RUBY PIPELINE PROJECT

ARCHAEOLOGICAL SITE TESTING AND EVALUATION AND DATA RECOVERY

OREGON SEGMENT: LAKE AND KLAMATH COUNTIES

Prepared for
Ruby Pipeline, LLC
Kinder Morgan, Inc.
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October 14, 2016

REPORT NO. 3446

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Overview of Big Valley in the eastern portion of the Ruby Pipeline project in Oregon.

By
Archaeological Investigations Northwest, Inc.
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TABLE OF CONTENTS

TABLE OF CONTENTS, continued

TABLE OF CONTENTS, continued

TABLE OF CONTENTS, continued

APPENDIX C

NORTHWEST RESEARCH OBSIDIAN STUDIES LABORATORY
OBSIDIAN STUDIES: GEOCHEMICAL SOURCING (X-RAY FLUORESCENCE) AND HYDRATION RIM MEASUREMENT

X-Ray Fluorescence Analysis and Obsidian Hydration Rim Measurement of Obsidian and Fine-Grained Volcanic Artifacts from Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

FINAL DRAFT

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2015

Northwest Research Obsidian Studies Laboratory

CONTENTS

APPENDICES

TABLES

FIGURES

X-Ray Fluorescence Analysis and Obsidian Hydration Rim Measurement of Obsidian and Fine-Grained Volcanic Artifacts from Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

Craig E. Skinner and Jennifer J. Thatcher
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INTRODUCTION

Two-thousand five-hundred and eighty-six obsidian (N=2,356) and fine-grained volcanic (FGV; N=230) artifacts from 50 archaeological sites associated with the Ruby Pipeline Project, Oregon, were subjected to energy dispersive X-ray fluorescence trace element provenance analysis (see Figure 1 and Table 1). The obsidian specimens were also processed for hydration rim measurements. The samples were prepared and analyzed at the Northwest Research Obsidian Studies Laboratory under the laboratory accession numbers 2012-106, 2012-111, 2012-121, 2012-122, 2012-140, 2012-153, 2013-02, 2013-11, 2013-15, 2013-21, 2013-22, 2013-34, and 2013-35.

ANALYTICAL METHODS

X-Ray Fluorescence Analysis

Introduction. Although a variety of different physical, optical, petrographic, and chemical attributes can be used to characterize materials such as volcanic glass, the use of trace element abundances to "fingerprint" obsidian and fine-grained volcanic (FGV) toolstone sources and artifacts has shown the greatest overall success and acceptance. X-ray fluorescence analytical methods, with their ability to nondestructively, accurately, and inexpensively measure trace element concentrations in obsidian and fine-grained volcanic materials, have been widely adopted for this purpose (Glascock et al. 1998; Harbottle 1982; Lambert 1997; Williams-Thorpe 1995). Most recently, the availability of portable X-ray analyzers (pXRF) has introduced the technology to a much wider potential audience of archaeologists. The use of these relatively inexpensive instruments should increase the accessibility of provenance studies to researchers, particularly in regions in which source chemistry is fairly straightforward (Ferguson 2012).

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 1986, 1998; 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 (Church 2000; Shackley 1998, 2002). Hughes (1986, 1998) and Frahm (2014) point out that these chemically identical obsidian outcrops must be considered as a single chemical group or chemical type and their terminology is followed here.

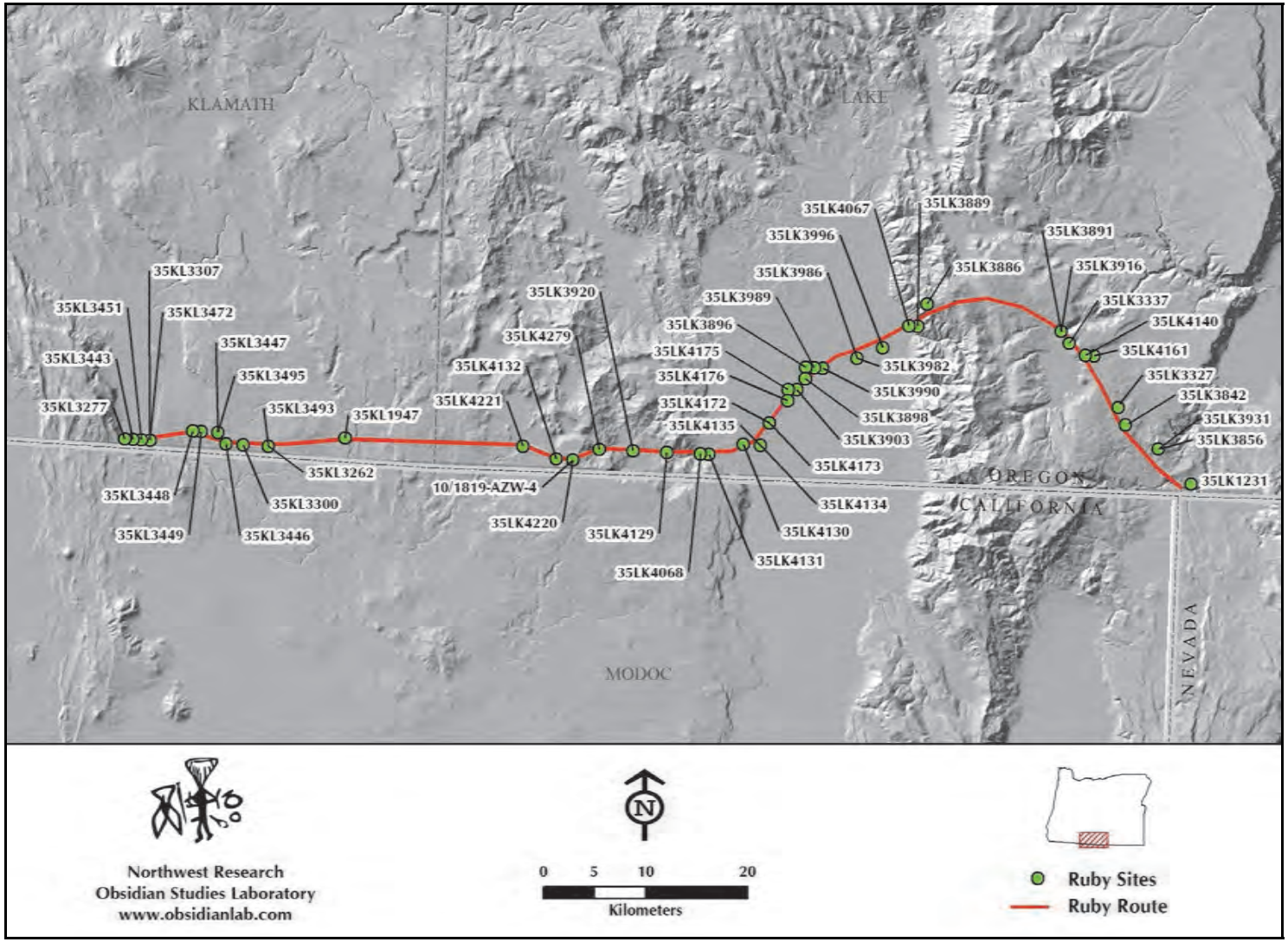

Figure 1. Ruby Pipeline sites selected for trace element and hydration investigations.

Table 1. Summary of provenance and hydration studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect. Table is continued on next page.

PROJECT SITE	XRF STUDIES N=			HYDRATION STUDIES **
	OBSIDIAN	FGV	TOTAL	N=
35LK1231 *	954	45	999	954
35LK3856	11	1	12	11
35LK3931 *	47	–	47	47
35LK3842	64	17	81	64
35LK3327 *	48	11	59	50
35LK4161	11	–	11	11
35LK4140	41	8	49	41
35LK3337 *	110	6	116	110
35LK3916	8	–	8	8
35LK3891	18	2	20	20
35LK3886	10	–	10	10
35LK3889	11	–	11	11
35LK4067	7	3	10	9
35LK3996	6	4	10	10
35LK3986 *	11	5	16	13
35LK3982	9	1	10	10
35LK3990	5	5	10	5
35LK3989	17	3	20	17
35LK3896	32	5	37	32
35LK3898	10	3	13	11
35LK3903	10	2	12	11
35LK4175	–	1	1	0
35LK4176	5	1	6	6
35LK4173	34	15	49	34
35LK4172	5	–	5	5
35LK4134	44	11	55	43
35LK4135	13	5	18	13
35LK4130 *	67	15	82	67

Table 1 (continued). Summary of trace element and hydration studies of Ruby Pipeline Project obsidian and FGV artifacts.

PROJECT SITE	XRF STUDIES N=			HYDRATION STUDIES * N=
	OBSIDIAN	FGV	TOTAL	
35LK4131	2	–	2	2
35LK4068	27	11	38	27
35LK4129	6	1	7	7
35LK3920 *	182	31	213	182
35LK4279	13	4	17	14
35LK4220	1	–	1	1
10/1819-AZW-4	1	–	1	1
35LK4132	12	2	14	13
35LK4221	46	4	50	46
35KL1947	3	–	3	3
35KL3262 *	328	2	330	328
35KL3493	1	–	1	1
35KL3300	12	–	12	12
35KL3446	9	–	9	9
35KL3495	11	1	12	11
35KL3447	16	1	17	16
35KL3449	44	4	48	44
35KL3448	4	–	4	4
35KL3472	4	–	4	4
35KL3307	10	–	10	10
35KL3451	5	–	5	5
35KL3443	1	–	1	1
35KL3277	10	–	10	9
TOTAL	**2356**	**230**	**2587**	**2372**

* Data recovery sites.
** Totals include all attempts (may include a few glassy FGV's) but do not include artifacts that were found to be non-obsidian after XRF analysis.

From small scale (household and site) to large scale (regional and interregional) levels of analysis, the spatial or geographic source patterning of characterized obsidian artifacts is influenced by many different cultural factors, environmental influences, and sampling and recovery methods (see Table 2). Interpretation of these source utilization patterns can provide valuable information about the prehistoric behavioral and environmental procurement variables responsible for observed artifact distributions. At the site level of analysis, patterns of source use may suggest the presence of specific activity areas, of single tool manufacturing events, or, in special cases, may point to differential access of goods and the existence of non-egalitarian social structures. At the intersite or regional level of investigation, the geographic patterning of artifacts can provide information about group mobility and procurement ranges, conveyance zones, territorial and ethnic boundaries, linguistic barriers, the location of trails and travel routes, the curational value of particular sources or formal artifact types, cultural preferences regarding glass quality and colors, the presence of trade and exchange systems, the existence of intergroup interaction, the exchange of prestige items between elites of different groups, and the symbolic value of some sources (Bettinger 1982; Dillian 2002; Ericson 1981; Freund 2013; Hodgson 2007; Hughes 1978, 1990, 2011; Hughes and Bettinger 1984; Jones et al 2003, 2012; Kelly 2011; Levine and Carballo 2014; Newlander 2012, 2015; Pintar and Rodriguez 2015; Roth 2000; Shackley 1990, 1996, 2002, 2005; Shott 2015; Skinner 1983; Skinner et al. 2004; Whitaker 2008). The additional effects of environmental influences such as the distance to source, the location of alternative or competing sources of lithic materials, the distribution of raw materials in secondary deposits, or the presence of potential barriers such as mountain ranges, must all be considered (e.g., Henrickson 2008). Bias introduced during sampling by certain recovery methods, artifact size, selection of specific classes of artifacts e.g., formed tools, projectile points, debitage, etc.), and the use of small numbers of samples may also affect the reconstruction of the spatial patterning of analyzed artifacts (Eerkens et al. 2002, 2007).

A concept that has proven particularly germane to the interpretation of obsidian provenance studies in the Great Basin and Southwest is that of *procurement range*. Shackley (2002) best summarizes the concept:

> I think that one of the most important factors in the reconstruction of hunter-gatherer settlement mobility and adaptation is an understanding of the potential range and habitat exploited in a year or a series of years, what I call procurement range. It is nearly axiomatic that to understand why a particular hunter-gatherer group inhabited the particular piece of landscape we work on, it is necessary to at least have an inkling as to where they have been.

The procurement range includes a potentially complex and multilayered collection of activities associated with seasonal resource procurement rounds *and* family and social contacts and gatherings and is distinct from the notion of territory, a construct that is best applied to more sedentary groups (Shackley 1990, 1996, 2002, 2005). The more recently-introduced terms of *conveyance zone* or *foraging territory* can be used almost synonymously with that of procurement range (Beck and Jones 2011; Jones et al. 2003, 2012; Newlander 2012, 2015; Smith 2010). In short, the geographic distribution of obsidian holds the potential to map the overall long-term patterns of mobility and range for these often highly-mobile prehistoric groups. When coupled with chronologic data such as those provided through obsidian hydration analysis methods, changes of these patterns over time may also be documented.

It is tempting to invoke the process of trade and exchange (indirect procurement) as a major explanatory mechanism for interpreting the presence of obsidian at a distance from a source and numerous volumes have been centered around this theme (e.g., Ericson and Baugh 1993, 1994). In all likelihood, however, most toolstone procurement probably occurs as an embedded process within the constraints of the procurement range (Binford 1979; Gould and Saggers 1985) and, occasionally, as long-distance direct

Table 2. Selection of cultural, environmental, and sampling variables that may influence the spatial and geographic distribution of characterized artifacts.

CULTURAL VARIABLES
Procurement range (i.e., conveyance zone)
Site function
Household organization
Status and prestige differences
Territorial boundaries
Ethnic, sociopolitical, or ethnolinguistic boundaries
Sociopolitical structure (i.e., more complex societies may develop more complex procurement systems)
Population mobility or stability
Population density (and the ensuing development of more complex procurement systems)
Locations of trails
Changes in cultural access to a source
Cultural preferences or taboos concerning specific sources
Color preferences (e.g., mahogany-colored glass)
Presence of long-distance direct procurement behavior
Presence of long-distance exchange systems
Time (diachronic changes of the cultural variables, e.g., changes in territory through time)
ENVIRONMENTAL VARIABLES
Distance to source (secondary source boundaries must be known)
Distance to alternative sources (particularly those of higher quality)
Size of available raw material
Quality of available raw material
Exhaustion of a source
Changes in physical access to a source (e.g., covered by volcanic tephra or subsequent eruptions)
Presence of geographic barriers (mountain ranges, canyons, lava fields, water bodies, etc.)
Locations of navigable streams and rivers
Co-occurrence of other additional resources (e.g., obsidian and water)
Post-occupational disturbance
Changes in habitat quality (e.g., increasing or decreasing aridity)
Time (diachronic changes of the environmental variables, e.g., changes in lake levels through time)
SAMPLING AND RECOVERY VARIABLES
Size of analyzed sample (N=)
Artifact category (e.g., formed tools, expedient tools, cores, debitage)
Recovery methods (e.g., 1/8" versus 1/4" inch screens used during excavation)
Physical size of artifact
Surface versus subsurface artifacts

intentional procurement of raw materials. In any event, the archaeological evidence needed to distinguish between indirect (trade and exchange) and direct procurement is often absent at many sites (Hughes 2011; Jackson and Ericson 1994; Meighan 1992).

Fine-Grained Volcanic (FGV) Materials. We use the term FGV - fine-grained volcanic material - to encompass a variety of different volcanic or igneous rocks that are used for the manufacture of prehistoric stone tools. These rock types most often include basalts, andesites, rhyolites, and dacites. However, the classification of volcanic rocks is not a straightforward exercise and is done using a combination of chemical and textural or petrographic attributes. In short, it's simply not possible to reliably determine the correct rock type for volcanic materials using only visual or trace element characteristics. A dark, fine-grained rock, for example, might be a basalt, rhyolite, dacite, shale (a metamorphosed sedimentary rock), or it might be something completely different. Because of this, we have adopted the FGV term in order to simply sidestep the need for accurate rock type classification terminology.

Fortunately, for all practical purposes in trace element provenance studies of FGV's, it is not important if the material being tested is a basalt, an andesite, a rhyolite, or is some other type of volcanic rock. The key characteristics are that the lithic material being tested is fine-grained, has no large phenocrysts or inclusions that can't be avoided by the X-ray beam (these are a different chemical composition than the fine-grained matrix in which they occur), and is volcanic in origin. Like obsidian, geochemical FGV sources must also be relatively homogeneous in their trace element composition and must be chemically distinguishable from other regionally-available FGV sources (something that must be determined pragmatically through the geochemical analysis of multiple samples from potential sources).

Sample Preparation Methods. Obsidian and FGV 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 (Davis et al. 1998). Although it is possible to analyze smaller samples (5-10 mm in diameter and 0.5-1.0 mm thick), these items will typically show greater variability in trace element values and may not be able to be reliably characterized. This is particularly true in areas with large numbers of available sources or complex prehistoric 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 appendices.

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

For the elements that are reported in Table A-1, we analyzed the collection with either an 8.8 or 3.5 mm diameter beam collimator installed - smaller diameter collimators are employed with smaller specimens and the tube voltage and count times are adjusted accordingly. Instrument control and data analysis are performed using WinTrace software (version 7) running under the Windows 7 operating system.

With XRF spectrometry, the target specimen or artifact is bombarded with X-rays or high-energy electrons from a conventional X-ray tube located in the spectrometer. This causes a disturbance of the electron orbitals of atoms and the sample then emits secondary or fluorescent X-rays of wavelengths that are then detected with our spectrometer. The resultant spectra lines or peaks are characteristic of the elements present in the specimen. The height of the peaks is directly proportional to the amount of each element and these are converted to quantitative parts per million figures by comparing them against calibration curves established using rock standards of known chemical composition. Further information about the principles of X-ray fluorescence analysis and their applications to provenance studies of obsidian and FGV artifacts can be found in Glascock (2002, 2010), Lundblad et al. (2008, 2010), Shackley (2010), and Williams (1987).

