	Glass Buttes 4	3.3 ± 0.1	NM ± NM	--
35-LK-2544	190	1139-18	SCU 3	Surface	DEB	Glass Buttes 4	3.5 ± 0.1	2.3 ± 0.1	Smaller rim on BRE
35-LK-2544	191	1139-19	SCU 3	Surface	DEB	Glass Buttes 4	3.9 ± 0.1	NM ± NM	--
35-LK-2544	192	1139-20	SCU 3	Surface	DEB	Glass Buttes 4	3.7 ± 0.1	NM ± NM	NVH on BRE
35-LK-2544	193	1139-21	SCU 6	Surface	DEB	Glass Buttes 4	3.5 ± 0.1	NM ± NM	--
35-LK-2544	194	1139-22	SCU 6	Surface	DEB	Glass Buttes 4	3.6 ± 0.1	NM ± NM	--
35-LK-2544	195	1139-23	SCU 6	Surface	DEB	Glass Buttes 4	3.3 ± 0.1	NM ± NM	--
35-LK-2544	196	1139-24	SCU 6	Surface	DEB	Glass Buttes 4	2.5 ± 0.1	NM ± NM	Same rim on BRE
35-LK-2544	197	1139-25	SCU 6	Surface	DEB	Glass Buttes 7	2.4 ± 0.1	NM ± NM	--
35-LK-2544	198	1139-26	SCU 6	Surface	DEB	Glass Buttes 4	3.5 ± 0.1	NM ± NM	--
35-LK-2544	199	1139-27	SCU 6	Surface	DEB	Glass Buttes 4	3.3 ± 0.1	2.1 ± 0.1	Smaller rim on BRE
35-LK-2544	200	1139-28	SCU 6	Surface	DEB	Glass Buttes 4	3.5 ± 0.1	NM ± NM	--

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Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims Rim 1	Hydration Rims Rim 2	Comments[B]
35-LK-2544	201	1139-29	SCU 6	Surface	DEB	Glass Buttes 4	3.3 ± 0.1	NM ± NM	--
35-LK-3171	202	1139-1	SCU 1	Surface	DEB	Glass Buttes 4	5.0 ± 0.1	NM ± NM	--
35-LK-3171	203	1139-14	SCU 16	Surface	DEB	Riley	5.2 ± 0.1	NM ± NM	--
35-LK-3171	204	1139-31	SCU 46	Surface	DEB	Glass Buttes 4	5.4 ± 0.1	NM ± NM	--
35-LK-3171	205	1139-41	SCU 63	Surface	DEB	Glass Buttes 3	2.4 ± 0.1	NM ± NM	REC
35-LK-3171	206	1139-43	SCU 67	Surface	DEB	Glass Buttes 4	2.9 ± 0.1	NM ± NM	--
35-LK-3171	207	1139-44	SCP 1	Surface	SCR	Glass Buttes 7	2.3 ± 0.1	NM ± NM	--
35-LK-3171	208	1139-45	SCP 2	Surface	EMP	Glass Buttes 3	2.3 ± 0.1	NM ± NM	DFV
35-LK-3171	209	1139-46	MCP 1	Surface	CRE	Glass Buttes 3	5.3 ± 0.1	NM ± NM	Same rim on BRE
35-LK-3171	210	1139-48	SCU 7	Surface	DEB	Glass Buttes 3	5.8 ± 0.1	NM ± NM	NVH on BRE
35-LK-3171	211	1139-49	SCU 14	Surface	DEB	Glass Buttes 4	7.1 ± 0.1	NM ± NM	Same rim on BRE
35-LK-3171	212	1139-50	SCU 37	Surface	DEB	Glass Buttes 3	1.8 ± 1.0	3.3 ± 0.1	Smaller rim on dorsal surface
35-LK-3171	213	1139-51	SCU 37	Surface	DEB	Glass Buttes 4	5.2 ± 0.1	NM ± NM	--
35-LK-3171	214	1139-52	SCU 41	Surface	DEB	Glass Buttes 3	3.5 ± 0.1	NM ± NM	--
35-LK-3171	215	1139-53	SCU 41	Surface	DEB	Glass Buttes 7	2.2 ± 0.1	NM ± NM	--
35-LK-3171	216	1139-54	SP 1	20-30	DEB	Glass Buttes 3	4.6 ± 0.1	NM ± NM	--
35-LK-3171	217	1139-55	SCU 52	Surface	DEB	Big Stick	4.8 ± 0.1	NM ± NM	--
35-LK-3171	218	1139-56	SCU 57	Surface	DEB	Big Stick	4.5 ± 0.1	NM ± NM	--
35-LK-3171	219	1139-57	SCU 44	Surface	DEB	Glass Buttes 7	2.6 ± 0.1	NM ± NM	--
35-LK-3171	220	1139-58	SCU 10	Surface	DEB	Glass Buttes 5	6.1 ± 0.1	NM ± NM	--
35-LK-3171	221	1139-59	SCU 39	Surface	DEB	Glass Buttes 7	2.1 ± 0.1	NM ± NM	BEV
35-HA-80	222	1139-14	SCU 18	Surface	DEB	Glass Buttes 7	2.3 ± 0.1	NM ± NM	--
35-HA-80	223	1139-24	SCU 40	Surface	DEB	Glass Buttes 3	3.2 ± 0.1	NM ± NM	--
35-HA-80	224	1139-38	SP 2	50-60	DEB	Glass Buttes 4 *	6.1 ± 0.1	NM ± NM	--
35-HA-80	225	1139-39	SP 1	20-30	DEB	Glass Buttes 4	5.5 ± 0.1	NM ± NM	--

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Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims Rim 1	Hydration Rims Rim 2	Comments[B]
35-HA-80	226	1139-40	SP 1	0-10	DEB	Glass Buttes 4	5.4 ± 0.1	NM ± NM	--
35-HA-80	227	1139-41	SCU 1	Surface	DEB	Glass Buttes 4	4.5 ± 0.1	NM ± NM	--
35-HA-80	228	1139-42	SCU 2	Surface	DEB	Glass Buttes 4	5.0 ± 0.1	NM ± NM	--
35-HA-80	229	1139-43	SCU 2	Surface	DEB	Glass Buttes 4	6.4 ± 0.1	NM ± NM	--
35-HA-80	230	1139-44	SCU 5	Surface	DEB	Glass Buttes 5	4.3 ± 0.1	NM ± NM	--
35-HA-80	231	1139-45	SCU 5	Surface	DEB	Glass Buttes 7	3.7 ± 0.1	NM ± NM	--
35-HA-80	232	1139-46	SCU 11	Surface	DEB	Glass Buttes 4	6.4 ± 0.1	NM ± NM	--
35-HA-80	233	1139-47	SCU 19	Surface	DEB	Glass Buttes 4	6.0 ± 0.1	NM ± NM	--
35-HA-80	234	1139-48	SCU 22	Surface	DEB	Glass Buttes 5	6.1 ± 0.1	NM ± NM	--
35-HA-80	235	1139-49	SCU 35	Surface	DEB	Glass Buttes 4	3.6 ± 0.1	NM ± NM	--
35-HA-80	236	1139-50	SCU 35	Surface	DEB	Glass Buttes 4	2.6 ± 0.1	NM ± NM	Same rim on BRE
35-HA-80	237	1139-51	SCU 42	Surface	DEB	Glass Buttes 4	3.5 ± 0.1	NM ± NM	--
35-HA-80	238	1139-52	SCU 48	Surface	DEB	Glass Buttes 6	3.9 ± 0.1	NM ± NM	--
35-HA-80	239	1139-53	SCU 7	Surface	DEB	Glass Buttes 3	4.4 ± 0.1	NM ± NM	--
35-HA-80	240	1139-54	SCU 6	Surface	DEB	Glass Buttes 5	2.4 ± 0.1	NM ± NM	Same rim on BRE
35-HA-80	241	1139-55	SCU 6	Surface	DEB	Glass Buttes 5	3.9 ± 0.1	NM ± NM	--
35-HA-2875	242	1139-1	SCU 2	Surface	DEB	Glass Buttes 3	6.0 ± 0.1	NM ± NM	--
35-HA-2875	243	1139-2	SCU 5	Surface	DEB	Glass Buttes 9	6.2 ± 0.1	NM ± NM	--
35-HA-2875	244	1139-3	SCU 7	Surface	DEB	Glass Buttes 4 *	8.1 ± 0.1	NM ± NM	--
35-HA-2875	245	1139-4	SCU 8	Surface	DEB	Quartz Mountain? *	7.1 ± 0.1	NM ± NM	--
35-HA-2875	246	1139-6	SCU 10	Surface	DEB	Glass Buttes 4	7.3 ± 0.1	NM ± NM	--
35-HA-2875	247	1139-7	SCU 11	Surface	DEB	Glass Buttes 4	5.5 ± 0.1	NM ± NM	--
35-HA-2875	248	1139-8	SCU 12	Surface	DEB	Glass Buttes 4	7.4 ± 0.1	2.1 ± 0.1	--
35-HA-2875	249	1139-12	SCU 21	Surface	DEB	Glass Buttes 4	6.4 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2875	250	1139-13	SCU 27	Surface	EMP	Glass Buttes 3	4.9 ± 0.1	NM ± NM	--