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 1986:35). Early experiments with intact obsidian flakes by Robert N. Jack, and later by Richard Hughes, however, indicated 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 (Hughes 1986:35-37; Jack 1976). Later experimental studies using samples with flat and slightly irregular surface geometries have corroborated Hughes and Jack's initial observations. Details about the effects of sample size and surface geometry are discussed in detail by Davis et al. (1998). In that study, 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 and with unpublished trace element data acquired through the analysis of geologic source samples. Chemical and sample provenance and provenience data collected for over 130,000 obsidian and FGV source specimens and analyzed artifacts are currently compiled in the FileMaker Pro 13 Advanced comparative reference database developed by Northwest Research Obsidian Studies Laboratory. Newly analyzed or unknown obsidian and FGV samples are compared directly to the cumulative information assembled in our proprietary laboratory database.

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. 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, i.e., these elements are those that allow the clearest geochemical distinction between sources. Occasionally, visual attributes are used to corroborate the source assignments although sources are never assigned on the basis of only megascopic characteristics.

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 usefulness 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 or freshly-flaked 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 (Ambrose 1998; 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 elsewhere and will not be discussed further here (Freter 1993; Friedman and Obradovich 1981; Friedman et al. 1994, 1997; Liritzis and Stevenson 2012; Michels and Tsong 1980; Skinner 1995b; Stevenson et al., 1993, 1998).

The preparation of a specimen for obsidian hydration analysis typically requires the physical removal of a thin slice of obsidian from the artifact surface to be examined (see the sample preparation section that follows for details), a modestly destructive technique that has changed little since the inception of the method. Although several alternative nondestructive methods of hydration rim measurement have been described by researchers, the vast majority of all samples prepared for hydration analysis (including all of those in the current investigation) still use the traditional approach (Friedman and Smith 1960; Friedman et al. 1997).

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 some mixed promise in recent years (Friedman and Trembour 1983; Michels et al. 1983a, 1983b; Rogers and Duke 2014; Stevenson et al. 2000, 2007; Tremaine 1989, 1993).

Although research into obsidian hydration dating methods and the development of rates that can be used to determine absolute dates has continued to the present and perhaps even experienced a bit of a recent resurgence, it seems likely that the original goal of the direct and accurate conversion of hydration rims to rates to dates will most often prove to be a somewhat elusive one (Anovitz et al 1999; Duke and Rogers 2013; Friedman et al. 1994, 1997; Liritzis 2003, 2007; Liritzis and Stevenson 2012; Meighan 1981; Rogers 2006a, 2006b, 2007, 2008a, 2008b, 2008c, 2008d, 2009, 2010a, 2010b, 2010c, 2011, 2012; Ridings 1996; Rogers and Duke 2014; Rogers and Yohe 2014; Stevenson et al. 1998). There are, in our opinion, simply too many variables affecting the rate of hydration rim development and too few ways in which to take them all into account.

However, despite the lack of success in the determination of accurate obsidian hydration ages, we have observed a great deal of hydration rim patterning in our 20 years of obsidian hydration investigations and it is clear to us that the use of hydration measurements as a relative dating method remains valid and very useful. In many geographic areas where there is a lack of organic material suitable for radiocarbon dating, where temporally-sensitive artifacts are absent, or other independent dating methods are not applicable (e.g., radiocarbon or tephrochronologic techniques), obsidian hydration analysis may provide the only temporal framework with which artifact and source use over time can be inferred.

While obsidian hydration analysis methods are most commonly used for the purpose of relative dating of artifacts, they have also been used to test for artifact reuse (hydration cuts are placed on flaked artifact surfaces that are suspected to have been created at different times through scavenging or rejuvenation), to compare periods of occupation and use among sites in similar environmental or geographic settings, to examine artifact production curves over time, and to test for stratigraphic integrity (Ericson 1981; Michels 1969; Michels and Tsong 1980; Rogers and Yohe 2014; Singer and Ericson 1977).

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.

The prepared slide is measured using an Olympus BHT petrographic microscope fitted with a video micrometer unit and a digital imaging video camera. 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. 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 in Table A-1 and the preparation and measurement of hydration rims are available at the Northwest Research Obsidian Studies Laboratory World Wide Web site at *www.obsidianlab.com* (Northwest Research 2015a).

RESULTS OF ANALYSIS

X-Ray Fluorescence Analysis of Obsidian and Vitrophyre Artifacts

Introduction. Forty-eight different geochemical obsidian and vitrophyre sources, 35 of which were correlated with known sources, were identified among the 2,355 obsidian and vitrophyre artifacts that were characterized by X-ray fluorescence analysis. The trace element composition of three of the artifacts indicates that they are not obsidian. The locations of the project sites and the obsidian sources are shown in Figure 2. In addition, maps of the locations of individual sites with 20 or more analyzed artifacts (N=19) and the known sources found at those sites is found in Appendix C of this report. Analytical results are presented in Table A-1 in the Appendix and are summarized in tables 4 and 5 and figures 3, 4, 5, 6, and 7.

Although obsidian provenance and hydration studies associated with Oregon archaeological projects have become increasingly common since their initial adoption in the 1980's, the investigation of large numbers of artifacts from single sites or projects has remained relatively uncommon. It is rare when more than a few hundred specimens are examined and the trace element or hydration study of much smaller numbers of samples has been much more common.

The exception to this has been the study of obsidian and, more recently, FGV artifacts from several extensive geographically-continuous projects that are composed of numerous archaeological sites and which run through obsidian-rich areas of Oregon (see Table 3). The obsidian studies associated with the Ruby Pipeline Project are among the more extensive ever carried out as part of an Oregon archaeological project and are exceeded in scope and size only by the multi-state PGT-PG&E Pipeline Expansion Project.

Table 3. Oregon archaeological projects with associated large-scale XRF provenance (obsidian and fine-grained volcanic artifacts) and obsidian hydration analysis studies.

PROJECT NAME	XRF ANALYSIS N=	HYDRATION ANALYSIS N=	REFERENCES
PGT-PG&E Pipeline Expansion Project	6,595	6,184	Skinner 1995a, 1995b
Ruby Pipeline Project	2,356	2,071	Current Investigation
PDCI Celilo-Sylmar Uprate Project	1,142	1,007	Skinner 2015; Thatcher 2015
PGT-Medford Pipeline Extension Project	624	624	Skinner et al. 1996
FTV Western Fiber Build Project	619	619	Skinner and Thatcher 1998

Very few previous obsidian provenance or hydration investigations have been carried out in the vicinity of the Ruby Pipeline Project corridor and all of these have been very limited in scope and in the number of analyzed artifacts. The only large-scale obsidian-related study that we are aware of in the Ruby Pipeline project area has been the very recent PDCI Celilo-Sylmar Uprate Project (Skinner 2015; Thatcher 2015).

Artifacts from Known Obsidian Sources. Two-thousand two-hundred and fifty-five of the characterized obsidian and vitrophyre artifacts were correlated with 35 known obsidian sources located in eastern Oregon, northeastern California, and northwestern Nevada.

With few exceptions, the overall pattern of obsidian source utilization along the 135 km-long project corridor is one that generally reflects direct-access local procurement of the *many* nearby sources of glass, an activity that was likely embedded in the regular seasonal activities of the prehistoric inhabitants of the region. This is particularly evident at sites in the eastern end of the project corridor where local obsidian (Surveyor Spring and Cowhead Lake) was directly available for the inhabitants of several of the investigated sites, particularly those at 35KL1231. At many of the sites, other obsidian sources were located at a distance of no more than 10-30 kilometers.

Also present is a very minor component of non-local sources (e.g., Quartz Mountain, Cougar Mountain, and Variety 5, all located in the Fort Rock Basin of south-central Oregon). The east-west geographic shift in obsidian use is readily apparent in Table 4 and in figures 3, 4, 5, 6, and 7 - the scatterplots summarizing the XRF results at sites along the project area (the geographic groups represented in the plots were rather arbitrarily-assigned). Sites located near the eastern end of the project area demonstrate a rapid transition to intensive use of Surveyor Spring and Cowhead Lake obsidian, two sources that until very recently were only occasionally identified in geochemical studies of artifacts. There are no examples of true long-distance procurement present in this substantially large regional sampling of artifacts.

Obsidian Use at 35LK1231. Site 35LK1231 is located at the eastern end of the Oregon project corridor and is situated within the boundaries of the Surveyor Spring obsidian source. It is no surprise that 734 (76.9%) of the 954 analyzed obsidian artifacts at the site originated from that source. Outcrops of glass from the Cowhead Lake source have been located as close as approximately 11 kilometers west-southwest of 35LK1231 but artifacts from that source made up only 9.2 (N=88) percent of the analyzed specimens. The greatest percentage of artifacts from northwestern Nevada sources are also found at 35LK1231. The remainder of the 20 known additional sources present at the site are represented by small numbers of artifacts ranging from N=1 to N=18. Overall obsidian use at the site is summarized in Figure 3.

Obsidian Use Between 35LK1231 and Goose Lake. The group of nine project sites that lay between 35LK1231 and Goose Lake clearly demonstrate a rapid east-west decrease in the use of obsidian from Surveyor Spring while, at the same time, shows a rise in the percentage of use of glass from Cowhead Lake. Artifacts from sources located in the Warner Mountains begin to appear in greater proportions although the contribution of obsidian from these sources in addition to Surveyor Spring and Cowhead Lake is relatively minor. General obsidian use at these sites is summarized in Figure 4.

Obsidian Use at Sites in the Goose Lake Vicinity. Moving westward, the next grouping of 18 sites circles the northern margins of Goose Lake. The procurement pattern of characterized artifacts from these sites demonstrates a marked shift to sources found to the south and with over 84 percent of the known sources located in northern California. Only 14 percent of the known sources are located in Oregon and only a single artifact from Surveyor Spring was found. A summary of the obsidian use at these sites is shown in Figure 5.

Obsidian Use at Sites Between Goose Lake and Yocum Valley. Approaching the western end of the project area, the next combination of nine sites is situated along a transect extending from the near the

western shore of Goose Lake to Yocum Valley. Once again, use of northern California obsidian sources dominates the procurement behavior and the percentage of California sources present rises to over 90 percent. Only 26 of the artifacts are from Oregon sources located north of the project with Spodue Mountain (N=8) and Drews Creek/Butcher Flat (N=7) making up the two most common sources. Once again, only a single Surveyor Spring artifact was found among the 247 known obsidian sources identified along this project segment. Interestingly, among the California sources in this project section, the proportion of artifacts from Cowhead Lake rises slightly above the Goose Lake vicinity sites to about 31 percent. Due to the geochemical similarities of obsidian from Cowhead Lake and Drews Creek/Butcher Flat, we reanalyzed many of these artifacts along with geologic samples from the laboratory reference collection and are satisfied that the source assignments of the two geochemical groups are correct. Obsidian use at the sites in this segment is summarized in Figure 6.

Obsidian Use at Sites in the Westernmost Portion of the Project Corridor. Fourteen sites were included in the western portion of or the project section. Once again, California sources dominated the procurement pattern at this group of sites, particularly the Blue Mountain source, Warner Mountains sources (Buck Mountain, Blue Spring, and Sugar Hill), Medicine Lake Volcano sources (GF/LIW/RS, East Medicine Lake, Grasshopper Group, Glass Mountain. Cougar Butte). The proportion of Cowhead Lake glass also remained high (26.5 percent of the California sources) and we once again carefully verified the accuracy of this source assignment. Oregon sources to the north comprised only seven percent of the total artifact sources in this project area and only one of those artifacts was from Surveyor Spring, the source of natural glass that was so dominant in the opposite end of the project corridor. The use of obsidian in this final westernmost section is summarized in Figure 7.

Additional information and maps concerning the locations, geologic settings, and prehistoric use of the obsidian and FGV sources identified in this investigation may be found at *www.obsidianlab.com* (Northwest Research 2015a) and *www.sourcecatalog.com* (Northwest Research 2015b).

Artifacts from Unknown Obsidian and Vitrophyre Sources. Of particular interest in this project was the identification of a large number of unknown obsidian (N=11) and vitrophyre (N=2) sources. Prior to the provenance studies associated with the Ruby Pipeline Project, there were few trace element investigations of obsidian artifacts or sources in the vicinity of the project corridor and little evidence suggesting that as-yet undiscovered sources might be lurking in the area. However, in recent XRF studies of artifacts from the Surprise Valley region, we had been surprised to note the presence of several new unknown obsidian sources. Little did we know how many additional ones would be added as part of the current investigation. Sites in which artifacts from unknown obsidian and vitrophyre sources were found are shown in Figure 8. The trace element composition of these same sources is illustrated and summarized in the scatterplot of Figure 9.

We have distinguished here between obsidian and vitrophyre sources and the distinction is largely a textural one. Obsidian is a holohyaline volcanic glass with a conchoidal fracture, a texture that is very suitable for the manufacture of artifacts. Vitrophyre, on the other hand, is a porphyritic igneous rock in which phenocrysts are set into a glassy groundmass - the result is a texture that produces flaked stone tools of an inferior quality. Volcanic vitrophyres generally see little use as a toolstone, particular in regions in which better-quality material may be found and only two specimens were noted in the current investigation.

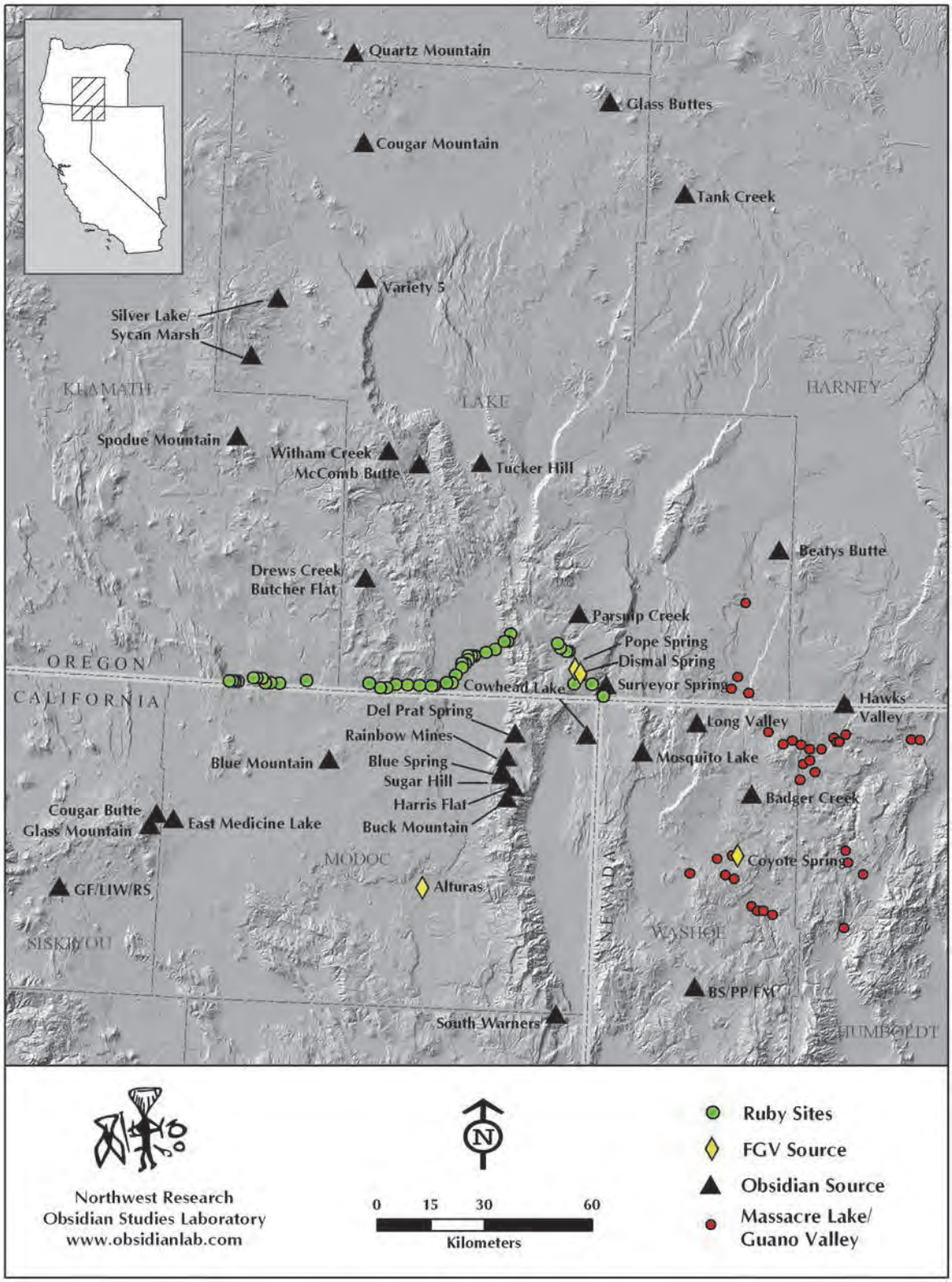

Figure 2. Obsidian and FGV sources identified as part of the project provenance studies.

Table 4. Summary of results of obsidian provenance studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect. Table is continued on next page.

OBSIDIAN SOURCES	RUBY PROJECT SITES					
	35LK1231	35LK3856	35LK3931	35LK3842	35LK3327	35LK4161
Badger Creek	1 (0.1%)	–	–	–	1 (2.1%)	–
Beatys Butte	9 (0.9%)	–	–	–	2 (4.2%)	–
Blue Mountain	–	–	–	–	–	–
Blue Spring	7 (0.7%)	–	–	–	–	–
BS/PP/FM	1 (0.1%)	–	–	–	–	–
Buck Mountain	24 (2.5%)	–	–	4 (6.3%)	2 (4.2%)	–
Cougar Butte	–	–	–	–	–	–
Cougar Mountain	–	–	–	–	–	–
Cowhead Lake	88 (9.2%)	2 (18.2%)	14 (29.8%)	23 (35.9%)	12 (25.0%)	9 (81.8%)
Del Prat Spring	–	–	–	–	–	–
Drews Creek/Butcher Flat	1 (0.1%)	–	–	–	–	–
East Medicine Lake	1 (0.1%)	–	–	–	–	–
GF/LIW/RS	–	–	–	–	–	–
Glass Buttes 1	1 (0.1%)	–	–	–	–	–
Glass Buttes 3	–	–	–	–	–	–
Glass Mountain	–	–	–	–	–	–
Grasshopper Group	–	–	–	–	–	–
Harris Flat	–	–	–	–	–	–
Hawks Valley	1 (0.1%)	–	–	–	–	–
Long Valley	3 (0.3%)	–	–	4 (6.3%)	–	–
Massacre Lake/Guano Valley	14 (1.5%)	–	–	2 (3.1%)	1 (2.1%)	–
McComb Butte	–	–	–	–	–	–
Mosquito Lake	18 (1.9%)	–	–	–	–	–
Not Obsidian	–	–	–	–	–	–
Parsnip Creek	2 (0.2%)	–	–	–	–	–
Quartz Mountain	1 (0.1%)	–	–	–	–	–
Rainbow Mines	–	–	–	–	–	–
Silver Lake/Sycan Marsh	1 (0.1%)	–	–	–	–	–
South Warners	–	–	–	–	–	–
Spodue Mountain	1 (0.1%)	–	–	–	1 (2.1%)	–
Sugar Hill	6 (0.6%)	–	–	–	3 (6.3%)	–
Surveyor Spring	734 (76.9%)	9 (81.8%)	32 (68.1%)	19 (29.7%)	22 (45.8%)	2 (18.2%)
Tank Creek	1 (0.1%)	–	–	–	–	–
Tucker Hill	3 (0.3%)	–	–	–	–	–
Unknown Obsidian Varieties	35 (3.7%	–	1 (2.1%)	12 (18.8%)	4 (8.3%)	–
Unknown Vitrophyre Varieties	–	–	–	–	–	–
Variety 5	1 (0.1%)	–	–	–	–	–
Witham Creek	–	–	–	–	–	–
TOTAL	**954**	**11**	**47**	**64**	**48**	**11**

Table 4 (continued). Summary of results of obsidian provenance studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect. Table is continued on next page.

OBSIDIAN SOURCES	RUBY PROJECT SITES					
	35LK4140	35LK3337	35LK3916	35LK3891	35LK3886	35LK3889
Badger Creek	–	–	–	–	–	–
Beatys Butte	–	2 (1.8%)	–	1 (5.6%)	–	–
Blue Mountain	–	–	–	–	–	–
Blue Spring	–	4 (3.6%)	1 (12.5%)	–	–	–
BS/PP/FM	–	–	–	–	–	–
Buck Mountain	1 (2.4%)	10 (9.1%)	2 (25.0%)	1 (5.6%)	–	2 (18.2%)
Cougar Butte	–	–	–	–	–	–
Cougar Mountain	–	–	–	–	–	–
Cowhead Lake	15 (36.6%)	33 (30.0%)	3 (37.5%)	7 (38.9%)	3 (30.0%)	8 (72.7%)
Del Prat Spring	–	–	–	–	–	–
Drews Creek/Butcher Flat	–	2 (1.8%)	–	–	7 (70.0%)	–
East Medicine Lake	–	–	–	–	–	–
GF/LIW/RS	–	–	–	–	–	–
Glass Buttes 1	–	–	–	–	–	–
Glass Buttes 3	–	–	–	–	–	–
Glass Mountain	–	–	–	–	–	–
Grasshopper Group						
Harris Flat	–	–	–	–	–	–
Hawks Valley	–	–	–	–	–	–
Long Valley	–	–	2 (25.0%)	–	–	–
Massacre Lake/Guano Valley	3 (7.3%)	8 (7.3%)	–	1 (5.6%)	–	–
McComb Butte	–	–	–	–	–	–
Mosquito Lake	–	2 (1.8%)	–	1 (5.6%)	–	–
Not Obsidian	–	–	–	–	–	–
Parsnip Creek	1 (2.4%)	1 (0.9%)	–	1 (5.6%)	–	–
Quartz Mountain	–	–	–	–	–	–
Rainbow Mines	2 (4.9%)	5 (4.5%)	–	2 (11.1%)	–	–
Silver Lake/Sycan Marsh	–	1 (0.9%)	–	1 (5.6%)	–	–
South Warners	–	–	–	–	–	–
Spodue Mountain	–	1 (0.9%)	–	–	–	–
Sugar Hill	2 (4.9%)	4 (3.6%)	–	1 (5.6%)	–	1 (9.1%)
Surveyor Spring	8 (19.5%)	19 (17.3%)	–	2 (11.1%)	–	–
Tank Creek	–	–	–	–	–	–
Tucker Hill	1 (2.4%)	6 (5.5%)	–	–	–	–
Unknown Obsidian Varieties	8 (19.5%)	11 (10.0%)	–	–	–	–
Unknown Vitrophyre Varieties	–	–	–	–	–	–
Variety 5	–	–	–	–	–	–
Witham Creek	–	–	–	–	–	–
TOTAL	**41**	**110**	**8**	**18**	**10**	**11**

Table 4 (continued). Summary of results of obsidian provenance studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect. Table is continued on next page.

OBSIDIAN SOURCES	RUBY PROJECT SITES					
	35LK4067	35LK3996	35LK3986	35KL3982	35LK3990	35LK3989
Badger Creek	–	–	–	–	–	–
Beatys Butte	–	–	–	–	–	–
Blue Mountain	–	–	–	–	–	–
Blue Spring	–	–	1 (9.1%)	3 (33.3%)	1 (20.0%)	2 (11.8%)
BS/PP/FM	–	–	–	–	–	–
Buck Mountain	–	–	2 (18.2%)	2 (22.2%)	1 (20.0%)	1 (5.9%)
Cougar Butte	–	–	–	–	–	–
Cougar Mountain	–	–	–	–	–	–
Cowhead Lake	2 (28.6%)	1 (16.7%)	–	–	2 (40.0%)	8 (47.1%)
Del Prat Spring	–	–	–	–	–	–
Drews Creek/Butcher Flat	2 (28.6%)	1 (16.7%)	–	–	–	–
East Medicine Lake	–	–	–	–	–	–
GF/LIW/RS	–	–	–	–	–	–
Glass Buttes 1	–	–	–	–	–	–
Glass Buttes 3	–	–	–	–	–	–
Glass Mountain	–	–	–	–	–	–
Grasshopper Group	–	–	–	–	–	–
Harris Flat	–	–	–	–	–	–
Hawks Valley	–	–	–	–	–	–
Long Valley	–	–	–	–	–	–
Massacre Lake/Guano Valley	–	–	–	–	–	–
McComb Butte	–	–	–	–	–	–
Mosquito Lake	–	–	–	–	–	–
Not Obsidian	–	–	–	–	–	–
Parsnip Creek	–	–	–	–	–	–
Quartz Mountain	–	–	–	–	–	–
Rainbow Mines	–	1 (16.7%)	1 (9.1%)	–	1 (20.0%)	–
Silver Lake/Sycan Marsh	–	–	–	–	–	–
South Warners	–	–	–	–	–	–
Spodue Mountain	–	–	–	–	–	–
Sugar Hill	2 (28.6%)	3 (50.0%)	6 (54.5%)	4 (44.4%)	–	3 (17.6%)
Surveyor Spring	–	–	–	–	–	1 (5.9%)
Tank Creek	–	–	–	–	–	–
Tucker Hill	–	–	–	–	–	2 (11.8%)
Unknown Obsidian Varieties	1 (14.3%)	–	1 (9.1%)	–	–	–
Unknown Vitrophyre Varieties	–	–	–	–	–	–
Variety 5	–	–	–	–	–	–
Witham Creek	–	–	–	–	–	–
TOTAL	**7**	**6**	**11**	**9**	**5**	**17**

Table 4 (continued). Summary of results of obsidian provenance studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect. Table is continued on next page.

OBSIDIAN SOURCES	RUBY PROJECT SITES					
	35LK3896	35LK3898	35LK3903	35KL4176	35LK4173	35LK4172
Badger Creek	–	–	–	–	1 (2.9%)	–
Beatys Butte	–	–	–	–	–	–
Blue Mountain	–	1 (11.1%)	–	–	1 (2.9%)	–
Blue Spring	1 (3.1%)	–	2 (20.0%)	1 (20.0%)	1 (2.9%)	–
BS/PP/FM	–	–	–	–	–	–
Buck Mountain	4 (12.5%)	2 (22.2%)	4 (40.0%)	–	6 (17.6%)	1 (20.0%)
Cougar Butte	–	–	–	–	–	–
Cougar Mountain	–	–	–	–	–	–
Cowhead Lake	9 (28.1%)	2 (22.2%)	1 (10.0%)	1 (20.0%)	6 (17.6%)	4 (80.0%)
Del Prat Spring	1 (3.1%)	–	–	–	–	–
Drews Creek/Butcher Flat	–	1 (11.1%)	–	–	2 (5.9%)	–
East Medicine Lake	–	–	–	–	–	–
GF/LIW/RS	–	–	–	–	–	–
Glass Buttes 1	–	–	–	–	–	–
Glass Buttes 3	1 (3.1%)	–	–	–	–	–
Glass Mountain	–	–	–	–	—	–
Grasshopper Group	–	–	–	–	–	–
Harris Flat	–	–	–	1 (20.0%)	–	–
Hawks Valley	–	–	–	–	–	–
Long Valley	–	–	–	–	–	–
Massacre Lake/Guano Valley	–	–	–	–	–	–
McComb Butte	1 (3.1%)	–	–	–	1 (2.9%)	–
Mosquito Lake	1 (3.1%)	–	–	–	–	–
Not Obsidian	–	–	–	–	–	–
Parsnip Creek	–	–	–	–	–	–
Quartz Mountain	–	–	–	–	–	–
Rainbow Mines	2 (6.3%)	2 (22.2%)	1 (10.0%)	–	3 (8.8%)	–
Silver Lake/Sycan Marsh	1 (3.1%)	–	–	1 (20.0%)	–	–
South Warners	–	–	–	–	–	–
Spodue Mountain	1 (3.1%)	–	–	–	3 (8.8%)	–
Sugar Hill	8 (25.0%)	1 (11.1%)	1 (10.0%)	1 (20.0%)	6 (17.6%)	–
Surveyor Spring	–	–	–	–	–	–
Tank Creek	–	–	–	–	–	–
Tucker Hill	–	–	–	–	1 (2.9%)	–
Unknown Obsidian Varieties	2 (6.3%)	–	1 (10.0%)	–	2 (5.9%)	–
Unknown Vitrophyre Varieties	–	–	–	–	–	–
Variety 5	–	–	–	–	–	–
Witham Creek	–	–	–	–	1 (2.9%)	–
TOTAL	**32**	**9**	**10**	**5**	**34**	**5**

Table 4 (continued). Summary of results of obsidian provenance studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect. Table is continued on next page.

OBSIDIAN SOURCES	RUBY PROJECT SITES					
	35LK4134	35LK4135	35LK4130	35KL4131	35LK4068	35LK4129
Badger Creek	–	–	–	–	–	–
Beatys Butte	–	–	–	–	–	–
Blue Mountain	1 (2.3%)	–	5 (7.5%)	–	2 (7.4%)	–
Blue Spring	–	1 (7.7%)	5 (7.5%)	–	2 (7.4%)	–
BS/PP/FM	–	–	–	–	–	–
Buck Mountain	14 (31.8%)	4 (30.8%)	19 (28.4%)	–	1 (3.7%)	–
Cougar Butte	–	–	–	–	–	–
Cougar Mountain	1 (2.3%)	–	–	–	–	–
Cowhead Lake	9 (20.4%)	3 (23.1%)	6 (9.0%)	–	7 (25.9%)	3 (50.0%)
Del Prat Spring	1 (2.3%)	–	–	–	–	–
Drews Creek/Butcher Flat	–	–	–	–	2 (7.4%)	1 (16.7%)
East Medicine Lake	1 (2.3%)	–	–	–	1 (3.7%)	–
GF/LIW/RS	1 (2.3%)	–	1 (1.5%)	–	–	–
Glass Buttes 1	–	–	–	–	–	–
Glass Buttes 3	–	–	–	–	–	–
Glass Mountain	–	–	–	–	–	–
Grasshopper Group	–	–	4 (6.0%)	–	–	–
Harris Flat	–	–	1 (1.5%)	–	–	–
Hawks Valley	–	–	–	–	–	–
Long Valley	–	–	–	–	–	–
Massacre Lake/Guano Valley	–	–	–	–	–	–
McComb Butte	–	–	1 (1.5%)	–	–	–
Mosquito Lake	1 (2.3%)	–	–	–	–	–
Not Obsidian	–	–	–	–	–	–
Parsnip Creek	–	–	–	–	–	–
Quartz Mountain	–	–	–	–	–	–
Rainbow Mines	3 (6.8%)	2 (15.4%)	3 (4.5%)	–	–	–
Silver Lake/Sycan Marsh	1 (2.3%)	–	–	–	–	–
South Warners	–	–	–	–	–	–
Spodue Mountain	1 (2.3%)	–	4 (6.0%)	–	–	–
Sugar Hill	8 (18.2%)	3 (23.1%)	12 (17.9%)	2 (100.0%)	11 (40.7%)	2 (33.3%)
Surveyor Spring	–	–	–	–	–	–
Tank Creek	–	–	–	–	–	–
Tucker Hill	2 (4.5%)	–	4 (6.0%)	–	–	–
Unknown Obsidian Varieties	–	–	2 (3.0%)	–	1 (3.7%)	–
Unknown Vitrophyre Varieties	–	–	–	–	–	–
Variety 5	–	–	–	–	–	–
Witham Creek	–	–	–	–	–	–
TOTAL	**44**	**13**	**67**	**2**	**27**	**6**

Table 4 (continued). Summary of results of obsidian provenance studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect. Table is continued on next page.

OBSIDIAN SOURCES	RUBY PROJECT SITES					
	35LK3920	35LK4279	35LK4220	10/1819-AW-4	35LK4132	35LK4221
Badger Creek	–	–	–	–	–	1 (2.1%)
Beatys Butte	2 (1.1%)	–	–	–	–	–
Blue Mountain	8 (4.4%)	2 (15.4%)	1 (100.0%)	–	4 (33.3%)	12 (25.5%)
Blue Spring	5 (2.8%)	–	–	–	–	2 (4.3%)
BS/PP/FM	–	–	–	–	–	–
Buck Mountain	39 (21.5%)	3 (23.1%)	–	–	3 (25.0%)	9 (19.1%)
Cougar Butte	–	–	–	–	–	–
Cougar Mountain	–	–	–	–	–	–
Cowhead Lake	52 (28.7%)	2 (15.4%)	–	–	2 (16.7%)	12 (25.5%)
Del Prat Spring	–	–	–	–	–	–
Drews Creek/Butcher Flat	4 (2.2%)	–	–	–	–	–
East Medicine Lake	1 (0.6%)	–	–	–	–	–
GF/LIW/RS	3 (1.7%)	–	–	–	–	1 (2.1%)
Glass Buttes 1	–	–	–	–	–	–
Glass Buttes 3	–	–	–	–	–	–
Glass Mountain	1 (0.6%)	–	–	–	–	–
Grasshopper Group	3 (1.7%)	–	–	–	–	–
Harris Flat	–	–	–	–	–	–
Hawks Valley	–	–	–	–	–	–
Long Valley	–	–	–	–	–	–
Massacre Lake/Guano Valley	2 (1.1%)	–	–	–	–	1 (2.1%)
McComb Butte	–	–	–	1 (100.0%)	–	–
Mosquito Lake	–	–	–	–	–	–
Not Obsidian	–	–	–	–	–	1 (2.1%)
Parsnip Creek	–	–	–	–	–	–
Quartz Mountain	–	–	–	–	–	–
Rainbow Mines	6 (3.3%)	1 (7.7%)	–	–	–	–
Silver Lake/Sycan Marsh	–	–	–	–	–	–
South Warners	1 (0.6%)	–	–	–	–	–
Spodue Mountain	7 (3.9%)	–	–	–	–	1 (2.1%)
Sugar Hill	36 (19.9%)	1 (7.7%)	–	–	3 (25.0%)	3 (6.4%)
Surveyor Spring	–	–	–	–	–	1 (2.1%)
Tank Creek	–	–	–	–	–	–
Tucker Hill	4 (%2.2)	–	–	–	–	–
Unknown Obsidian Varieties	7 (3.9%)	2 (15.4%)	–	–	–	3 (6.4%)
Unknown Vitrophyre Varieties	–	2 (15.4%)	–	–	–	–
Variety 5	–	–	–	–	–	–
Witham Creek	–	–	–	–	–	–
TOTAL	**181**	**13**	**1**	**1**	**12**	**47**

Table 4 (continued). Summary of results of obsidian provenance studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect. Table is continued on next page.