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35-HA-2875	251	1139-14	SCP 1	Surface	EMP	Glass Buttes 4	5.7 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2875	252	1139-15	SP 1	0-10	DEB	Glass Buttes 4	5.8 ± 0.1	NM ± NM	BEV
35-HA-2875	253	1139-22	SCU 8	Surface	DEB	Glass Buttes 4	7.2 ± 0.1	NM ± NM	--
35-HA-2875	254	1139-23	SCU 10	Surface	DEB	Glass Buttes 4 *	7.2 ± 0.1	3.7 ± 0.1	Smaller rim on BRE
35-HA-2875	255	1139-24	SCU 12	Surface	DEB	Glass Buttes 4	7.1 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2875	256	1139-25	SCU 12	Surface	DEB	Glass Buttes 4	6.4 ± 0.1	NM ± NM	--
35-HA-2875	257	1139-26	SCU 13	Surface	DEB	Glass Buttes 4	5.9 ± 0.1	NM ± NM	--
35-HA-2880	258	1139-1	SCU 2	Surface	DEB	Upper Gap Lake	5.3 ± 0.1	NM ± NM	--
35-HA-2880	259	1139-9	SCU 2	Surface	DEB	Upper Gap Lake	3.5 ± 0.1	NM ± NM	--
35-HA-2880	260	1139-15	SCU 53	Surface	DEB	Glass Buttes 1	NA ± NA	NM ± NM	NVH
35-HA-2880	261	1139-16	SCU 62	Surface	DEB	Upper Gap Lake	5.1 ± 0.1	NM ± NM	--
35-HA-2880	262	1139-18	SCU 68	Surface	DEB	Palamino Buttes A	6.1 ± 0.1	NM ± NM	PAT
35-HA-2880	263	1139-20	SCU 77	Surface	DEB	Squaw Mountain	7.3 ± 0.1	NM ± NM	--
35-HA-2880	264	1139-22	SCU 82	Surface	DEB	Glass Buttes 4	5.9 ± 0.1	NM ± NM	--
35-HA-2880	265	1139-24	SCU 90	Surface	EMP	Buck Spring	8.9 ± 0.1	NM ± NM	--
35-HA-2880	266	1139-26	SCU 99	Surface	DEB	Glass Buttes 4	6.2 ± 0.1	NM ± NM	--
35-HA-2880	267	1139-28	SCP 1	Surface	EMP	Rimrock Spring	6.0 ± 0.1	NM ± NM	--
35-HA-2880	268	1139-29	SCP 2	Surface	SCR	Beatys Butte	5.0 ± 0.1	NM ± NM	--
35-HA-2880	269	1139-30	SCP 3	Surface	SCR	Big Stick	7.1 ± 0.1	NM ± NM	--
35-HA-2880	270	1139-31	SCP 4	Surface	BIF	Glass Buttes 3	5.7 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2880	271	1139-36	SP 1	30-40	BIF	Tank Creek	6.6 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2880	272	1139-40	SCU 17	Surface	DEB	Squaw Mountain	5.9 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2880	273	1139-41	SCU 17	Surface	DEB	Big Stick	5.1 ± 0.1	NM ± NM	--
35-HA-2880	274	1139-42	SCU 18	Surface	DEB	Upper Gap Lake	NA ± NA	NM ± NM	NVH; REC
35-HA-2880	275	1139-43	SCU 29	Surface	DEB	Glass Buttes 4	7.9 ± 0.1	NM ± NM	Same rim on BRE