OBSIDIAN SOURCES	RUBY PROJECT SITES					
	35KL1947	35KL3262	35KL3493	35KL3300	35KL3446	35KL3495
Badger Creek	–	–	–	–	–	–
Beatys Butte	–	–	–	–	–	–
Blue Mountain	2 (66.7%)	190 57.9(%)	–	5 (41.7%)	7 (77.8%)	1 (9.1%)
Blue Spring	1 (33.3%)	–	–	–	–	–
BS/PP/FM	–	–	–	–	–	–
Buck Mountain	–	6 (1.8%)	–	–	–	1 (9.1%)
Cougar Butte	–	6 (1.8%)	–	–	–	2 (18.2%)
Cougar Mountain	–	–	–	–	–	–
Cowhead Lake	–	89 (27.1%)	–	2 (16.7%)	–	4 (36.3%)
Del Prat Spring	–	–	–	–	–	–
Drews Creek/Butcher Flat	–	2 (0.6%)	–	–	–	–
East Medicine Lake	–	8 (2.4%)	–	–	–	1 (9.1%)
GF/LIW/RS	–	1 (0.3%)	–	1 (8.3%)	–	–
Glass Buttes 1	–	–	–	–	–	–
Glass Buttes 3	–	–	–	–	–	–
Glass Mountain	–	–	–	–	1 (11.1%)	–
Grasshopper Group	–	6 (1.8%)	–	–	–	–
Harris Flat	–	–	–	–	–	–
Hawks Valley	–	–	–	–	–	–
Long Valley	–	–	–	–	–	–
Massacre Lake/Guano Valley	–	–	–	–	–	–
McComb Butte	–	–	–	–	–	–
Mosquito Lake	–	–	–	–	–	–
Not Obsidian	–	–	–	–	–	1 (9.1%)
Parsnip Creek	–	–	–	–	–	–
Quartz Mountain	–	–	–	–	–	–
Rainbow Mines	–	–	–	–	–	–
Silver Lake/Sycan Marsh	–	2 (0.6%)	–	1 (8.3%)	–	–
South Warners	–	–	–	–	–	–
Spodue Mountain	–	11 (3.4%)	–	3 (25.0%)	–	–
Sugar Hill	–	5 (1.5%)	–	–	1 (11.1%)	–
Surveyor Spring	–	–	1 (100.0%)	–	–	–
Tank Creek	–	–	–	–	–	–
Tucker Hill	–	–	–	–	–	1 (9.1%)
Unknown Obsidian Varieties	–	2 (0.6%)	–	–	–	–
Unknown Vitrophyre Varieties	–	–	–	–	–	–
Variety 5	–	–	–	–	–	–
Witham Creek	–	–	–	–	–	–
TOTAL	**3**	**328**	**1**	**12**	**9**	**11**

Table 4 (continued). Summary of results of obsidian provenance studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect. Table is continued on next page.

OBSIDIAN SOURCES	RUBY PROJECT SITES					
	35KL3447	35KL3449	35KL3448	35KL3472	35KL3307	35KL3451
Badger Creek	–	–	–	–	–	–
Beatys Butte	–	–	–	–	–	–
Blue Mountain	5 (31.2%)	9 (20.5%)	4 (100.0%)	3 (75.0%)	1 (10.0%)	–
Blue Spring	–	–	–	–	–	–
BS/PP/FM	–	–	–	–	–	–
Buck Mountain	–	4 (9.1%)	–	–	3 (30.0%)	1 (20.0%)
Cougar Butte	–	–	–	–	1 (10.0%)	1 (20.0%)
Cougar Mountain	–	–	–	–	–	–
Cowhead Lake	–	13 (29.5%)	–	–	2 (20.0%)	2 (40.0%)
Del Prat Spring	–	–	–	–	–	–
Drews Creek/Butcher Flat	–	1 (2.3%)	–	–	–	–
East Medicine Lake	7 (43.7%)	3 (6.8%)	–	–	1 (10.0%)	–
GF/LIW/RS	–	1 (2.3%)	–	–	–	–
Glass Buttes 1	–	–	–	–	–	–
Glass Buttes 3	–	–	–	–	–	–
Glass Mountain	1 (6.3%)	2 (4.5%)	–	1 (25.0%)	1 (10.0%)	–
Grasshopper Group	1 (6.3%)	4 (9.1%)	–	–	–	–
Harris Flat	–	–	–	–	–	–
Hawks Valley	–	–	–	–	–	–
Long Valley	–	–	–	–	–	–
Massacre Lake/Guano Valley	–	–	–	–	–	–
McComb Butte	–	–	–	–	–	–
Mosquito Lake	–	–	–	–	–	–
Not Obsidian	–	–	–	–	–	–
Parsnip Creek	–	–	–	–	–	–
Quartz Mountain	–	–	–	–	–	–
Rainbow Mines	–	–	–	–	–	–
Silver Lake/Sycan Marsh	1 (6.3%)	1 (2.3%)	–	–	–	–
South Warners	–	–	–	–	–	–
Spodue Mountain	1 (6.3%)	3 (6.8%)	–	–	–	1 (20.0%)
Sugar Hill	–	1 (2.3%)	–	–	–	–
Surveyor Spring	–	–	–	–	–	–
Tank Creek	–	–	–	–	–	–
Tucker Hill	–	2 (4.5%)	–	–	1 (10%)	–
Unknown Obsidian Varieties	–	–	–	–	–	–
Unknown Vitrophyre Varieties	–	–	–	–		–
Variety 5	–	–	–	–	–	–
Witham Creek	–	–	–	–	–	–
TOTAL	**16**	**44**	**4**	**4**	**10**	**5**

Table 4 (continued). Summary of results of obsidian provenance studies of Ruby Pipeline artifacts. Project sites are ordered from east to west along the pipeline transect.

OBSIDIAN SOURCES	RUBY PROJECT SITES		TOTAL
	35KL3447	35KL3451	
Badger Creek	–	–	4
Beatys Butte	–	–	16
Blue Mountain	1 (100%)	8 (80.0%)	273
Blue Spring	–	–	40
BS/PP/FM	–	–	1
Buck Mountain	–	–	176
Cougar Butte	–	1 (10%)	11
Cougar Mountain	–	–	1
Cowhead Lake	–	–	461
Del Prat Spring	–	–	2
Drews Creek/Butcher Flat	–	–	26
East Medicine Lake	–	–	24
GF/LIW/RS	–	–	9
Glass Buttes 1	–	–	1
Glass Buttes 3	–	–	1
Glass Mountain	–	–	7
Grasshopper Group	–	–	18
Harris Flat	–	–	2
Hawks Valley	–	–	1
Long Valley	–	–	9
Massacre Lake/Guano Valley	–	–	32
McComb Butte	–	–	5
Mosquito Lake	–	–	23
Not Obsidian	–	1 (10.0%)	3
Parsnip Creek	–	–	5
Quartz Mountain	–	–	1
Rainbow Mines	–	–	35
Silver Lake/Sycan Marsh	–	–	11
South Warners	–	–	1
Spodue Mountain	–	–	39
Sugar Hill	–	–	140
Surveyor Spring	–	–	850
Tank Creek	–	–	1
Tucker Hill	–	–	27
Unknown Obsidian Varieties	–	–	95
Unknown Vitrophyre Varieties	–	–	2
Variety 5	–	–	1
Witham Creek	–	–	1
TOTAL	**1**	**10**	**2355**

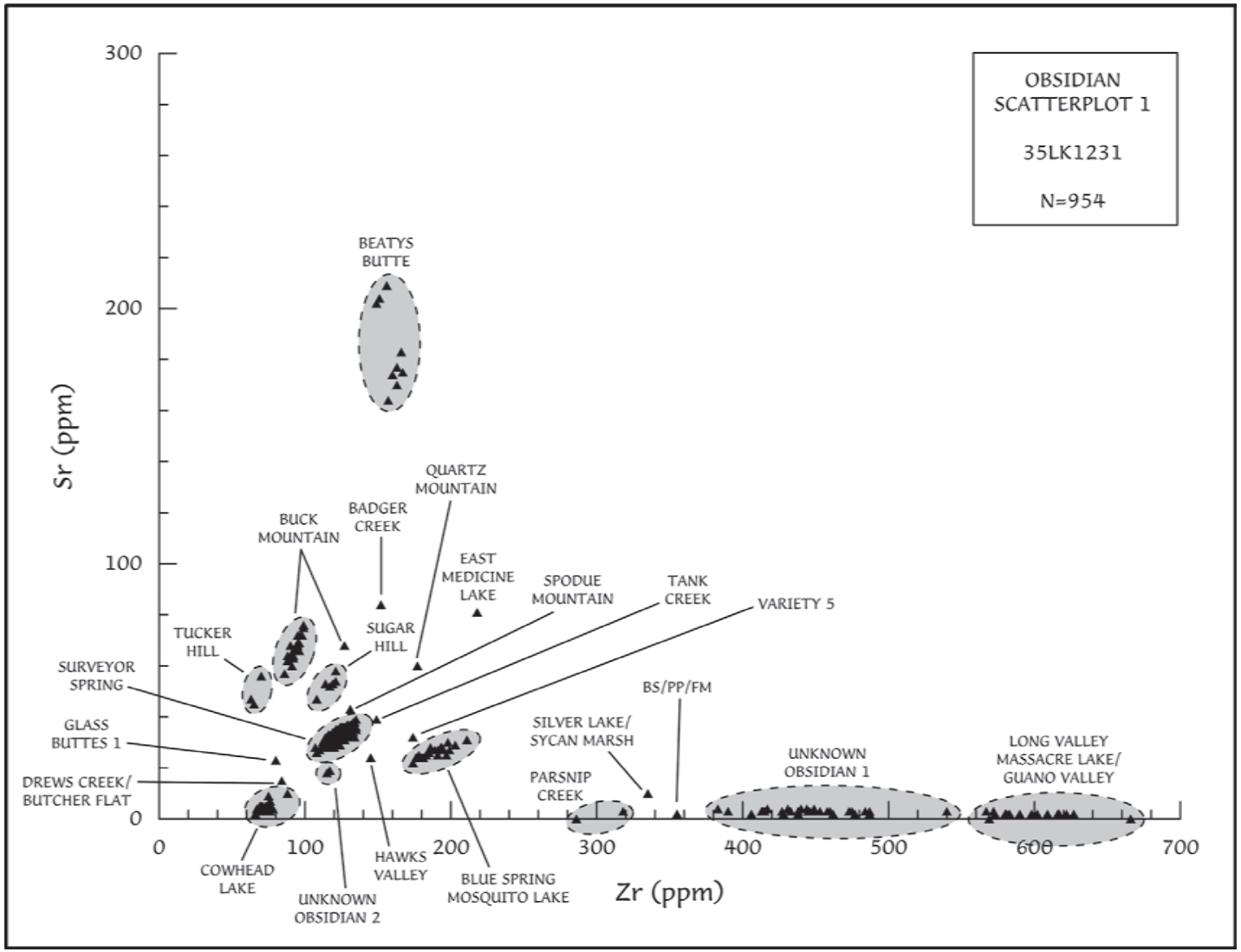

Figure 3. Scatterplot of zirconium (Zr) plotted versus strontium (Sr) for all obsidian artifacts from 35LK1231, the easternmost site in the project area. Individual geochemical sources are more clearly distinguishable when additional trace elements are considered.

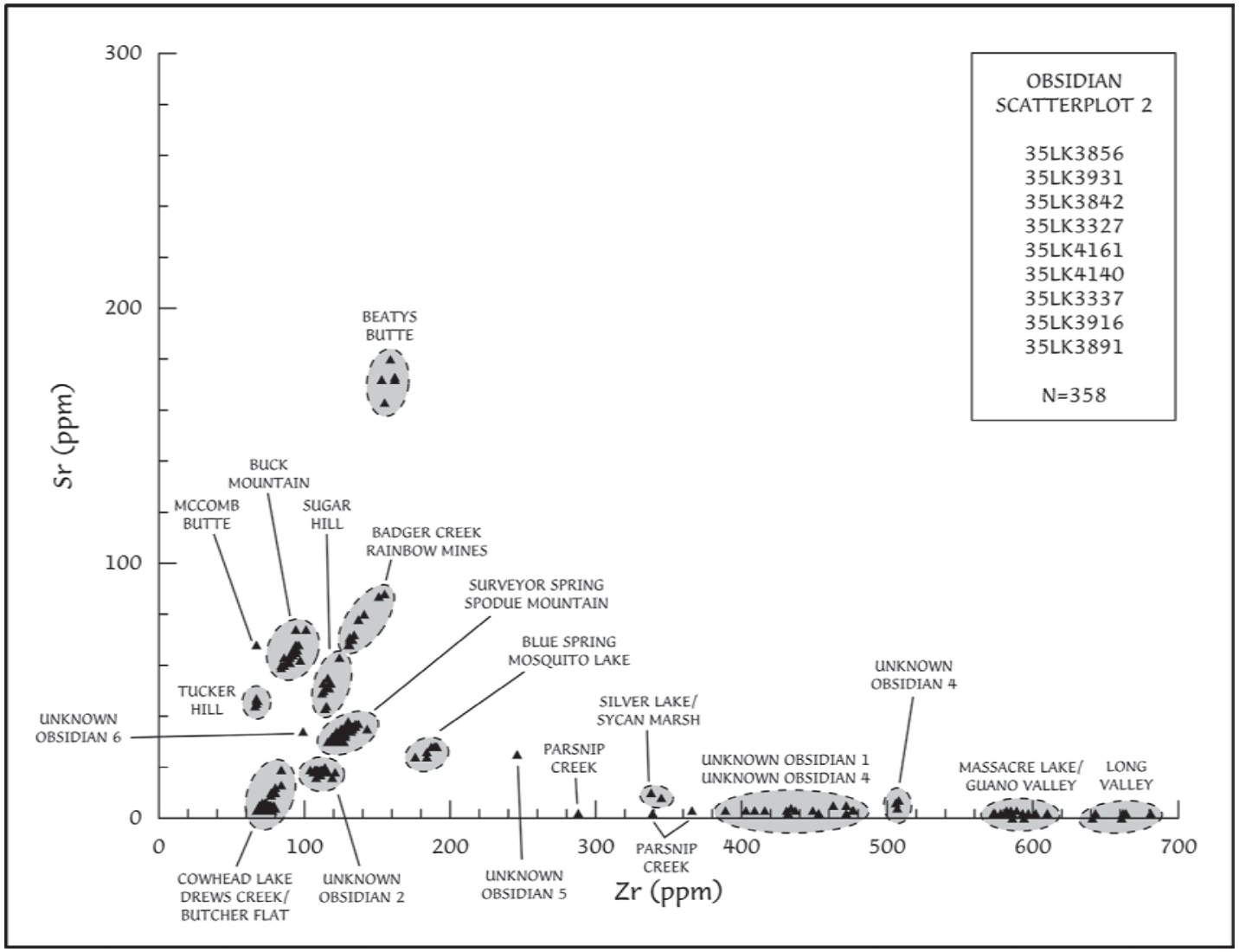

Figure 4. Scatterplot of zirconium (Zr) plotted versus strontium (Sr) for all obsidian artifacts from project sites located in the eastern part of the project corridor between 35LK1231 and Goose Lake. Individual geochemical sources are more clearly distinguishable when additional trace elements are considered.