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35-HA-2880	276	1139-44	SCU 51	Surface	DEB	Glass Buttes 4	6.8 ± 0.1	NM ± NM	--
35-HA-2880	277	1139-45	SCU 53	Surface	DEB	Chickahominy	8.3 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2876	278	1139-32	SCP1	Surface	BIF	Glass Buttes 4	5.8 ± 0.1	NM ± NM	--
35-HA-2876	279	1139-33	SCP 2	Surface	BIF	Glass Buttes 4	5.7 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2876	280	1139-34	SCP 3	Surface	BIF	Glass Buttes 4	5.7 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2876	281	1139-35	MCP 1	Surface	BIF	Glass Buttes 4	5.7 ± 0.1	NM ± NM	--
35-HA-2876	282	1139-39	SCU 3	Surface	DEB	Glass Buttes 4	6.4 ± 0.1	4.6 ± 0.1	Smaller rim on BRE
35-HA-2876	283	1139-40	SCU 6	Surface	DEB	Glass Buttes 4	3.7 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2876	284	1139-41	SCU 7	Surface	DEB	Glass Buttes 4	6.2 ± 0.1	NM ± NM	--
35-HA-2876	285	1139-42	SCU 7	Surface	DEB	Glass Buttes 1	8.0 ± 0.1	NM ± NM	--
35-HA-2876	286	1139-43	SP 1	20-30	DEB	Glass Buttes 4	5.4 ± 0.0	NM ± NM	--
35-HA-2876	287	1139-44	SP 1	0-10	DEB	Glass Buttes 4	7.3 ± 0.1	4.1 ± 0.1	--
35-HA-2876	288	1139-45	SCU 13	Surface	DEB	Glass Buttes 4	7.2 ± 0.1	NM ± NM	--
35-HA-2876	289	1139-46	SCU 16	Surface	DEB	Glass Buttes 4	6.4 ± 0.1	NM ± NM	--
35-HA-2876	290	1139-47	SCU 19	Surface	DEB	Glass Buttes 4	7.7 ± 0.1	NM ± NM	--
35-HA-2876	291	1139-48	SCU 19	Surface	DEB	Glass Buttes 4	5.6 ± 0.1	52.3 ± 0.2	Larger rim is cortex
35-HA-2876	292	1139-49	SCU 23	Surface	DEB	Glass Buttes 4	5.7 ± 0.1	NM ± NM	--
35-HA-2876	293	1139-50	SCU 23	Surface	DEB	Glass Buttes 4	5.4 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2876	294	1139-51	SCU 30	Surface	DEB	Glass Buttes 4	3.9 ± 0.1	NM ± NM	REC
35-HA-2876	295	1139-52	SCU 28	Surface	DEB	Glass Buttes 4	3.9 ± 0.1	NM ± NM	--
35-HA-2876	296	1139-53	SCU 28	Surface	DEB	Glass Buttes 4	4.2 ± 0.1	NM ± NM	--
35-HA-2876	297	1139-54	SCU 22	Surface	DEB	Glass Buttes 4	6.3 ± 0.1	NM ± NM	--
35-HA-2877	298	1139-2	SCU 3	Surface	DEB	Glass Buttes 4	6.9 ± 0.1	NM ± NM	--
35-HA-2877	299	1139-3	SCU 4	Surface	DEB	Glass Buttes 4	5.4 ± 0.1	NM ± NM	--
35-HA-2877	300	1139-4	SCU 4	Surface	EMP	Glass Buttes 4	7.0 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims Rim 1	Hydration Rims Rim 2	Comments[B]
35-HA-2877	301	1139-6	SCU 6	Surface	DEB	Glass Buttes 4	6.4 ± 0.1	NM ± NM	--
35-HA-2877	302	1139-7	SCU 8	Surface	DEB	Glass Buttes 4	6.4 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2877	303	1139-10	SCU 17	Surface	DEB	Glass Buttes 4	5.7 ± 0.1	NM ± NM	--
35-HA-2877	304	1139-11	SCU 18	Surface	DEB	Glass Buttes 4	5.0 ± 0.1	NM ± NM	--
35-HA-2877	305	1139-14	SCU 23	Surface	DEB	Glass Buttes 4	5.8 ± 0.1	NM ± NM	--
35-HA-2877	306	1139-16	SCU 26	Surface	DEB	Glass Buttes 4	5.5 ± 0.1	NM ± NM	--
35-HA-2877	307	1139-18	SCP 1	Surface	EMP	Glass Buttes 4	7.0 ± 0.1	NM ± NM	REC
35-HA-2877	308	1139-19	SCP 2	Surface	PPT	Glass Buttes 3	7.3 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2877	309	1139-23	SP 2	0-10	DEB	Glass Buttes 4	5.3 ± 0.1	NM ± NM	--
35-HA-2877	310	1139-30	SP 1	30-40	DEB	Glass Buttes 4	4.8 ± 0.1	NM ± NM	--
35-HA-2877	311	1139-31	SP 2	0-10	DEB	Glass Buttes 4	7.0 ± 0.1	NM ± NM	--
35-HA-2877	312	1139-32	SP 2	0-10	DEB	Glass Buttes 4	4.8 ± 0.1	NM ± NM	--
35-HA-2877	313	1139-33	SCU 3	Surface	DEB	Glass Buttes 4	7.5 ± 0.1	NM ± NM	--
35-HA-2877	314	1139-34	SCU 4	Surface	DEB	Glass Buttes 9	7.1 ± 0.1	2.1 ± 0.1	Smaller rim on BRE
35-HA-2877	315	1139-35	SP 1	30-40	DEB	Glass Buttes 4	4.9 ± 0.1	NM ± NM	--
35-HA-2877	316	1139-36	SP 2	40-50	DEB	Glass Buttes 4	5.2 ± 0.1	NM ± NM	--
35-HA-2877	317	1139-38	SCU 17	Surface	DEB	Glass Buttes 4	6.1 ± 0.1	NM ± NM	--
35-HA-2878	318	1139-1	SCP 1	Surface	DEB	Glass Buttes 4	6.0 ± 0.1	NM ± NM	--
35-HA-2878	319	1139-2	SCP 2	Surface	DEB	Glass Buttes 4	6.4 ± 0.1	NM ± NM	--
35-HA-2878	320	1139-4	SCP 4	Surface	DEB	Glass Buttes 4	5.5 ± 0.1	NM ± NM	--
35-HA-2878	321	1139-5	SCP 5	Surface	DEB	Glass Buttes 4	5.1 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2878	322	1139-6	SCP 6	Surface	DEB	Glass Buttes 4	5.2 ± 0.1	2.8 ± 0.1	Smaller rim on dorsal surface
35-HA-2878	323	1139-7	SCP 7	Surface	DEB	Glass Buttes 4	5.9 ± 0.1	NM ± NM	--
35-HA-2878	324	1139-11	SCU 4	Surface	DEB	Glass Buttes 4	4.6 ± 0.1	NM ± NM	--
35-HA-2878	325	1139-33	SP 2	0-10	DEB	Glass Buttes 4	5.7 ± 0.1	NM ± NM	REC

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Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims Rim 1	Hydration Rims Rim 2	Comments[B]
35-HA-2878	326	1139-34	SP 1	40-50	EMP	China Lake	6.0 ± 0.1	NM ± NM	--
35-HA-2878	327	1139-35	SP 1	40-50	DEB	China Lake	5.8 ± 0.0	NM ± NM	--
35-HA-2878	328	1139-36	SCU 3	Surface	DEB	Glass Buttes 4	4.1 ± 0.1	NM ± NM	--
35-HA-2878	329	1139-37	SCU 7	Surface	DEB	Glass Buttes 4	5.1 ± 0.1	NM ± NM	--
35-HA-2878	330	1139-38	SCU 7	Surface	DEB	Glass Buttes 4	5.1 ± 0.0	NM ± NM	--
35-HA-2878	331	1139-39	SCU 9	Surface	DEB	Glass Buttes 4	4.1 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2878	332	1139-40	SCU 9	Surface	DEB	Glass Buttes 4	5.1 ± 0.1	NM ± NM	NVH on BRE
35-HA-2878	333	1139-41	SCU 11	Surface	DEB	Glass Buttes 4	4.3 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2878	334	1139-42	SCU 11	Surface	DEB	Glass Buttes 4	5.7 ± 0.1	NM ± NM	--
35-HA-2878	335	1139-43	SCU 15	Surface	DEB	Glass Buttes 4	5.4 ± 0.1	NM ± NM	--
35-HA-2878	336	1139-44	SCU 17	Surface	DEB	Glass Buttes 4	5.3 ± 0.1	NM ± NM	--
35-HA-2878	337	1139-45	SCU 19	Surface	DEB	Glass Buttes 4	5.1 ± 0.1	NM ± NM	--
35-HA-2879	338	1139-1	SCU 5	Surface	DEB	Glass Buttes 4	NA ± NA	NM ± NM	NVH; REC
35-HA-2879	339	1139-2	SCU 7	Surface	DEB	Tank Creek	4.1 ± 0.1	NM ± NM	--
35-HA-2879	340	1139-4	SCU 9	Surface	DEB	Glass Buttes 7	2.3 ± 0.1	NM ± NM	--
35-HA-2879	341	1139-5	SCU 10	Surface	DEB	Glass Buttes 4	4.8 ± 0.1	NM ± NM	--
35-HA-2879	342	1139-7	SCU 14	Surface	DEB	Glass Buttes 4	4.1 ± 0.1	NM ± NM	--
35-HA-2879	343	1139-8	SCU 15	Surface	DEB	Glass Buttes 4	4.3 ± 0.1	NM ± NM	REC
35-HA-2879	344	1139-11	SCU 22	Surface	DEB	Glass Buttes 4	6.0 ± 0.1	2.6 ± 0.1	Smaller rim on ventral surface
35-HA-2879	345	1139-12	SCP 1	Surface	BIF	Glass Buttes 4	4.4 ± 0.1	NM ± NM	--
35-HA-2879	346	1139-13	SP 1	0-10	DEB	Glass Buttes 5	3.5 ± 0.1	NM ± NM	--
35-HA-2879	347	1139-15	SP 2	10-20	DEB	Glass Buttes 4	4.1 ± 0.1	NM ± NM	--
35-HA-2879	348	1139-20	SP 2	20-30	DEB	Glass Buttes 4	3.9 ± 0.1	NM ± NM	--
35-HA-2879	349	1139-21	SP 2	40-50	DEB	Glass Buttes 4	3.6 ± 0.0	NM ± NM	--
35-HA-2879	350	1139-22	SCU 10	Surface	DEB	Glass Buttes 4	3.5 ± 0.1	NM ± NM	--

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Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-HA-2879	351	1139-23	SCU 8	Surface	DEB	Glass Buttes 4	3.7 ± 0.1	NM ± NM	--
35-HA-2879	352	1139-24	SCU 8	Surface	DEB	Glass Buttes 4	3.9 ± 0.1	NM ± NM	--
35-HA-2879	353	1139-25	SCU 8	Surface	DEB	Glass Buttes 4	4.6 ± 0.1	NM ± NM	--
35-HA-2879	354	1139-26	SCU 8	Surface	DEB	Glass Buttes 4	4.4 ± 0.1	NM ± NM	--
35-HA-2879	355	1139-27	SCU 8	Surface	DEB	Glass Buttes 4	3.7 ± 0.1	NM ± NM	--
35-HA-2879	356	1139-28	SCU 8	Surface	DEB	Glass Buttes 3	3.8 ± 0.1	NM ± NM	--
35-HA-2879	357	1139-29	SCU 13	Surface	DEB	Glass Buttes 4	4.3 ± 0.0	NM ± NM	--
35-HA-2899	358	1139-1	SCP 1	Surface	BIF	Burns	7.9 ± 0.1	3.0 ± 0.1	--
35-HA-2899	359	1139-4	SCP 4	Surface	COR	Burns	5.7 ± 0.1	NM ± NM	--
35-HA-2899	360	1139-5	SCP 5	Surface	BIF	Rimrock Spring	7.2 ± 0.1	NM ± NM	--
35-HA-2899	361	1139-6	SCP 6	Surface	BIF	Burns	4.9 ± 0.1	NM ± NM	--
35-HA-2899	362	1139-10	SCP 10	0-10	BIF	Mud Ridge	8.2 ± 0.1	NM ± NM	--
35-HA-2899	363	1139-12	SCP 12	Surface	PPT	Burns	4.6 ± 0.1	NM ± NM	NVH on BRE
35-HA-2899	364	1139-13	SCP 13	Surface	EMP	Burns	5.7 ± 0.1	NM ± NM	--
35-HA-2899	365	1139-14	SCP 14	Surface	PPT	Burns	8.0 ± 0.1	NM ± NM	--
35-HA-2899	366	1139-15	MCP 1	Surface	BIF	Burns	7.5 ± 0.1	NM ± NM	--
35-HA-2899	367	1139-17	MCP 3	Surface	BIF	Mud Ridge	5.0 ± 0.1	NM ± NM	--
35-HA-2899	368	1139-27	SP 5	0-10	DEB	Burns	6.6 ± 0.1	NM ± NM	--
35-HA-2899	369	1139-31	SP 6	0-10	COR	Mud Ridge	4.6 ± 0.1	NM ± NM	--
35-HA-2899	370	1139-33	SP 6	10-20	COR	Burns	4.6 ± 0.1	NM ± NM	--
35-HA-2899	371	1139-34	SP 6	10-20	BIF	Rimrock Spring	4.0 ± 0.1	NM ± NM	--
35-HA-2899	372	1139-36	SCU 103	Surface	DEB	Mud Ridge	9.1 ± 0.1	NM ± NM	--
35-HA-2899	373	1139-37	SCU 87	Surface	EMP	Burns	7.2 ± 0.1	NM ± NM	--
35-HA-2899	374	1139-38	SCU 79	Surface	DEB	Rimrock Spring	7.0 ± 0.1	NM ± NM	NVH on modified edge
35-HA-2899	375	1139-39	SCU 68	Surface	DEB	Buck Spring	3.0 ± 0.1	NM ± NM	REC

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	Specimen				Artifact		Hydration Rims		
Site	No.	Catalog No.	Unit	Depth	Type[A]	Artifact Source	Rim 1	Rim 2	Comments[B]
35-HA-2899	376	1139-40	SCU 139	Surface	EMP	Mud Ridge	7.5 ± 0.1	NM ± NM	--
35-HA-2899	377	1139-41	SCU 131	Surface	DEB	Burns	6.2 ± 0.1	NM ± NM	--
35-HA-2901	378	1139-36	SCU 30	Surface	DEB	Burns	6.2 ± 0.1	NM ± NM	--
35-HA-2901	379	1139-46	SCP 1	Surface	BIF	Burns	5.4 ± 0.0	NM ± NM	--
35-HA-2901	380	1139-47	SCP 2	Surface	BIF	Squaw Mountain	6.8 ± 0.1	NM ± NM	--
35-HA-2901	381	1139-48	SCP 3	Surface	EMP	Burns	6.3 ± 0.1	NM ± NM	--
35-HA-2901	382	1139-50	SCP 5	Surface	EMP	Burns	6.3 ± 0.1	NM ± NM	--
35-HA-2901	383	1139-51	SCP 6	Surface	PPT	Dog Hill	6.2 ± 0.1	NM ± NM	NVH on BRE
35-HA-2901	384	1139-52	SCP 7	Surface	EMP	Burns	5.4 ± 0.1	NM ± NM	--
35-HA-2901	385	1139-54	SCP 9	Surface	BIF	Dog Hill	5.7 ± 0.1	NM ± NM	--
35-HA-2901	386	1139-55	SCP 10	Surface	EMP	Burns	6.2 ± 0.1	NM ± NM	--
35-HA-2901	387	1139-56	SCP 11	Surface	EMP	Burns	5.3 ± 0.1	NM ± NM	NVH on ventral surface
35-HA-2901	388	1139-58	SCP 13	Surface	COR	Burns	5.9 ± 0.1	NM ± NM	--
35-HA-2901	389	1139-59	SCP 14	Surface	BIF	Burns	5.7 ± 0.1	NM ± NM	--
35-HA-2901	390	1139-60	MCP 1	Surface	EMP	Burns	6.6 ± 0.1	NM ± NM	--
35-HA-2901	391	1139-61	SCU 4	Surface	DEB	Burns	6.1 ± 0.1	NM ± NM	--
35-HA-2901	392	1139-62	SCU 10	Surface	EMP	Burns	7.1 ± 0.1	NM ± NM	--
35-HA-2901	393	1139-63	SCU 10	Surface	DEB	Burns	5.9 ± 0.1	NM ± NM	--
35-HA-2901	394	1139-64	SCU 12	Surface	BIF	Burns	6.8 ± 0.1	4.3 ± 0.0	--
35-HA-2901	395	1139-65	SCU 12	Surface	DEB	Burns	5.4 ± 0.1	NM ± NM	NVH on BRE
35-HA-2901	396	1139-66	SCU 16	Surface	DEB	Burns	6.1 ± 0.1	NM ± NM	--
35-HA-2901	397	1139-67	SCU 17	Surface	DEB	Burns	6.2 ± 0.1	NM ± NM	--
35-HA-2893	398	1139-1	SCP 1	Surface	PPT	Burns	5.7 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2893	399	1139-2	SCP 2	Surface	BIF	Buck Spring	7.9 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2893	400	1139-3	SCP 3	Surface	PPT	Buck Spring	5.7 ± 0.1	NM ± NM	Same rim on BRE