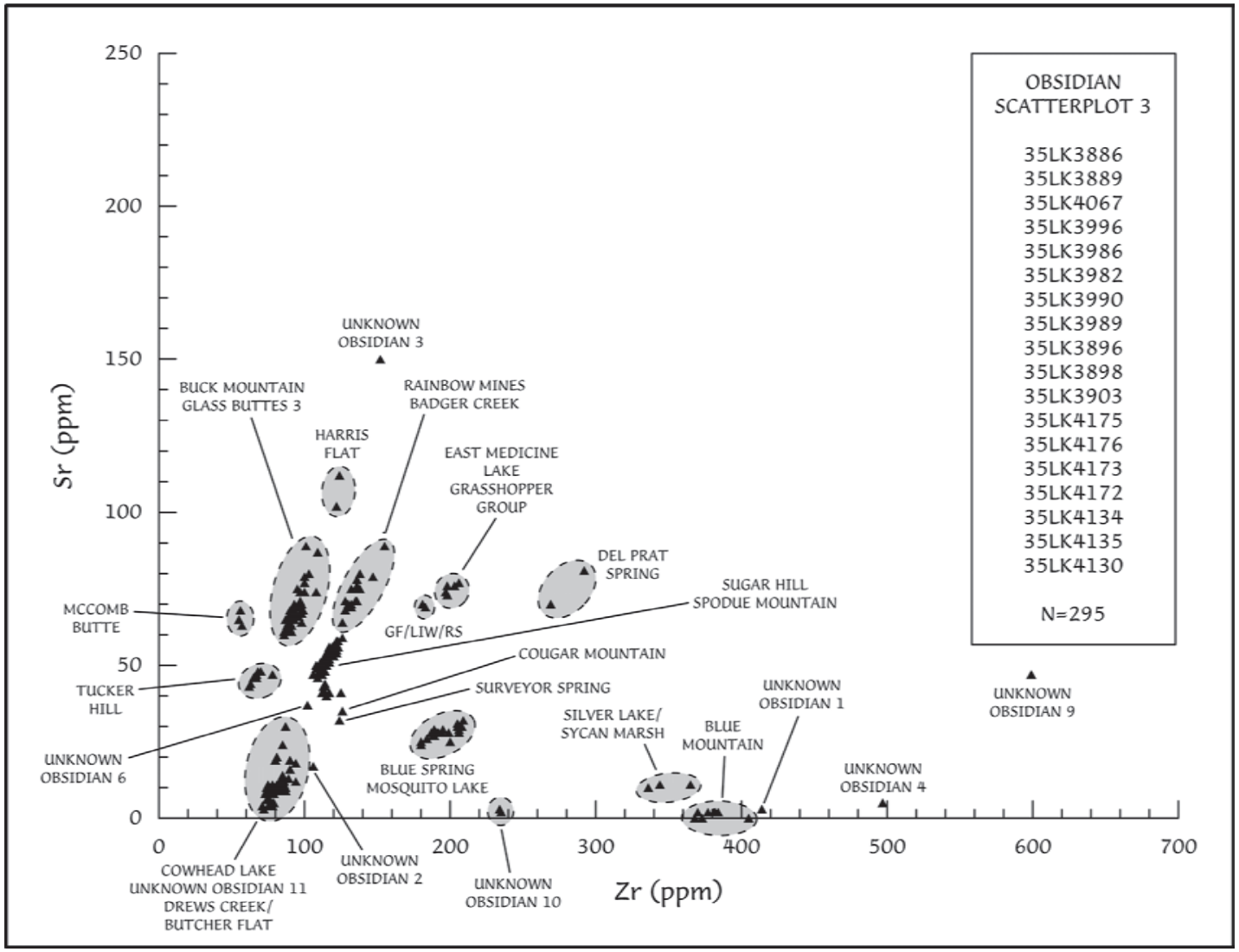

Figure 5. Scatterplot of zirconium (Zr) plotted versus strontium (Sr) for all obsidian artifacts from project sites in the Goose Lake area. Individual geochemical sources are more clearly distinguishable when additional trace elements are considered. The single artifact from the Witham Creek source is not displayed.

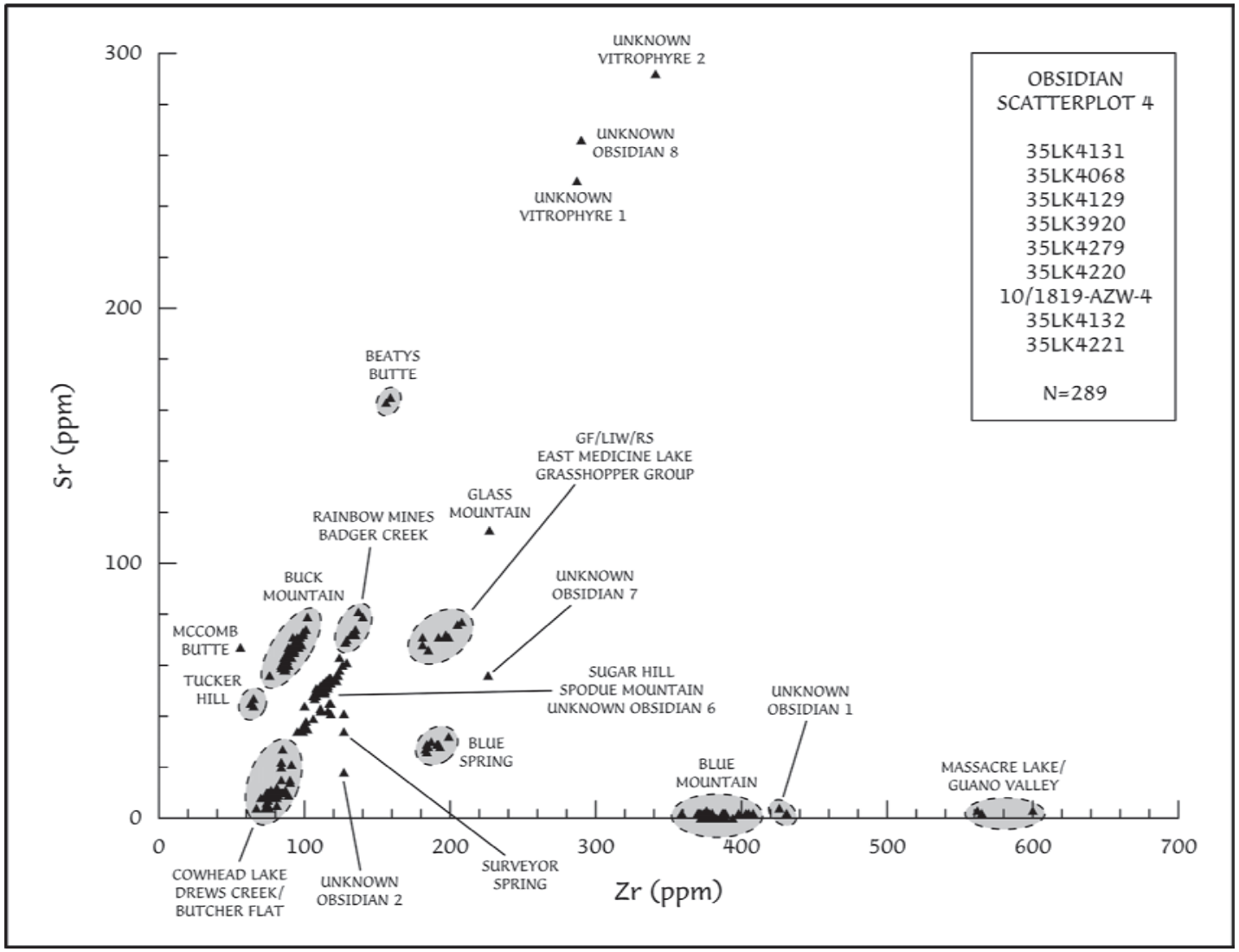

Figure 6. Scatterplot of zirconium (Zr) plotted versus strontium (Sr) for all obsidian artifacts from project sites located between Goose Lake and Yocum Valley. Individual geochemical sources are more clearly distinguishable when additional trace elements are considered.

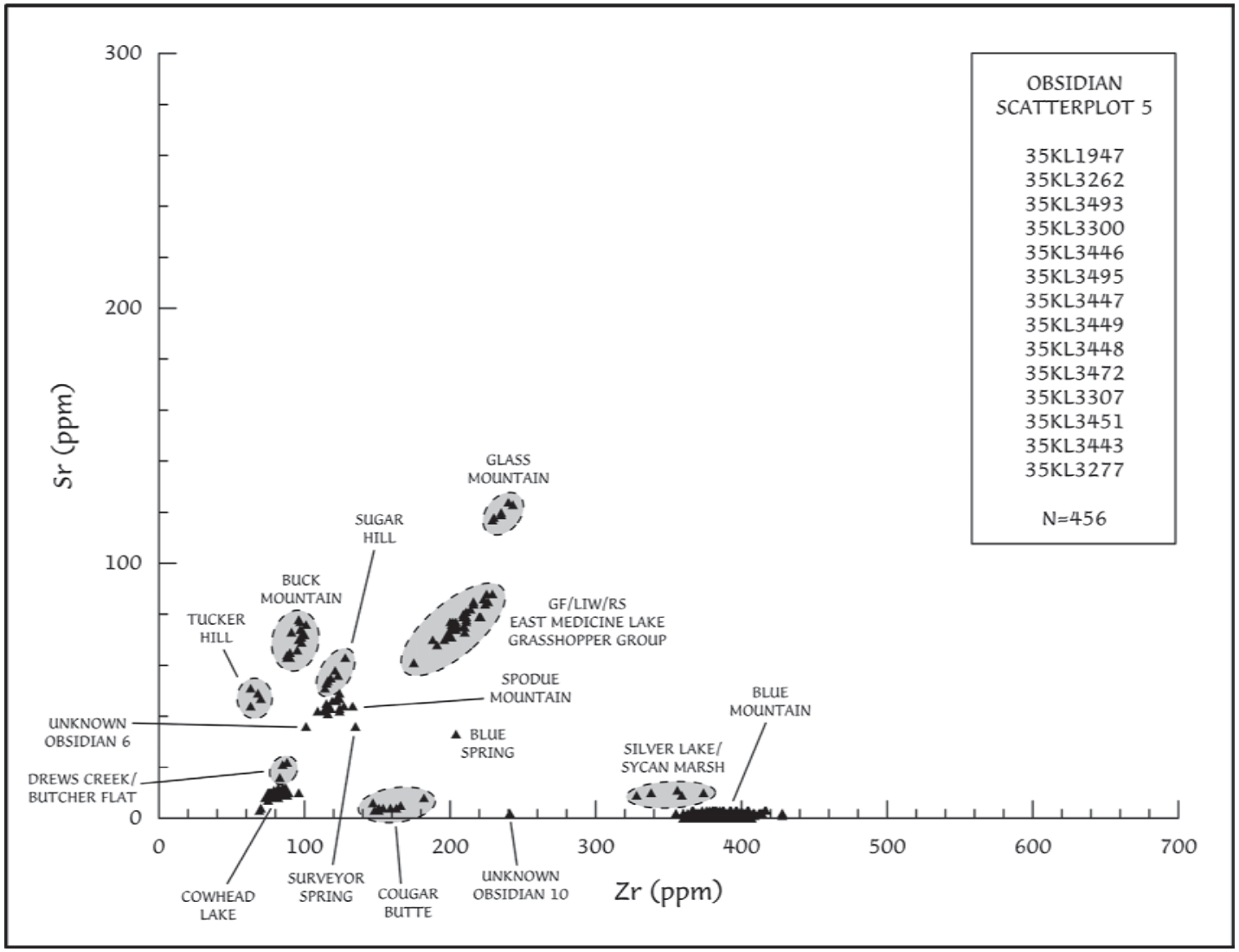

Figure 7. Scatterplot of zirconium (Zr) plotted versus strontium (Sr) for all obsidian artifacts from project sites in the westernmost portion of the project area. Individual geochemical sources are more clearly distinguishable when additional trace elements are considered.

Of the 95 Ruby Pipeline obsidian artifacts whose chemical signatures did not match any known sources in our current laboratory reference collection, the majority (75% or N=71) were found at sites at the extreme eastern end of the project corridor (35LK1231, 35LK3931, 35LK3842, 35LK3327, 35LK4140, and 35LK3337). Almost half of these (N=35) were identified at 35LK1231, the easternmost of the project sites.

Unknown Obsidian 1. Representing approximately half of the total number of artifacts from unidentified obsidian and vitrophyre sources, Unknown Obsidian 1 is the most archaeologically-significant of the unknown obsidian sources found among the Ruby Pipeline Project artifacts. This source is one that we have found on several other occasions at Oregon and California sites near the Oregon-Nevada border and Unknown Obsidian 1 occurs most frequently at Ruby Pipeline Project sites along the eastern end of the project corridor. Most notably, 32 artifacts from Unknown Obsidian 1 were identified at 35KL1231. Recent provenance investigations of artifacts associated with the PDCI Celilo-Uprate Project (Skinner 2015, Thatcher 2015), one whose southernmost sites are located near 35LK1231, also found numerous Unknown Obsidian 1 artifacts along the southern end of that project transect. These intersecting lines of evidence lead us to believe that the source is situated in the general area of 35LK1231, probably somewhere between Irish Hill (located six kilometers north of Highway 140) and the vicinity immediately north of 35KL1231 (situated about 20 km south of Highway 140) The project-wide distribution of Unknown Obsidian 1 is shown in Table 5 and Figure 8 and the rapid eastward-increasing frequency of obsidian from that source is clearly evident on the map.

Unknown Obsidian 2. With 20 identified project-wide artifacts representing approximately 20 percent of the artifacts from unknown obsidian sources, Unknown Obsidian 2 is the second-most common one that was found at the project sites (Table 5). As with the previous unknown source, artifacts from Unknown Obsidian 2 are much more common at sites near the eastern end of the project and it seems likely that the source is located somewhere in this area.

Unknown Obsidian 6. Use of this unknown source is most common at sites in the general Goose Lake vicinity (Table 5 and Figure 8). The largest number of artifacts (N=5) from this group occurs not far west of Goose Lake at 35LK3920 and suggests that outcrops of glass from this source might eventually be located somewhere in this neighborhood.

Unknown Vitrophyre 1 and 2. Although these two vitrophyre sources play only a very minor role as toolstone sources, they deserve a brief mention because of their unusual nature and physical appearance. Both were recovered at 35LK4297 and it is probable that both sources are found somewhere in the immediate vicinity of that site.

The remaining unknown obsidian sources appear only in very small quantities at project sites and the use of these minor unknown obsidian sources is likely to be largely restricted to the local area near the sources. Future attempts at locating these sources will be aided by additional artifact provenance studies in the project area and the sources are likely to be eventually located relatively close to the sites in which they were found as part of the current investigation.

Overall along the entire Oregon segment of the Ruby Pipeline Project, artifacts from unknown obsidian sources were overwhelmingly discovered at sites along the eastern end of the project and, to a lesser extent, the central portion of the study area (Table 5 and Figure 8). The western third of the project corridor was almost completely devoid of unknown sources and future attempts at locating these unknown geologic sources will need to be focused in the region bordering the eastern portion of the project.

Table 5. Unknown obsidian and vitrophyre sources identified at Ruby Pipeline Project sites. Table is continued on next page.

PROJECT SITE	UNKNOWN OBSIDIAN SOURCES											UNKNOWN VITROPHYRE SOURCES		TOTAL
	1	2	3	4	5	6	7	8	9	10	11	1	2	
35LK1231	32	3	–	–	–	–	–	–	–	–	–	–	–	35
35LK3856	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK3931	1	–	–	–	–	–	–	–	–	–	–	–	–	1
35LK3842	8	4	–	–	–	–	–	–	–	–	–	–	–	12
35LK3327	–	4	–	–	–	–	–	–	–	–	–	–	–	4
35LK4161	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4140	1	5	–	1	1	–	–	–	–	–	–	–	–	8
35LK3337	3	3	–	4	–	1	–	–	–	–	–	–	–	11
35LK3916	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK3891	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK3886	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK3889	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4067	–	–	–	1	–	–	–	–	–	–	–	–	–	1
35LK3996	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK3986	–	–	–	–	–	1	–	–	–	–	–	–	–	1
35LK3982	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK3990	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK3989	–	–	–	–	–	–	–	–	–	–	–	–	–	0

Table 5 (continued). Unknown obsidian and vitrophyre sources identified at Ruby Pipeline Project sites. Table is continued on next page.

PROJECT SITE	UNKNOWN OBSIDIAN SOURCES											UNKNOWN VITROPHYRE SOURCES		TOTAL
	1	2	3	4	5	6	7	8	9	10	11	1	2	
35LK3896	–	–	–	–	–	–	–	–	–	1	1	–	–	2
35LK3898	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK3903	–	–	1	–	–	–	–	–	–	–	–	–	–	1
35LK4175	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4176	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4173	1	–	–	–	–	–	–	–	1	–	–	–	–	2
35LK4172	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4134	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4135	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4130	–	1	–	–	–	–	–	–	–	1	–	–	–	2
35LK4131	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4068	–	–	–	–	–	1	–	–	–	–	–	–	–	1
35LK4129	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK3920	2	–	–	–	–	5	–	–	–	–	–	–	–	7
35LK4279	–	–	–	–	–	–	1	1	–	–	–	1	1	4
35KL4220	–	–	–	–	–	–	–	–	–	–	–	–	–	0
10/1819-AZW-4	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4132	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35LK4221	–	1	–	–	–	2	–	–	–	–	–	–	–	3

Table 5 (continued). Unknown obsidian and vitrophyre sources identified at Ruby Pipeline Project sites.