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Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-HA-2893	401	1139-4	SCP 4	Surface	EMP	Riley	4.4 ± 0.1	NM ± NM	--
35-HA-2893	402	1139-5	SCP 5	Surface	BIF	Buck Spring	9.0 ± 0.0	3.6 ± 0.0	Smaller rim on dorsal surface
35-HA-2893	403	1139-7	SCP 7	Surface	BIF	Buck Spring	3.7 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2893	404	1139-8	SCP 8	Surface	BIF	Buck Spring	3.7 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2893	405	1139-10	SCP 10	Surface	EMP	Buck Spring	6.1 ± 0.1	4.5 ± 0.0	Smaller rim on dorsal surface
35-HA-2893	406	1139-11	SCP 11	Surface	BIF	Buck Spring	5.9 ± 0.1	2.8 ± 0.1	Smaller rim on dorsal surface
35-HA-2893	407	1139-12	SCP 12	Surface	PPT	Riley	3.9 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2893	408	1139-14	MCP 1	Surface	BIF	Burns	5.3 ± 0.1	NM ± NM	--
35-HA-2893	409	1139-15	SCP 2	Surface	EMP	Buck Spring	1.9 ± 0.1	NM ± NM	--
35-HA-2893	410	1139-17	MCP 4	Surface	BIF	Buck Spring	6.1 ± 0.1	NM ± NM	--
35-HA-2893	411	1139-20	SCU 2	Surface	BIF	Double O	3.7 ± 0.1	NM ± NM	--
35-HA-2893	412	1139-21	SCU 2	Surface	DEB	Buck Spring	5.3 ± 0.1	1.7 ± 0.1	Smaller rim on dorsal surface
35-HA-2893	413	1139-30	SCU 12	Surface	DEB	Buck Spring	3.6 ± 0.0	NM ± NM	--
35-HA-2893	414	1139-35	SCU 19	Surface	DEB	Buck Spring	4.1 ± 0.1	NM ± NM	--
35-HA-2893	415	1139-39	SCU 22	Surface	BIF	Buck Spring	3.7 ± 0.1	NM ± NM	BEV
35-HA-2893	416	1139-40	SCU 22	Surface	DEB	Buck Spring	7.3 ± 0.1	NM ± NM	--
35-HA-2893	417	1139-69	SCU 85	Surface	EMP	Buck Spring	7.3 ± 0.1	NM ± NM	REC; NVH on modified edge
35-HA-2904	418	1139-1	SCU 2	Surface	DEB	Burns	8.1 ± 0.1	NM ± NM	--
35-HA-2904	419	1139-19	SCU 8	Surface	EMP	Burns	6.1 ± 0.1	NM ± NM	--
35-HA-2904	420	1139-32	SCU 18	Surface	EMP	Burns	5.2 ± 0.1	NM ± NM	--
35-HA-2904	421	1139-53	SCU 55	Surface	EMP	Chickahominy	5.8 ± 0.1	NM ± NM	--
35-HA-2904	422	1139-61	SCU 64	Surface	EMP	Rimrock Spring	2.8 ± 0.1	NM ± NM	--
35-HA-2904	423	1139-65	SCP 1	Surface	PPT	Whitewater Ridge	5.1 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2904	424	1139-66	SCP 2	Surface	PPT	Burns	7.3 ± 0.1	NM ± NM	--
35-HA-2904	425	1139-68	SCP 4	Surface	PPT	Rimrock Spring	3.2 ± 0.1	NM ± NM	Same rim on BRE

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Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-HA-2904	426	1139-70	MCP 1	Surface	BIF	Burns	4.4 ± 0.1	NM ± NM	--
35-HA-2904	427	1139-71	MCP 2	Surface	BIF	Burns	6.1 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2904	428	1139-72	SCU 6	Surface	DEB	Burns	4.0 ± 0.0	NM ± NM	--
35-HA-2904	429	1139-73	SCU 6	Surface	DEB	Burns	5.7 ± 0.1	NM ± NM	--
35-HA-2904	430	1139-74	SCU 6	Surface	DEB	Burns	5.0 ± 0.1	NM ± NM	--
35-HA-2904	431	1139-75	SCU 70	Surface	DEB	Dog Hill	3.5 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2904	432	1139-76	SCU 57	Surface	DEB	Burns	3.3 ± 0.0	NM ± NM	Same rim on BRE
35-HA-2904	433	1139-77	SCU 46	Surface	EMP	Buck Spring	8.2 ± 0.1	5.5 ± 0.1	Smaller rim on modified surface
35-HA-2904	434	1139-78	SCU 43	Surface	DEB	Burns	7.3 ± 0.1	NM ± NM	--
35-HA-2904	435	1139-79	SCU 43	Surface	DEB	Burns	3.3 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2904	436	1139-80	SCU 16	Surface	DEB	Burns	4.9 ± 0.0	NM ± NM	NVH on BRE
35-HA-2904	437	1139-81	SCU 14	Surface	DEB	Burns	4.8 ± 0.1	NM ± NM	--
35-HA-2906	438	1139-58	SCU 58	Surface	DEB	Burns	2.6 ± 0.1	NM ± NM	--
35-HA-2906	439	1139-65	SCP 1	Surface	BIF	Burns	5.5 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2906	440	1139-66	SCP 2	Surface	BIF	Tule Spring	2.4 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2906	441	1139-67	SCP 3	Surface	PPT	Gregory Creek	3.2 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2906	442	1139-68	SCP 4	Surface	PPT	Whitewater Ridge	4.0 ± 0.1	NM ± NM	--
35-HA-2906	443	1139-74	MCP 2	Surface	COR	Burns	4.4 ± 0.1	NM ± NM	--
35-HA-2906	444	1139-71	SCP 7	Surface	BIF	Burns	4.9 ± 0.1	NM ± NM	--
35-HA-2906	445	1139-73	MCP 1	40-50	EMP	Burns	6.4 ± 0.1	NM ± NM	--
35-HA-2906	446	1139-75	MCP 3	Surface	BIF	Burns	4.9 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2906	447	1139-76	MCP 4	Surface	BIF	Dog Hill	5.0 ± 0.1	NM ± NM	--
35-HA-2906	448	1139-78	MCP 6	Surface	PPT	Burns	4.2 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2906	449	1139-80	SCU 60	Surface	DEB	Burns	6.4 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2906	450	1139-81	SCU 68	Surface	DEB	Burns	7.1 ± 0.1	NM ± NM	--

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NA = Not Available; NM = Not Measured; * = Small sample

Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-HA-2906	451	1139-82	SCU 80	Surface	DEB	Dog Hill	6.2 ± 0.1	NM ± NM	--
35-HA-2906	452	1139-83	SCU 74	Surface	DEB	Burns	5.0 ± 0.1	NM ± NM	--
35-HA-2906	453	1139-84	SCU 121	Surface	UFT	Burns	6.4 ± 0.1	NM ± NM	REC
35-HA-2906	454	1139-85	SCU 76	Surface	DEB	Burns	2.3 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2906	455	1139-86	SCU 76	Surface	DEB	Burns	7.1 ± 0.1	NM ± NM	--
35-HA-2906	456	1139-87	SCU 58	Surface	DEB	Burns	6.8 ± 0.1	NM ± NM	DFV
35-HA-2906	457	1139-89	SCU 100	Surface	DEB	Burns	4.4 ± 0.1	NM ± NM	--
35-HA-2913	458	1139-1	SCU 1	Surface	DEB	Wolf Creek	4.0 ± 0.1	NM ± NM	--
35-HA-2913	459	1139-2	SCU 3	Surface	DEB	Van Gulch	5.0 ± 0.1	NM ± NM	--
35-HA-2913	460	1139-3	SCU 10	Surface	DEB	Wolf Creek	4.6 ± 0.1	NM ± NM	--
35-HA-2913	461	1139-4	SCU 12	Surface	DEB	Unknown 2	NA ± NA	NM ± NM	REC; UNR
35-HA-2913	462	1139-8	SCP 1	Surface	PPT	Gregory Creek	3.0 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2913	463	1139-9	SCP 2	Surface	PPT	Wolf Creek	4.3 ± 0.0	NM ± NM	Same rim on BRE
35-HA-2913	464	1139-11	SCP 4	Surface	BIF	Gregory Creek	3.7 ± 0.1	NM ± NM	NVH on BRE
35-HA-2913	465	1139-12	SCP 5	Surface	DEB	Wolf Creek	7.0 ± 0.0	NM ± NM	--
35-HA-2913	466	1139-14	SP 1	0-10	DEB	Wolf Creek	3.9 ± 0.1	NM ± NM	--
35-HA-2913	467	1139-16	SCU 1	Surface	DEB	Wolf Creek	3.6 ± 0.0	NM ± NM	--
35-ML-978	468	1139-15	SCU 18	Surface	DEB	Gregory Creek	3.7 ± 0.1	NM ± NM	--
35-ML-978	469	1139-31	SCU 35	Surface	DEB	Gregory Creek	4.1 ± 0.1	NM ± NM	--
35-ML-978	470	1139-35	SCU 39	Surface	DEB	Gregory Creek	5.1 ± 0.1	NM ± NM	NVH on modified edge
35-ML-978	471	1139-36	SCP 1	Surface	PPT	Gregory Creek	4.2 ± 0.1	NM ± NM	Same rim on BRE
35-ML-978	472	1139-38	SCP 3	Surface	PPT	Gregory Creek	2.5 ± 0.1	NM ± NM	Same rim on BRE
35-ML-978	473	1139-39	SCP 4	Surface	PPT	Skull Springs	6.1 ± 0.1	NM ± NM	OPA; same rim on BRE
35-ML-978	474	1139-55	SP 2	0-10	DEB	Gregory Creek	3.9 ± 0.1	NM ± NM	--
35-ML-978	475	1139-56	SP 1	20-30	DEB	Venator	3.9 ± 0.1	NM ± NM	--