PROJECT SITE	UNKNOWN OBSIDIAN SOURCES											UNKNOWN VITROPHYRE SOURCES		TOTAL
	1	2	3	4	5	6	7	8	9	10	11	1	2	
35KL1947	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3262	–	–	–	–	–	1	–	–	–	1	–	–	–	2
35KL3493	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3300	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3446	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3495	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3447	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3449	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3448	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3472	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3307	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3451	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3443	–	–	–	–	–	–	–	–	–	–	–	–	–	0
35KL3277	–	–	–	–	–	–	–	–	–	–	–	–	–	0
TOTAL	**48**	**21**	**1**	**6**	**1**	**11**	**1**	**1**	**1**	**3**	**1**	**1**	**1**	**97**

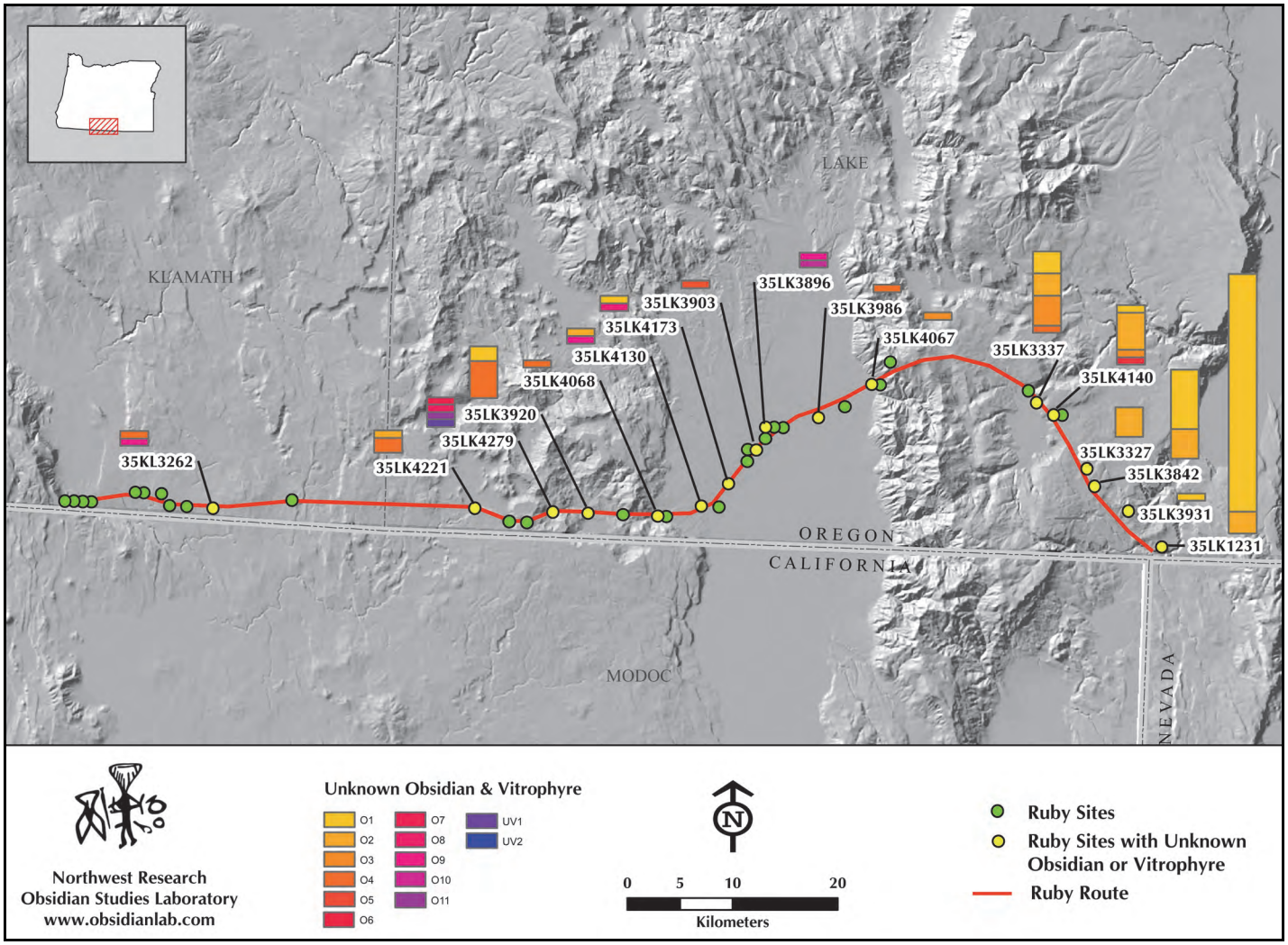

Figure 8. Locations and proportions of obsidian and vitrophyre unknown artifact sources identified at the project sites. In the legend above, O1 = Unknown Obsidian 1, etc., and UV1 = Unknown Vitrophyre 1, etc.

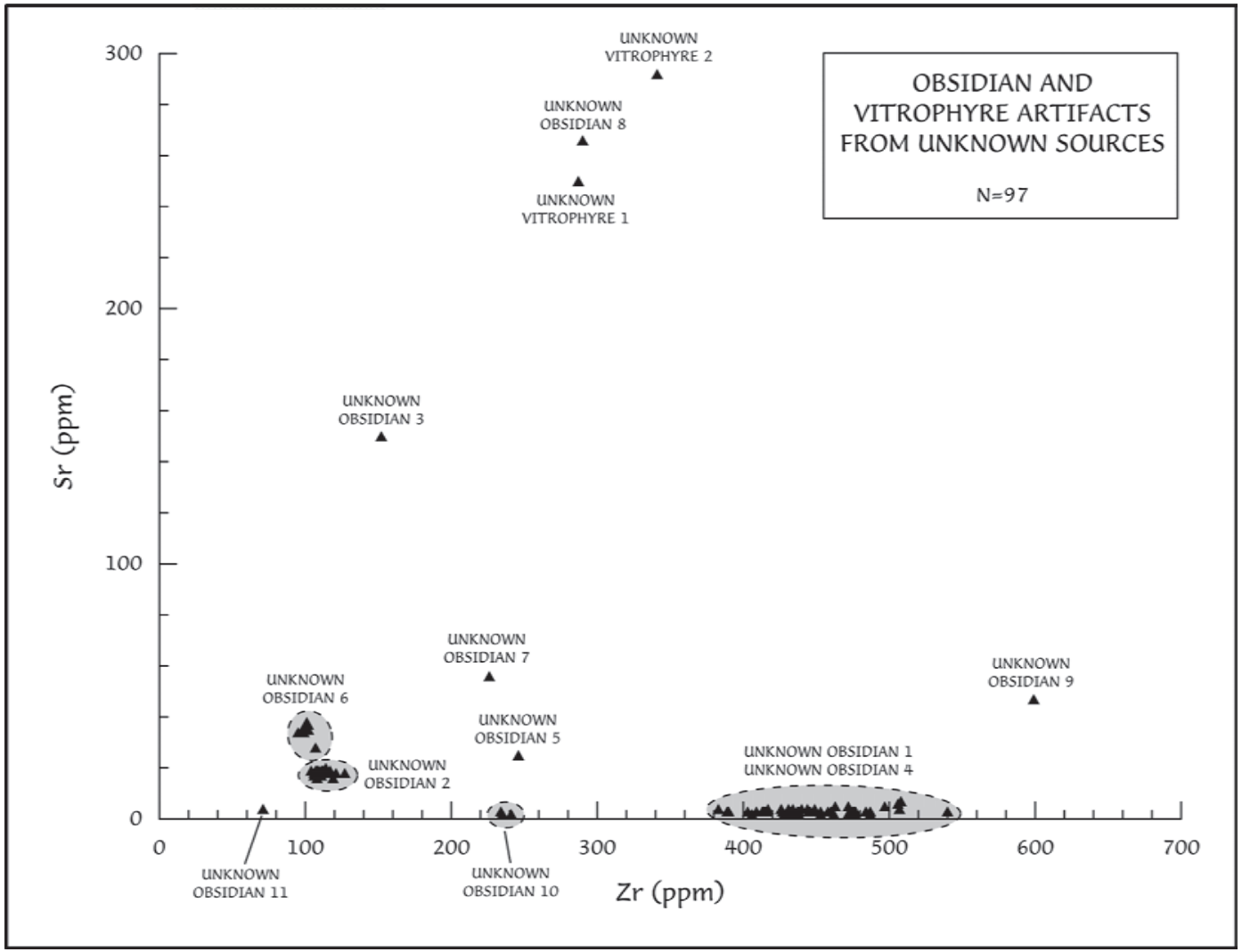

Figure 9. Scatterplot of zirconium (Zr) plotted versus strontium (Sr) for obsidian and vitrophyre artifacts from unknown sources. Unknown sources 1 and 4 are clearly distinguishable from one another when additional trace elements are considered.

X-Ray Fluorescence Analysis of Fine-Grained Volcanic (FGV) Artifacts. Eleven geochemical groups, only four of which were correlated with known sources of fine-grained volcanic toolstone, were identified among the 230 FGV artifacts that were characterized by X-ray fluorescence analysis. The trace element composition of five of the specimens suggests that they are non-volcanic. The locations of the project sites and the identified FGV sources are shown in Table 1 and Figure 2. Analytical results are presented in Table A-1 in the Appendix and are summarized in Table 6 and Figure 2. The results of the trace element studies of the artifacts are summarized in figures 12 and 13.

The Dismal Spring and Pope Spring FGV sources were sampled and geochemically characterized as part of the current project and these results are discussed elsewhere in the Ruby Pipeline Project report. Geologic samples of the widely-used and high-quality Alturas FGV toolstone that have been analyzed by Northwest Research originate from several locations immediately west of the Warner Mountains of northeastern California and were first recognized in the Alturas area. Outcrops of the Coyote Spring FGV source material, also a high-quality and widely-utilized prehistoric toolstone source, are found at many outcrops in the Nut Mountain area of northwestern Nevada.

FGV Artifacts from Known Sources. Eighty-one of the 230 analyzed FGV artifacts were correlated with known Oregon, California, and Nevada sources - Alturas, Coyote Spring, Dismal Spring, and Pope Spring - contained in the laboratory source reference database. An additional named source, Pope Spring B, was not located as part of the current investigation. Four characterized unknown specimens from 35LK3327 were assigned the Pope Spring B name on its basis of their proximity to Pope Spring and the presence of unmodified surface cortex on all four pieces.

FGV Artifacts from Unknown Sources. Given the dearth of FGV source studies in the vicinity of the project sites, we were not surprised to find that many of the FGV artifacts (N=140) were from unknown sources (see Figure 10). We identified five different geochemical groupings, the majority of them from two sources (Unknown FGV A and Unknown FGV B). Thirty-seven of the 230 analyzed FGV artifacts were placed into an undifferentiated (Unknown FGV) source category, i.e., they showed no tendencies to cluster as geochemical groups and showed little similarity in composition to the Unknown FGV groups (A-E and Pope Spring B) or to any previously identified sources.

The Unknown FGV A artifacts (N=49) were found primarily at sites in the immediate Goose Lake area and the vicinity not far to the west of Goose Lake (Figure 10). One hundred percent of the 11 unknown FGV artifacts from 35LK4068 fell into the Unknown FGV A group and any search for the geologic origins of that source would have to begin at that site location.

However, artifacts from the other main unknown FGV source - Unknown FGV B (N=40) - are found over a much more widely dispersed geographic area and examples were identified at sites ranging from 35LK1231 at the eastern end of the project to 35KL3945 near the western end of the project corridor (Figure 11). Given the often local nature of most FGV toolstone procurement activities, it seems likely that the widespread distribution of this source reflects the generalized availability of this toolstone along much of the study area.

The results of the trace element studies summarized in Table 6 and figures 10, 11, 12, and 13 suggest that FGV material procurement at sites along the project corridor was generally a local activity and that longer-distance procurement of FGV toolstone was much more the exception than the rule. Artifacts from FGV sources are often larger in size than their counterparts made of other materials and the frequency of surface cortex is usually much higher, characteristics that point to the local procurement of the largest proportion of most of the FGV raw materials.

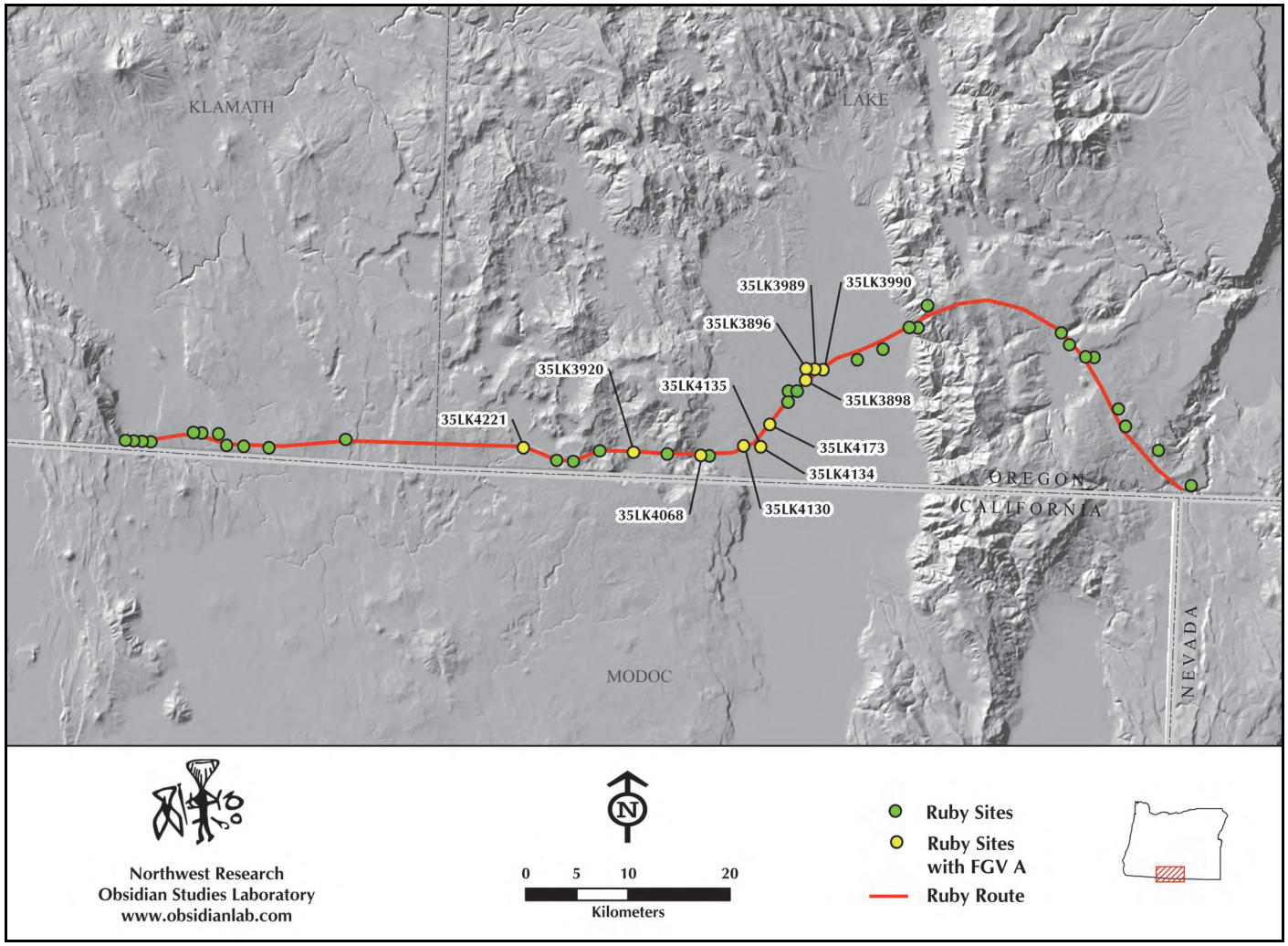

Figure 10. The labeled sites mark the locations at which Unknown FGV A was identified in the archaeological assemblages.

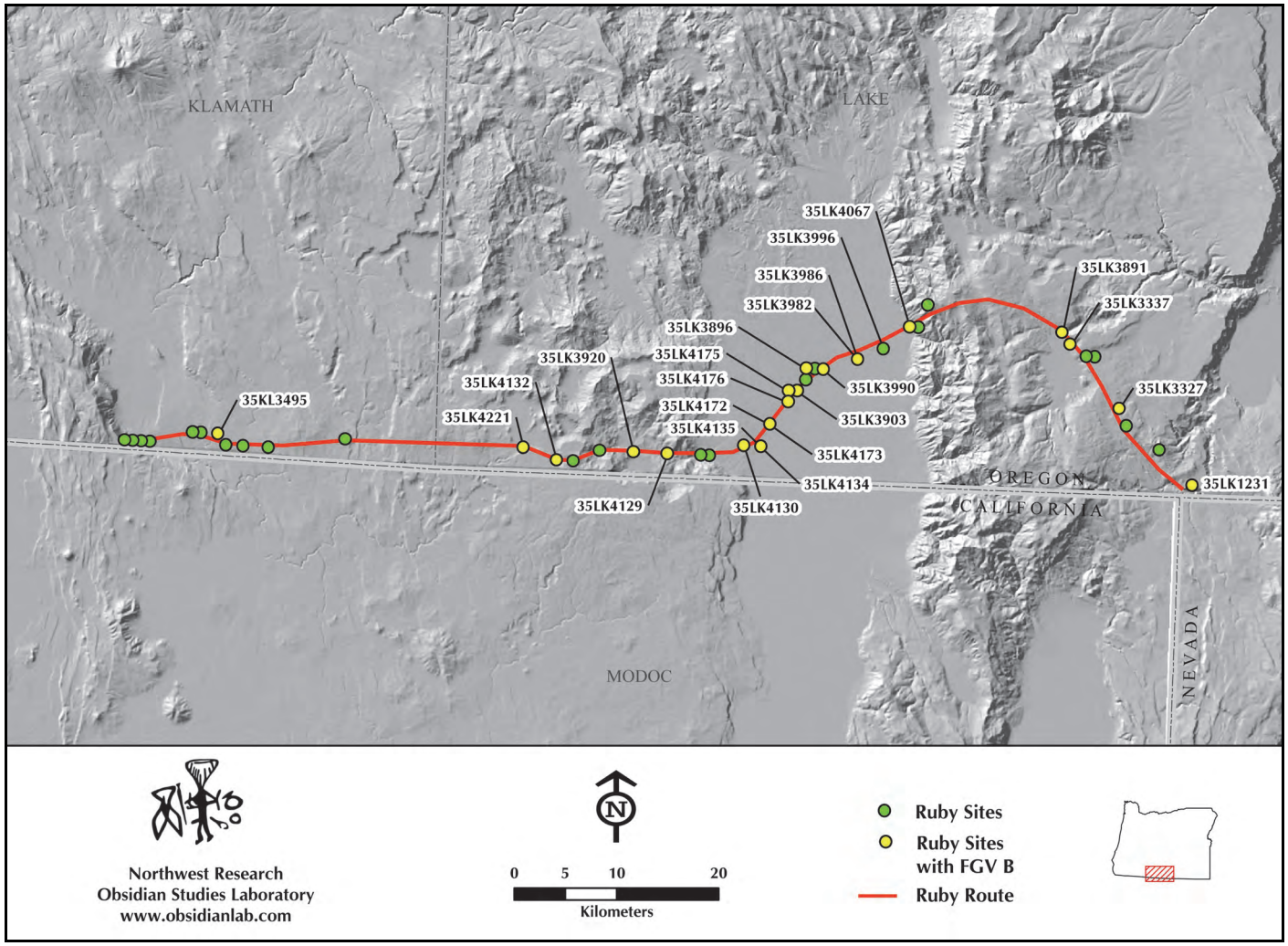

Figure 11. The labeled sites mark the locations at which Unknown FGV B was identified in the archaeological assemblages.