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Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-ML-978	476	1139-57	SCU 14	Surface	DEB	Coyote Wells	6.2 ± 0.1	NM ± NM	--
35-ML-978	477	1139-58	SCU 14	Surface	DEB	Gregory Creek	3.9 ± 0.1	NM ± NM	--
35-ML-978	478	1139-59	SCU 14	Surface	DEB	Coyote Wells	6.3 ± 0.1	NM ± NM	--
35-ML-978	479	1139-60	SCU 30	Surface	BIF	Gregory Creek	4.6 ± 0.1	NM ± NM	--
35-ML-978	480	1139-61	SCU 30	Surface	DEB	Gregory Creek	4.4 ± 0.1	2.2 ± 0.0	--
35-ML-978	481	1139-62	SCU 30	Surface	DEB	Gregory Creek	4.5 ± 0.1	NM ± NM	--
35-ML-978	482	1139-63	SCU 20	Surface	DEB	Gregory Creek	3.3 ± 0.1	NM ± NM	--
35-ML-978	483	1139-64	SCU 20	Surface	DEB	Coyote Wells	NA ± NA	NM ± NM	NVH
35-ML-978	484	1139-65	SCU 33	Surface	DEB	Gregory Creek	4.6 ± 0.1	NM ± NM	--
35-ML-978	485	1139-66	SCU 33	Surface	DEB	Gregory Creek	3.9 ± 0.1	NM ± NM	--
35-ML-978	486	1139-67	SCU 18	Surface	DEB	Gregory Creek	3.9 ± 0.1	NM ± NM	--
35-ML-978	487	1139-68	SCU 18	Surface	DEB	Gregory Creek	3.9 ± 0.1	NM ± NM	--
35-ML-974	488	1139-3	SCU 2	Surface	DEB	Gregory Creek	4.4 ± 0.1	NM ± NM	--
35-ML-974	489	1139-21	SCU 18	Surface	DEB	Gregory Creek	2.8 ± 0.1	4.6 ± 0.1	Smaller rim on dorsal surface
35-ML-974	490	1139-22	SCP 1	Surface	BIF	Wolf Creek	7.9 ± 0.1	NM ± NM	--
35-ML-974	491	1139-23	SCP 2	Surface	BIF	Gregory Creek	4.6 ± 0.1	NM ± NM	Same rim on BRE
35-ML-974	492	1139-25	SCP 4	Surface	BIF	Gregory Creek	4.6 ± 0.1	3.6 ± 0.0	Smaller rim on BRE
35-ML-974	493	1139-26	SCP 5	Surface	PPT	Gregory Creek	4.4 ± 0.1	NM ± NM	REC
35-ML-974	494	1139-27	SCP 6	Surface	DEB	Skull Springs	NA ± NA	NM ± NM	NVH
35-ML-974	495	1139-28	SCU 14	Surface	DEB	Gregory Creek	NA ± NA	NM ± NM	NVH
35-ML-974	496	1139-29	SCU 14	Surface	DEB	Gregory Creek	3.9 ± 0.1	NM ± NM	--
35-ML-974	497	1139-30	SCU 13	Surface	DEB	Gregory Creek	4.4 ± 0.1	NM ± NM	--
35-ML-974	498	1139-31	SCU 13	Surface	DEB	Gregory Creek	2.4 ± 0.1	NM ± NM	--
35-ML-974	499	1139-32	SCU 11	Surface	DEB	Gregory Creek	4.2 ± 0.1	NM ± NM	DFV
35-ML-974	500	1139-33	SCU 11	Surface	DEB	Gregory Creek	3.9 ± 0.1	NM ± NM	--

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Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

							Hydration Rims		
Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type [A]	Artifact Source	Rim 1	Rim 2	Comments [B]
35-ML-974	501	1139-34	SCU 11	Surface	DEB	Gregory Creek	3.9 ± 0.1	NM ± NM	--
35-ML-974	502	1139-35	SCU 8	Surface	DEB	Gregory Creek	3.9 ± 0.1	NM ± NM	--
35-ML-974	503	1139-36	SCU 3	Surface	DEB	Gregory Creek	4.2 ± 0.1	NM ± NM	--
35-ML-974	504	1139-37	SCU 3	Surface	DEB	Gregory Creek	4.3 ± 0.1	NM ± NM	--
35-ML-974	505	1139-38	SCU 10	Surface	DEB	Gregory Creek	3.7 ± 0.1	NM ± NM	--
35-ML-974	506	1139-39	SCU 10	Surface	DEB	Gregory Creek	4.6 ± 0.1	NM ± NM	--
35-ML-974	507	1139-40	SCU 9	Surface	DEB	Gregory Creek	3.0 ± 0.1	NM ± NM	--
35-HA-70	508	1139-11	SCU 4	Surface	DEB	Curtis Creek	2.6 ± 0.1	NM ± NM	--
35-HA-70	509	1139-40	SCP 1	Surface	BIF	Van Gulch	3.9 ± 0.1	NM ± NM	--
35-HA-70	510	1139-41	SCP 2	Surface	PPT	Tank Creek	3.7 ± 0.1	NM ± NM	--
35-HA-70	511	1139-44	SCP 5	Surface	BIF	Tule Spring	3.4 ± 0.1	NM ± NM	--
35-HA-70	512	1139-45	SCP 6	Surface	PPT	Wolf Creek	3.9 ± 0.1	NM ± NM	--
35-HA-70	513	1139-46	SCP 7	Surface	BIF	Tule Spring	3.5 ± 0.1	NM ± NM	--
35-HA-70	514	1139-48	SCU 6	Surface	DEB	Tule Spring	3.7 ± 0.1	NM ± NM	--
35-HA-70	515	1139-49	SCU 6	Surface	DEB	Tule Spring	3.5 ± 0.1	NM ± NM	--
35-HA-70	516	1139-50	SCU 9	Surface	DEB	Tule Spring	3.7 ± 0.1	NM ± NM	--
35-HA-70	517	1139-51	SCU 9	Surface	DEB	Wolf Creek	3.9 ± 0.1	NM ± NM	--
35-HA-70	518	1139-52	SCU 8	Surface	DEB	Wolf Creek	3.7 ± 0.1	NM ± NM	--
35-HA-70	519	1139-53	SCU 7	Surface	DEB	Curtis Creek	2.6 ± 0.1	NM ± NM	--
35-HA-70	520	1139-54	SCU 7	Surface	DEB	Tule Spring	2.8 ± 0.1	NM ± NM	--
35-HA-70	521	1139-55	SCU 10	Surface	DEB	Tule Spring	3.1 ± 0.1	NM ± NM	--
35-HA-70	522	1139-56	SCU 10	Surface	DEB	Tule Spring	3.9 ± 0.1	NM ± NM	--
35-HA-70	523	1139-57	SCU 3	Surface	DEB	Tule Spring	3.6 ± 0.0	NM ± NM	--
35-HA-70	524	1139-58	SCU 3	Surface	DEB	Gregory Creek	1.7 ± 0.1	NM ± NM	--
35-HA-70	525	1139-59	SCU 2	Surface	DEB	Wolf Creek	3.7 ± 0.1	NM ± NM	--

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Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

	Specimen				Artifact		Hydration Rims		
Site	No.	Catalog No.	Unit	Depth	Type [A]	Artifact Source	Rim 1	Rim 2	Comments [B]
35-HA-70	526	1139-60	SCU 7	Surface	DEB	Tule Spring	9.0 ± 0.0	3.7 ± 0.1	Larger rim measurement is cortex
35-HA-70	527	1139-61	SCU 7	Surface	COR	Wolf Creek	3.7 ± 0.1	NM ± NM	--
35-HA-2885	528	1139-2	SCP 2	Surface	EMP	Chickahominy	6.1 ± 0.0	16.1 ± 0.1	Smaller rim on modified edge
35-HA-2885	529	1139-5	SCP 5	Surface	EMP	Chickahominy	5.5 ± 0.1	NM ± NM	--
35-HA-2885	530	1139-6	SCP 6	Surface	EMP	Chickahominy	NA ± NA	NM ± NM	NVH
35-HA-2885	531	1139-7	SCP 7	Surface	COR	Chickahominy	3.7 ± 0.1	NM ± NM	--
35-HA-2885	532	1139-8	SCP 8	Surface	PPT	Double O	4.4 ± 0.1	NM ± NM	NVH on BRE
35-HA-2885	533	1139-9	SCP 9	Surface	PPT	Chickahominy	7.0 ± 0.1	NM ± NM	NVH on BRE
35-HA-2885	534	1139-10	SCP 10	Surface	PPT	Double O	1.3 ± 0.1	4.4 ± 0.1	Smaller rim on BRE
35-HA-2885	535	1139-68	SCU 7	Surface	DEB	Chickahominy	8.1 ± 0.1	NM ± NM	REC; DFV
35-HA-2885	536	1139-69	SCU 16	Surface	DEB	Chickahominy	3.9 ± 0.1	NM ± NM	--
35-HA-2885	537	1139-70	SCU 32	Surface	DEB	Chickahominy	4.8 ± 0.1	NM ± NM	--
35-HA-2885	538	1139-71	SCU 75	Surface	DEB	Chickahominy	3.6 ± 0.1	NM ± NM	--
35-HA-2885	539	1139-72	SCU 135	Surface	DEB	Chickahominy	5.0 ± 0.1	NM ± NM	--
35-HA-2885	540	1139-73	SCU 80	Surface	DEB	Chickahominy	4.4 ± 0.1	NM ± NM	--
35-HA-2885	541	1139-74	SCU 163	Surface	DEB	Chickahominy	4.4 ± 0.1	NM ± NM	--
35-HA-2885	542	1139-75	SCU 148	Surface	DEB	Chickahominy	4.0 ± 0.1	NM ± NM	--
35-HA-2885	543	1139-76	SCU 189	Surface	EMP	Chickahominy	6.1 ± 0.0	NM ± NM	--
35-HA-2885	544	1139-77	SCU 206	Surface	DEB	Chickahominy	5.4 ± 0.0	NM ± NM	--
35-HA-2885	545	1139-78	SCU 244	Surface	DEB	Chickahominy	2.9 ± 0.0	NM ± NM	--
35-HA-2885	546	1139-79	SCU 224	Surface	DEB	Chickahominy	5.7 ± 0.1	NM ± NM	--
35-HA-2885	547	1139-80	SCU 263	Surface	DEB	Chickahominy	5.7 ± 0.1	NM ± NM	REC; DFV
35-ML-976	548	1139-1	SCU 1	Surface	DEB	Gregory Creek	NA ± NA	NM ± NM	NVH
35-ML-976	549	1139-2	SCU 2	Surface	EMP	Gregory Creek	2.8 ± 0.1	NM ± NM	--
35-ML-976	550	1139-4	SCU 6	Surface	DEB	Gregory Creek	3.7 ± 0.1	NM ± NM	DFV

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Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-ML-976	551	1139-5	SCU 7	Surface	DEB	Gregory Creek	3.0 ± 0.1	NM ± NM	--
35-ML-976	552	1139-8	SCU 8	Surface	DEB	Gregory Creek	3.1 ± 0.1	NM ± NM	--
35-ML-976	553	1139-9	SCP 1	Surface	EMP	Venator	NA ± NA	NM ± NM	UNR
35-ML-976	554	1139-30	SP 1	0-10	DEB	Gregory Creek	5.0 ± 0.1	NM ± NM	--
35-ML-976	555	1139-31	SCU 6	Surface	DEB	Gregory Creek	4.0 ± 0.0	NM ± NM	--
35-ML-976	556	1139-32	SP 2	0-10	DEB	Gregory Creek	4.0 ± 0.1	NM ± NM	--
35-ML-979	557	1139-10	SCU 6	Surface	DEB	Coyote Wells	5.9 ± 0.1	NM ± NM	--
35-ML-979	558	1139-30	SCU 24	Surface	DEB	Coyote Wells East	4.4 ± 0.1	NM ± NM	--
35-ML-979	559	1139-31	SCU 26	Surface	DEB	Coyote Wells *	3.8 ± 0.0	NM ± NM	--
35-ML-979	560	1139-40	SCU 47	Surface	DEB	Gregory Creek	3.5 ± 0.1	NM ± NM	--
35-ML-979	561	1139-43	SCU 51	Surface	DEB	Coyote Wells *	3.5 ± 0.1	NM ± NM	--
35-ML-979	562	1139-47	SCU 53	Surface	DEB	Venator	4.1 ± 0.1	NM ± NM	--
35-ML-979	563	1139-48	SCU 54	Surface	DEB	Gregory Creek	3.1 ± 0.0	NM ± NM	--
35-ML-979	564	1139-52	SCP 3	Surface	PPT	Gregory Creek *	3.6 ± 0.0	NM ± NM	--
35-ML-979	565	1139-55	SCP 6	Surface	EMP	Coyote Wells	6.1 ± 0.1	NM ± NM	--
35-ML-979	566	1139-60	SP 1	0-10	DEB	Gregory Creek	NA ± NA	NM ± NM	NVH
35-ML-979	567	1139-64	SCU 55	Surface	DEB	Gregory Creek	3.4 ± 0.1	NM ± NM	Same rim on BRE
35-ML-979	568	1139-65	SCU 49	Surface	DEB	Gregory Creek	3.5 ± 0.1	NM ± NM	--
35-ML-979	569	1139-66	SCU 7	Surface	DEB	Coyote Wells	3.7 ± 0.1	NM ± NM	--
35-ML-979	570	1139-67	SCU 7	Surface	DEB	Coyote Wells East	3.5 ± 0.1	NM ± NM	--
35-ML-979	571	1139-68	SCU 10	Surface	DEB	Coyote Wells?	NA ± NA	NM ± NM	OPA
35-ML-979	572	1139-69	SCU 6	Surface	DEB	Coyote Wells	5.1 ± 0.1	NM ± NM	--
35-ML-979	573	1139-70	SCU 8	Surface	DEB	Gregory Creek	3.3 ± 0.1	NM ± NM	--
35-ML-979	574	1139-71	SCU 9	Surface	DEB	Coyote Wells	6.8 ± 0.1	NM ± NM	OPA
35-ML-979	575	1139-72	SCU 51	Surface	DEB	Gregory Creek	5.1 ± 0.1	NM ± NM	--