Table 6. Summary of FGV provenance studies of Ruby Pipeline artifacts. Project sites with analyzed FGV artifacts are ordered from east to west along the pipeline transect. Table is continued on next page.

PROJECT SITE	FINE-GRAINED VOLCANIC (FGV) ARTIFACT SOURCES												TOTAL
							UNKNOWN FGV SOURCES						
	ALTURAS	COYOTE SPRING	DISMAL SPRING	NOT FGV	POPE SPRING	POPE SPRING B	A	B	C	D	E	UND*	
35LK1231	4	2	23	–	–	–	–	6	3	–	1	6	45
35LK3856	–	–	1	–	–	–	–	–	–	–	–	–	1
35LK3842	–	1	14	–	1	–	–	–	–	–	–	1	17
35LK3327	1	–	3	–	1	4	–	1	–	–	–	1	11
35LK4140	–	–	3	1	–	–	–	–	–	–	–	4	8
35LK3337	–	–	3	–	–	–	–	1	–	–	1	1	6
35LK3891	–	–	1	–	–	–	–	1	–	–	–	–	2
35LK4067	1	–	–	–	–	–	–	2	–	–	–	–	3
35LK3996	2	–	–	–	–	–	–	2	–	–	–	–	4
35LK3986	4	–	–	–	–	–	–	1	–	–	–	–	5
35LK3982	–	–	–	–	–	–	–	1	–	–	–	–	1
35LK3990	1	–	–	–	–	–	2	2	–	–	–	–	5
35LK3989	1	–	–	–	–	–	1	–	–	–	–	1	3
35LK3896	1	–	–	–	–	–	2	2	–	–	–	–	5
35LK3898	1	–	–	–	–	–	1	–	–	–	–	1	3
35LK3903	–	–	–	–	–	–	1	1	–	–	–	–	2

* UND = Undifferentiated FGV sources that do not fall into recognizable geochemical groups.

Table 6 (continued). Summary of FGV provenance studies of Ruby Pipeline artifacts. Project sites with analyzed FGV artifacts are ordered from east to west along the pipeline transect.

PROJECT SITE	FINE-GRAINED VOLCANIC (FGV) ARTIFACT SOURCES												TOTAL
							UNKNOWN FGV SOURCES						
	ALTURAS	COYOTE SPRING	DISMAL SPRING	NOT FGV	POPE SPRING	POPE SPRING B	A	B	C	D	E	UND*	
35LK4175	–	–	–	–	–	–	–	1	–	–	–	–	1
35LK4176	–	–	–	–	–	–	–	1	–	–	–	–	1
35LK4173	3	–	–	1	–	–	4	3	1	–	–	3	15
35LK4134	1	–	–	–	–	–	7	1	1	–	–	1	11
35LK4135	–	–	–	–	–	–	3	2	–	–	–	–	5
35LK4130	1	–	–	–	–	–	8	3	2	–	–	1	15
35LK4068	–	–	–	–	–	–	11	–	–	–	–	–	11
35LK4129	–	–	–	–	–	–	–	1	–	–	–	–	1
35LK3920	6	–	–	3	–	–	8	5	2	1	1	5	31
35LK4279	–	–	–	–	–	–	–	–	–	–	–	4	4
35LK4132	–	–	–	–	–	–	–	1	–	–	–	1	2
35LK4221	–	–	–	–	–	–	1	1	–	1	–	1	4
35LK3262	1	–	–	–	–	–	–	–	–	–	–	1	2
35KL3495	–	–	–	–	–	–	–	1	–	–	–	–	1
35KL3447	–	–	–	–	–	–	–	–	–	–	–	1	1
35KL3449	–	–	–	–	–	–	–	–	–	–	–	4	4
TOTAL	**28**	**3**	**48**	**5**	**2**	**4**	**49**	**40**	**9**	**2**	**3**	**37**	**230**

* UND = Undifferentiated FGV sources that do not fall into recognizable geochemical groups.

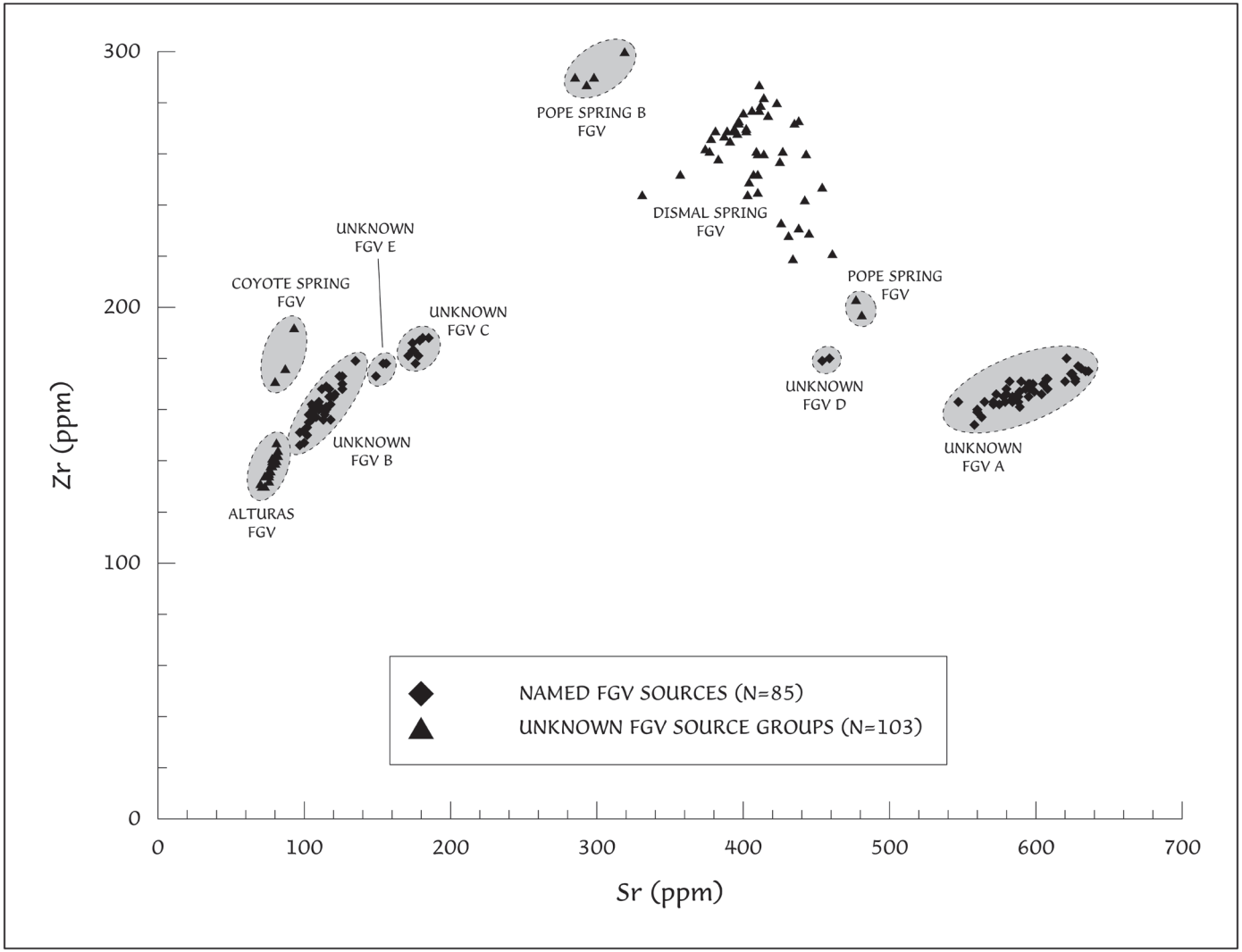

Figure 12. Scatterplot of strontium (Sr) plotted versus zirconium (Zr) for all analyzed FGV artifacts correlated with known and unknown geochemical source groups. Non-FGV artifacts are not shown on the above plot.

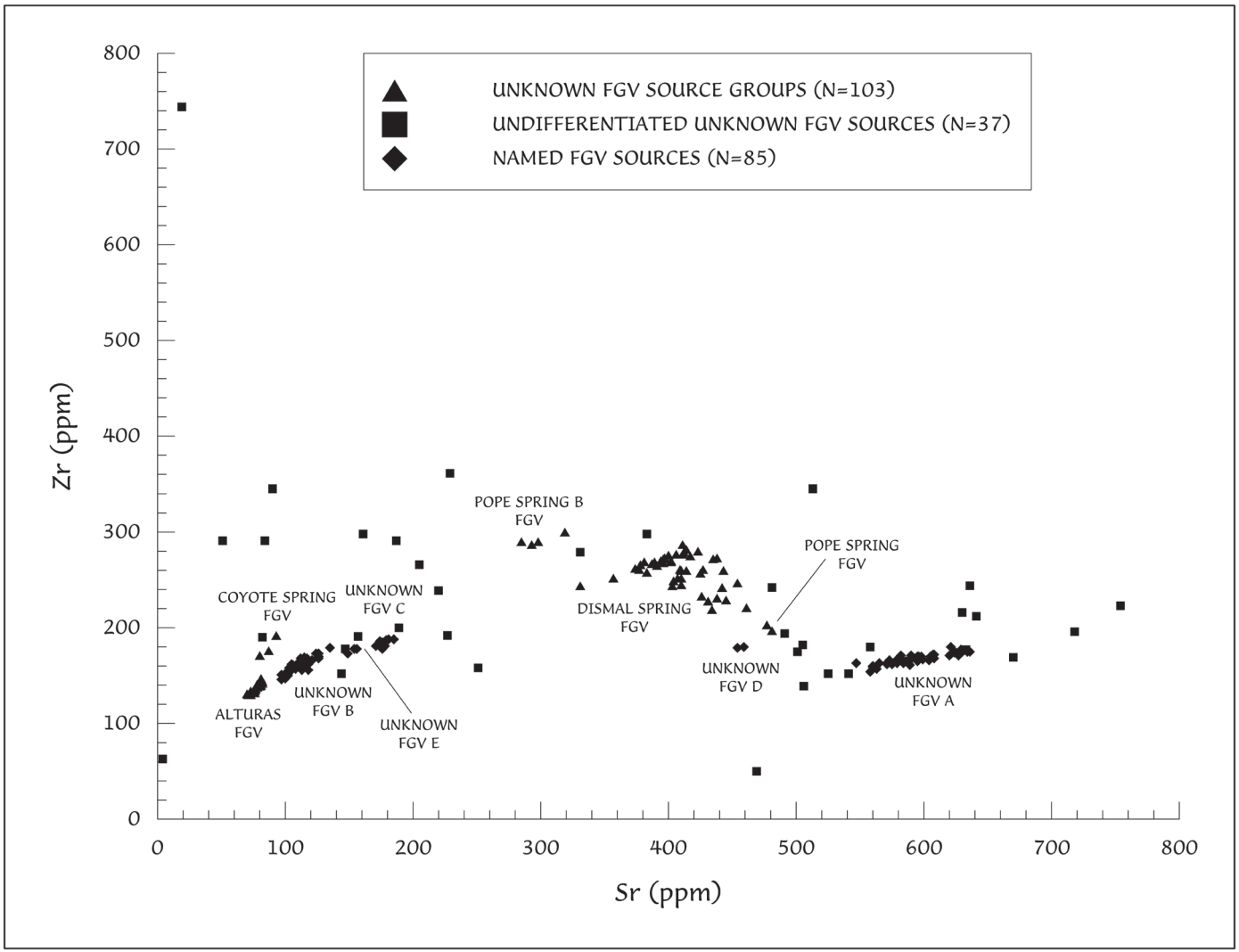

Figure 13. Scatterplot of strontium (Sr) plotted versus zirconium (Zr) for all analyzed FGV artifacts. Non-FGV artifacts are not shown on the above plot.

Additional details about specific analytical methods and procedures used for the geochemical analysis of the elements reported in Table A-1 are available at the Northwest Research Obsidian Studies Laboratory World Wide Web site at *www.obsidianlab.com* (Northwest Research 2015a).

Obsidian Hydration Analysis. Two-thousand and seventy-one of the obsidian (and FGV) specimens that were analyzed by X-ray fluorescence analysis were prepared for obsidian hydration analysis and yielded 2,600 measurable rims. The specimen slides are curated at the Northwest Research Obsidian Studies Laboratory under accession numbers 2012-106, 2012-111, 2012-121, 2012-122, 2012-140, 2012-153, 2013-02, 2013-11, 2013-15, 2013-21, 2013-21, 2013-22, 2013-34, and 2013-35. The results are reported in Table B-1 in the Appendix and are summarized in tables 7 through 57 (east to west along the project corridor).

Due to the large quantity of measurable hydration rims recorded during analysis of the artifacts, the considerable number of sites chosen for hydration analysis (N=51), and the substantial disparity in sample size among the analyzed artifacts from the sites (N=1 to N=1,139), we have chosen to summarize the results using basic summary statistics - minimum hydration value (in microns), maximum hydration value, median value, standard deviation, and total number of successfully measured hydration rims. An overall summarization of the hydration analysis results is shown in Table 7. Hydration data for all sites in which hydration analysis was carried out is presented in tables 8 through 57. While the table notations regarding S.D. (standard deviation) and total (total number of hydration rims found, including multiple rims) are designated only in Table 7, the same convention is followed throughout the remainder of the hydration summary tables. The NA designation in a summary table indicates that an artifact from the indicated source was analyzed but that no measurable hydration rim was found.

We emphasize here that sample size effects at many of the sites with few analyzed artifacts render these summary statistics only as very approximate guides for interpreting the hydration data. Nevertheless, the data may be useful in looking at some of the individual sites as well as providing information that can be useful in intersite comparisons.

Given the consideration that must be applied to the previously mentioned sample size effects, the minimum and maximum hydration rim values (and range of values) shown in tables 8 through 57 can be used to gauge the approximate occupational span at individual sites. The median rim value may furnish clues concerning the period of maximum occupational intensity at a site, and the standard deviation is an indicator of the overall characteristics of dispersion for the rim measurements.

Similarly, when sample sizes are adequate at sites in which obsidian raw material is found, the examination of diachronic production rate curves - the distribution of rim measurements with rim values as the x-axis and number of rims as the y-axis - may also be very informative (Ericson 1981; Singer and Ericson 1977). For the Ruby Project, 35LK1231 provides the premier example of this type of curve.

Although fine-grained volcanic materials rarely yield measurable hydration rims, we found examples on three project artifacts from the Alturas FGV and Unknown FGV B sources (from 35LK3996, 35LK3986, and 35LK3891). Most artifacts from these sources were excluded from hydration analysis due to the high crystalline component of the raw material but these three examples were chosen because of their relatively glassy texture and suspected rhyolitic composition.

Additional details about specific analytical methods used for the preparation and measurement of hydration rims reported in Table B-1 are available at the Northwest Research Obsidian Studies Laboratory website at *www.obsidianlab.com* (Northwest Research 2015b).

Table 7. Summary of results of obsidian hydration measurements of all project artifacts. Continued on next page.

PROJECT SITE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D. *	TOTAL **
35LK1231	1.1	15.8	6.2	2.3	1,139
35LK3856	4.6	12.1	8.1	2.7	8
35LK3931	1.9	10.6	5.4	1.8	44
35LK3842	1.8	9.5	4.9	1.7	68
35LK3327	1.7	9.1	6.1	1.7	47
35LK4161	1.6	6.1	4.1	1.2	13
35LK4140	1.4	8.2	4.3	1.6	46
35LK3337	1.3	8.0	3.3	1.5	128
35LK3916	1.3	8.4	3.9	2.1	11
35LK3891	1.4	9.2	4.3	2.0	21
35LK3886	1.4	2.4	1.9	0.4	9
35LK3889	3.4	6.6	4.5	0.9	11
35LK4067	1.8	6.9	4.4	1.4	7
35LK3996	4.2	8.5	5.3	1.4	6
35LK3986	3.6	8.3	4.7	1.4	13
35LK3982	3.6	4.6	4.0	0.4	9
35LK3990	5.2	6.1	5.7	0.4	5
35LK3989	2.3	8.6	5.4	1.5	19
35LK3896	1.9	12.4	5.9	1.7	33
35LK3898	1.5	7.7	4.3	1.7	10
35LK3903	4.1	6.5	5.2	0.8	9
35LK4175	NA	NA	NA	NA	0
35LK4176	3.6	6.9	5.0	1.5	5
35LK4173	1.7	9.4	5.6	1.6	34
35LK4172	5.4	7.9	6.6	0.8	5
35LK4134	1.1	7.1	4.4	1.4	50

* S.D. = Standard deviation of all hydration rim measurements; ** Total number of measurable rims found on artifact(s).