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Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
							Rim 1	Rim 2	
35-ML-979	576	1139-76	SCU 1	Surface	DEB	Eldorado	5.1 ± 0.1	NM ± NM	REC
35-ML-981	577	1139-44	SP 2	0-10	DEB	Gregory Creek?	3.6 ± 0.1	NM ± NM	--
35-ML-982	578	1139-2	SCP 2	Surface	DEB	Gregory Creek	3.7 ± 0.1	NM ± NM	--
35-HA-2895	579	1139-6	SCP 6	Surface	BIF	Buck Spring	5.5 ± 0.1	NM ± NM	--
35-HA-2895	580	1139-9	SCP 9	Surface	EMP	Dog Hill	5.3 ± 0.1	2.3 ± 0.0	Smaller rim on modified edge
35-HA-2895	581	1139-10	SCP 10	Surface	BIF	Burns	7.0 ± 0.1	NM ± NM	--
35-HA-2895	582	1139-40	SCP 40	Surface	BIF	Buck Spring	7.3 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2895	583	1139-55	SCP 55	Surface	BIF	Buck Spring	7.3 ± 0.1	NM ± NM	--
35-HA-2895	584	1139-67	SCP 67	Surface	BIF	Buck Spring	8.4 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2895	585	1139-70	SCP 70	Surface	PPT	Big Stick	5.5 ± 0.1	NM ± NM	REC
35-HA-2895	586	1139-75	SCP 75	Surface	PPT	Buck Spring	5.5 ± 0.1	NM ± NM	--
35-HA-2895	587	1139-86	SCP 86	Surface	PPT	Whitewater Ridge	6.2 ± 0.1	NM ± NM	--
35-HA-2895	588	1139-96	SCP 96	Surface	BIF	Buck Spring	6.6 ± 0.1	NM ± NM	--
35-HA-2895	589	1139-106	SCP 106	Surface	BIF	Buck Spring	7.1 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2895	590	1139-109	SCP 109	Surface	PPT	Buck Spring	5.1 ± 0.1	2.8 ± 0.1	Smaller rim on BRE
35-HA-2895	591	1139-113	SCP 113	Surface	PPT	Beatys Butte	5.1 ± 0.1	2.3 ± 0.1	Smaller rim on BRE
35-HA-2895	592	1139-137	SCP 137	Surface	PPT	Burns	5.6 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2895	593	1139-138	SCP 138	Surface	PPT	Buck Spring	7.6 ± 0.1	NM ± NM	DFV; Same rim on BRE
35-HA-2895	594	1139-142	SCP 142	Surface	BIF	Buck Spring	5.9 ± 0.1	NM ± NM	--
35-HA-2895	595	1139-153	SCP 153	Surface	BIF	Buck Spring	10.0 ± 0.1	NM ± NM	--
35-HA-2895	596	1139-190	SCP 172	Surface	BIF	Riley	5.5 ± 0.1	NM ± NM	--
35-HA-2895	597	1139-191	SCP 173	Surface	PPT	Venator	NA ± NA	NM ± NM	UNR
35-HA-2895	598	1139-192	SCP 192	Surface	PPT	Beatys Butte	5.1 ± 0.1	NM ± NM	--
35-HA-2905	599	1139-62	SCU 53	Surface	EMP	Burns	4.6 ± 0.1	NM ± NM	--
35-HA-2905	600	1139-80	SCP 1	Surface	BIF	Burns	6.8 ± 0.1	4.5 ± 0.0	--

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Table B-1. Obsidian Hydration Results and Sample Provenience: FTV Western Fiber Build Project Sites, Oregon

Site	Specimen No.	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims Rim 1	Hydration Rims Rim 2	Comments[B]
35-HA-2905	601	1139-83	SCP 4	Surface	EMP	Burns	6.2 ± 0.1	NM ± NM	--
35-HA-2905	602	1139-84	SCP 5	Surface	PPT	Burns	6.8 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2905	603	1139-85	SCP 6	Surface	BIF	Burns	3.9 ± 0.1	NM ± NM	--
35-HA-2905	604	1139-87	SCP 8	Surface	BIF	Burns	5.5 ± 0.1	NM ± NM	--
35-HA-2905	605	1139-88	SCP 9	Surface	BIF	Burns	6.8 ± 0.1	NM ± NM	--
35-HA-2905	606	1139-91	SCP 12	Surface	BIF	Mud Ridge	7.3 ± 0.1	NM ± NM	--
35-HA-2905	607	1139-92	SCP 13	Surface	BIF	Dog Hill	3.2 ± 0.1	NM ± NM	--
35-HA-2905	608	1139-93	SCP14	Surface	EMP	Burns	4.6 ± 0.1	NM ± NM	--
35-HA-2905	609	1139-94	SCP 15	Surface	BIF	Burns	4.6 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2905	610	1139-95	SCP 16	Surface	BIF	Burns	6.9 ± 0.1	NM ± NM	DFV
35-HA-2905	611	1139-96	SCP 17	Surface	BIF	Burns	4.6 ± 0.1	NM ± NM	--
35-HA-2905	612	1139-103	MCP 1	Surface	BIF	Dog Hill	3.7 ± 0.1	NM ± NM	NVH on BRE
35-HA-2905	613	1139-104	MCP 2	Surface	BIF	Burns	3.9 ± 0.1	NM ± NM	NVH on BRE
35-HA-2905	614	1139-105	MCP 3	Surface	EMP	Burns	5.5 ± 0.1	NM ± NM	--
35-HA-2905	615	1139-106	MCP 4	Surface	PPT	Whitewater Ridge	5.5 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2905	616	1139-107	MCP 5	Surface	BIF	Burns	6.8 ± 0.1	NM ± NM	--
35-HA-2905	617	1139-108	MCP 6	Surface	BIF	Burns	4.6 ± 0.1	NM ± NM	Same rim on BRE
35-HA-2905	618	1139-109	MCP 7	Surface	SCR	Burns	7.5 ± 0.1	NM ± NM	--

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[A] BIF = Biface; COR = Core; CRE = Crescent; DEB = Debitage; EMP = Edge Modified Piece; PPT = Projectile Point; SCR = Scraper; UFT = Utilized Flake Tool

[B] See text for explanation of comment abbreviations

NA = Not Available; NM = Not Measured; * = Small sample

Abbreviations and Definitions Used in the Comments Column

All hydration rim measurements are reported in microns (µm)

BEV - (Beveled). Artifact morphology or cut configuration resulted in a beveled thin section edge.

BRE - (BREak). The thin section cut was made across a broken edge of the artifact. Resulting hydration measurements may reveal when the artifact was broken, relative to its time of manufacture.

DES - (DEStroyed). The artifact or flake was destroyed in the process of thin section preparation. This sometimes occurs during the preparation of extremely small items, such as pressure flakes.

DFV - (Diffusion Front Vague). The diffusion front, or the visual boundary between hydrated and unhydrated portions of the specimen, are poorly defined. This can result in less precise measurements than can be obtained from sharply demarcated diffusion fronts. The technician must often estimate the hydration boundary because a vague diffusion front often appears as a relatively thick, dark line or a gradation in color or brightness between hydrated and unhydrated layers.

DIS - (DIScontinuous). A discontinuous or interrupted hydration rind was observed on the thin section.

HV - (Highly Variable). The hydration rind exhibits variable thickness along continuous surfaces. This variability can occur with very well- defined bands as well as those with irregular or vague diffusion fronts.

IRR - (IRRegular). The surfaces of the thin section (the outer surfaces of the artifact) are uneven and measurement is difficult.

1SO - (1 Surface Only). Hydration was observed on only one surface or side of the thin section.

NOT - (NOT obsidian). Petrographic characteristics of the artifact or obsidian specimen indicate that the specimen is not obsidian.

NVH - (No Visible Hydration). No hydration rind was observed on one or more surfaces of the specimen. This does not mean that hydration is absent, only that hydration was not observed. Hydration rinds smaller than one micron often are not birefringent and thus cannot be seen by optical microscopy. "NVH" may be reported for the manufacture surface of a tool while a hydration measurement is reported for another surface, e.g. a remnant ventral flake surface.

OPA - (OPAque). The specimen is too opaque for measurement and cannot be further reduced in thickness.

PAT - (PATinated). This description is usually noted when there is a problem in measuring the thickness of the hydration rind, and refers to the unmagnified surface characteristics of the artifact, possibly indicating the source of the measurement problem. Only extreme patination is normally noted.

REC - (RECut). More than one thin section was prepared from an archaeological specimen. Multiple thin sections are made if preparation quality on the initial specimen is suspect or obviously poor. Additional thin sections may also be prepared if it is perceived that more information concerning an artifact's manufacture or use can be obtained.

UNR - (UNReadable). The optical quality of the hydration rind is so poor that accurate measurement is not possible. Poor thin section preparation is not a cause.

WEA - (WEAthered). The artifact surface appears to be damaged by wind erosion or other mechanical action.