Table 7 (continued). Summary of results of obsidian hydration measurements of all project artifacts.

PROJECT SITE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D. *	TOTAL **
35LK4135	1.5	8.5	5.0	1.8	14
35LK4130	1.9	10.2	5.2	1.8	69
35LK4131	3.4	3.6	3.5	0.1	2
35LK4068	1.9	6.5	4.4	1.2	28
35LK4129	4.7	7.6	6.1	1.1	4
35LK3920	1.0	12.5	3.5	1.5	192
35LK4279	1.6	6.3	3.9	1.5	10
35LK4220	1.9	1.9	NA	NA	1
10/1819-AZW-4	3.5	3.5	NA	NA	1
35LK4132	1.5	3.3	2.0	0.6	12
35LK4221	1.1	8.5	3.4	1.6	42
35KL1947	1.3	2.6	1.9	0.6	3
35KL3262	1.3	7.0	3.2	1.3	347
35KL3493	9.0	9.0	NA	NA	1
35KL3300	1.5	6.1	3.1	2.0	10
35KL3446	1.4	2.9	1.9	0.4	9
35KL3495	1.6	6.5	4.6	1.7	12
35KL3447	1.5	6.5	3.3	1.5	18
35KL3449	1.6	7.6	3.7	1.6	43
35KL3448	2.0	3.5	2.6	0.5	4
35KL3472	2.2	4.6	3.1	0.9	4
35KL3307	1.5	6.0	3.4	1.5	10
35KL3451	2.1	3.3	2.9	0.5	4
35KL3443	5.0	5.0	NA	NA	1
35KL3277	1.4	3.3	2.4	0.7	10
TOTAL					**2,601**

* S.D. = Standard deviation of all hydration rim measurements; ** Total number of measurable rims found on artifact(s).

Table 8. Summary of results of obsidian hydration analysis of artifacts from 35LK1231.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Badger Creek	4.6	4.6	NA	NA	1
Beatys Butte	2.8	5.6	4.2	0.9	10
Blue Spring	2.4	7.0	4.8	1.5	8
BS/PP/FM	8.4	8.4	NA	NA	1
Buck Mountain	1.1	10.6	5.0	2.1	23
Cowhead Lake	1.2	9.6	5.0	1.9	106
Drews Creek/Butcher Flat	6.0	6.0	NA	NA	1
East Medicine Lake	6.3	7.9	7.1	0.8	2
Glass Buttes 1	3.0	4.9	4.0	0.9	2
Hawks Valley	4.3	4.3	NA	NA	1
Long Valley	1.2	7.5	5.3	2.4	4
Massacre Lake/Guano Valley	1.1	10.6	5.7	1.8	20
Mosquito Lake	1.3	7.0	4.7	1.7	18
Parsnip Creek	6.0	9.1	7.5	1.5	2
Quartz Mountain	NA	NA	NA	NA	0
Silver Lake/Sycan Marsh	1.4	5.1	3.8	1.7	3
Spodue Mountain	6.6	6.6	NA	NA	1
Sugar Hill	1.8	7.2	4.5	1.8	7
Surveyor Spring	1.1	15.8	6.6	2.4	884
Tank Creek	4.5	6.1	5.3	0.8	2
Tucker Hill	2.6	4.7	4.0	1.0	3
Unknown Obsidian 1	1.4	6.3	4.5	1.4	33
Unknown Obsidian 2	2.8	7.7	5.2	1.6	5
Variety 5	1.6	6.2	3.9	2.3	2
TOTAL					**1,139**

Table 9. Summary of results of obsidian hydration analysis of artifacts from 35LK3856.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Cowhead Lake	5.0	6.2	5.6	0.6	2
Surveyor Spring	4.6	12.1	8.9	2.7	6
TOTAL					**8**

Table 10. Summary of results of obsidian hydration analysis of artifacts from 35LK3931.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Cowhead Lake	2.2	6.4	4.5	1.4	13
Surveyor Spring	1.9	10.6	5.8	1.8	30
Unknown Obsidian 1	7.0	7.0	NA	NA	1
TOTAL					**44**

Table 11. Summary of results of obsidian hydration analysis of artifacts from 35LK3842.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Buck Mountain	3.1	8.1	5.6	2.0	5
Cowhead Lake	2.0	8.1	4.6	1.3	22
Long Valley	2.4	4.9	4.1	0.9	5
Massacre Lake/Guano Valley	4.0	6.1	5.5	0.6	2
Surveyor Spring	1.8	9.5	5.8	2.1	22
Unknown Obsidian 1	3.1	4.6	3.9	0.4	8
Unknown Obsidian 2	2.0	4.1	3.4	0.9	4
TOTAL					**68**

Table 12. Summary of results of obsidian hydration analysis of artifacts from 35LK3327.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Badger Creek	3.5	3.5	NA	NA	1
Beatys Butte	4.5	4.5	NA	NA	1
Buck Mountain	3.6	3.6	NA	NA	1
Cowhead Lake	1.7	6.6	4.8	1.8	14
Massacre Lake/Guano Valley	7.4	7.4	NA	NA	1
Spodue Mountain	6.4	6.4	NA	NA	1
Sugar Hill	6.4	6.5	6.5	0.0	2
Surveyor Spring	5.4	9.1	7.2	1.0	22
Unknown Obsidian 2	5.0	6.5	5.7	0.6	4
TOTAL					**47**

Table 13. Summary of results of obsidian hydration analysis of artifacts from 35LK4161.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Cowhead Lake	2.6	5.1	3.9	0.6	10
Surveyor Spring	1.6	6.1	4.5	2.1	3
TOTAL					**13**

Table 14. Summary of results of obsidian hydration analysis of artifacts from 35LK4140

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Buck Mountain	2.0	2.0	NA	NA	1
Cowhead Lake	1.4	8.2	4.2	1.5	18
Massacre Lake/Guano Valley	1.7	5.5	3.9	1.3	4
Parsnip Creek	4.1	4.1	NA	NA	1
Rainbow Mines	4.8	6.9	5.9	1.1	2
Sugar Hill	1.5	6.6	4,1	2.5	2
Surveyor Spring	2.8	8.1	5.4	1.5	10
Tucker Hill	1.9	1.9	NA	NA	1
Unknown Obsidian 1	3.3	3.3	NA	NA	1
Unknown Obsidian 2	3.0	5.2	4.1	0.7	5
Unknown Obsidian 3	NA	NA	NA	NA	0
Unknown Obsidian 5	2.9	2.9	NA	NA	1
TOTAL					**46**

Table 15. Summary of results of obsidian hydration analysis of artifacts from 35LK3337.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Beatys Butte	1.6	3.1	2.1	0.7	3
Blue Spring	1.9	5.3	3.0	1.3	4
Buck Mountain	1.3	5.6	2.7	1.3	11
Cowhead Lake	1.7	6.3	3.3	1.5	43
Drews Creek/Butcher Flat	2.3	5.9	4.1	1.5	3
Massacre Lake/Guano Valley	1.7	4.9	2.9	1.0	9
McComb Butte	1.4	1.4	NA	NA	1
Mosquito Lake	3.2	5.9	4.6	1.3	2
Parsnip Creek	3.3	3.3	NA	NA	1
Rainbow Mines	2.3	6.4	3.4	1.4	6
Silver Lake/Sycan Marsh	5.6	5.7	5.7	0.0	2
Spodue Mountain	NA	NA	NA	NA	0
Sugar Hill	2.0	2.7	2.5	0.3	4
Surveyor Spring	1.3	8.0	3.7	1.9	21
Tucker Hill	1.6	4.4	3.3	1.1	7
Unknown Obsidian 1	2.1	5.9	4.2	1.7	5
Unknown Obsidian 2	2.4	4.8	3.4	1.0	3
Unknown Obsidian 4	3.7	4.7	4.2	0.5	2
Unknown Obsidian 6	2.3	2.3	NA	NA	1
TOTAL					**128**

Table 16. Summary of results of obsidian hydration analysis of artifacts from 35LK3916.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Spring	1.3	1.3	NA	NA	1
Buck Mountain	4.1	4.2	4.1	0.1	2
Cowhead Lake	1.3	5.0	3.2	1.7	4
Long Valley	1.9	8.4	3.4	1.5	4
TOTAL					**11**

Table 17. Summary of results of obsidian hydration analysis of artifacts from 35LK3891.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Beatys Butte	1.4	3.3	2.3	0.9	2
Buck Mountain	3.1	3.1	NA	NA	1
Cowhead Lake	3.4	6.6	4.7	1.2	7
Massacre Lake/Guano Valley	4.6	4.6	NA	NA	1
Mosquito Lake	5.1	5.1	NA	NA	1
Parsnip Creek	5.0	5.0	NA	NA	1
Rainbow Mines	1.8	6.1	3.4	1.9	3
Silver Lake /Sycan Marsh	1.7	1.7	NA	NA	1
Sugar Hill	1.8	1.8	NA	NA	1
Surveyor Spring	8.0	9.2	8.6	0.6	2
Unknown FGV B	4.2	4.2	NA	NA	1
TOTAL					**21**

Table 18. Summary of results of obsidian hydration analysis of artifacts from 35LK3886.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Cowhead Lake	1.4	2.3	1.7	0.4	3
Drews Creek/Butcher Flat	1.5	2.4	2.0	0.3	6
TOTAL					**9**

Table 19. Summary of results of obsidian hydration analysis of artifacts from 35LK3889.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Buck Mountain	4.0	4.5	4.2	0.2	2
Cowhead Lake	3.4	6.6	4.6	1.0	8
Sugar Hill	3.0	3.9	NA	NA	1
TOTAL					**11**

Table 20. Summary of results of obsidian hydration analysis of artifacts from 35LK4067.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Cowhead Lake	3.8	4.1	3.9	0.1	2
Drews Creek/Butcher Flat	4.9	6.9	5.9	1.0	2
Sugar Hill	1.8	4.8	3.8	1.4	3
Unknown Obsidian 4	NA	NA	NA	NA	0
TOTAL					**7**

Table 21. Summary of results of obsidian hydration analysis of artifacts from 35LK3996.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Alturas FGV	8.5	8.5	NA	NA	1
Cowhead Lake	4.5	4.5	NA	NA	1
Drews Creek/Butcher Flat	5.9	5.9	NA	NA	1
Rainbow Mines	4.8	4.8	NA	NA	1
Sugar Hill	4.2	4.6	4.4	0.2	2
TOTAL					**6**

Table 22. Summary of results of obsidian hydration analysis of artifacts from 35LK3986.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Alturas FGV	8.3	8.3	NA	NA	1
Blue Spring	3.6	3.6	NA	NA	1
Buck Mountain	3.9	4.1	4.0	0.1	2
Rainbow Mines	6.7	6.7	NA	NA	1
Sugar Hill	3.9	6.2	4.4	0.7	7
Unknown Obsidian 6	3.8	3.8	NA	NA	1
TOTAL					**13**

Table 23. Summary of results of obsidian hydration analysis of artifacts from 35LK3982.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Spring	3.6	3.9	3.7	0.2	3
Buck Mountain	3.6	4.5	4.1	0.5	2
Sugar Hill	3.7	4.6	4.1	0.4	4
TOTAL					**9**

Table 24 Summary of results of obsidian hydration analysis of artifacts from 35LK3990.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Spring	6.1	6.1	NA	NA	1
Buck Mountain	5.2	5.2	NA	NA	1
Cowhead Lake	5.9	6.1	6.0	0.1	2
Rainbow Mines	5.2	5.2	NA	NA	1
TOTAL					**5**

Table 25 Summary of results of obsidian hydration analysis of artifacts from 35LK3989.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Spring	5.2	5.9	5.5	0.4	2
Buck Mountain	5.4	5.4	NA	NA	1
Cowhead Lake	2.3	6.5	5.3	1.5	9
Sugar Hill	3.6	5.9	4.7	1.0	3
Surveyor Spring	6.5	8.6	7.5	1.0	2
Tucker Hill	4.8	4.9	4.9	0.1	2
TOTAL					**19**

Table 26. Summary of results of obsidian hydration analysis of artifacts from 35LK3896.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Spring	5.3	5.3	NA	NA	1
Buck Mountain	4.1	6.2	5.4	0.8	4
Cowhead Lake	1.9	12.4	5.9	2.8	10
Del Prat Spring	6,1	6.1	NA	NA	1
Glass Buttes 3	4.1	4.1	NA	NA	1
McComb Butte	4.5	4.5	NA	NA	1
Mosquito Lake	7.0	7.0	NA	NA	1
Rainbow Mines	5.2	6.3	5.7	0.5	2
Silver Lake/Sycan Marsh	6.0	6.0	NA	NA	1
Spodue Mountain	6.1	6.1	NA	NA	1
Sugar Hill	5.5	6.2	6.0	0.2	8
Unknown Obsidian 10	7.0	7.0	NA	NA	1
Unknown Obsidian 11	7.2	7.2	NA	NA	1
TOTAL					**33**

Table 27. Summary of results of obsidian hydration analysis of artifacts from 35LK3898.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Spring	1.5	2.9	2.2	0.7	2
Buck Mountain	3.2	4.8	4.0	0.8	2
Cowhead Lake	3.9	5.6	4.7	0.8	2
Drews Creek/Butcher Flat	3.9	3.9	NA	NA	1
Rainbow Mines	3.3	7.7	5.5	2.2	2
Sugar Hill	6.0	6.0	NA	NA	1
TOTAL					**10**

Table 28. Summary of results of obsidian hydration analysis of artifacts from 35LK3903.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Spring	4.4	5.0	4.8	0.3	3
Buck Mountain	4.8	5.0	4.9	0.1	2
Cowhead Lake	6.5	6.5	NA	NA	1
Rainbow Mines	5.8	5.8	NA	NA	1
Sugar Hill	6.3	6.3	NA	NA	1
Unknown Obsidian 3	4.1	4.1	NA	NA	1
TOTAL					**9**

Table 29. Summary of results of obsidian hydration analysis of artifacts from 35LK4176.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Spring	3.9	3.9	NA	NA	1
Cowhead Lake	6.9	6.9	NA	NA	1
Harris Flat?	3.6	3.6	NA	NA	1
Silver Lake/Sycan Marsh	6.6	6.6	NA	NA	1
Sugar Hill	3.9	3.9	NA	NA	1
TOTAL					**5**

Table 30. Summary of results of obsidian hydration analysis of artifacts from 35LK4173.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Badger Creek	1.7	1.7	NA	NA	1
Blue Mountain	1.7	1.7	NA	NA	1
Blue Spring	5.5	5.5	NA	NA	1
Buck Mountain	5.1	9.4	6.5	1.5	6
Cowhead Lake	5.9	7.3	6.7	0.6	6
Drews Creek/Butcher Flat	5.2	7.1	6.0	0.8	3
McComb Butte	4.0	4.8	4.4	0.4	2
Rainbow Mines	4.1	6.1	5.1	0.8	3
Spodue Mountain	6.5	6.5	NA	NA	1
Sugar Hill	3.2	8.0	5.7	1.6	7
Tucker Hill	5.7	5.7	NA	NA	1
Unknown Obsidian 1	4.2	4.2	NA	NA	1
Unknown Obsidian 9	NA	NA	NA	NA	0
Witham Creek	3.4	3.4	NA	NA	1
TOTAL					**34**

Table 31. Summary of results of obsidian hydration analysis of artifacts from 35LK4172.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Buck Mountain	5.4	5.4	NA	NA	1
Cowhead Lake	6.2	7.9	6.9	0.6	4
TOTAL					**5**

Table 32. Summary of results of obsidian hydration analysis of artifacts from 35LK4134.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.7	1.7	NA	NA	1
Buck Mountain	1.1	7.1	4.1	1.3	17
Cougar Mountain	4.6	4.6	NA	NA	1
Cowhead Lake	3.2	7.1	4.7	1.3	11
Del Prat Spring	5.6	5.6	NA	NA	1
East Medicine Lake	5.8	5.8	NA	NA	1
GF/LIW/RS	1.5	4.7	3.6	1.5	3
Mosquito Lake	7.1	7.1	NA	NA	1
Rainbow Mines	3.6	7.1	5.1	1.5	3
Silver Lake/Sycan Marsh	2.9	2.9	NA	NA	1
Sugar Hill	2.3	7.0	4.1	1.4	7
Tucker Hill	4.2	4.8	4.5	0.3	3
TOTAL					**50**

Table 33. Summary of results of obsidian hydration analysis of artifacts from 35LK4135.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Spring	5.3	5.3	NA	NA	1
Buck Mountain	3.1	5.8	4.7	1.0	4
Cowhead Lake	4.3	7.3	6.1	1.3	3
Rainbow Mines	1.5	6.5	4.1	2.0	3
Sugar Hill	3.2	8.5	5.4	2.3	3
TOTAL					**14**

Table 34. Summary of results of obsidian hydration analysis of artifacts from 35LK4130.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	2.1	3.2	2.5	0.4	5
Blue Spring	1.9	6.3	5.0	1.6	5
Buck Mountain	1.9	10.2	5.4	1.9	21
Cowhead Lake	2.1	8.1	5.3	2.0	6
GF/LIW/RS	5.0	5.0	NA	NA	1
Grasshopper Group	3.4	7.6	5.3	1.6	4
Harris Flat?	5.1	5.1	NA	NA	1
McComb Butte	4.8	4.8	NA	NA	1
Rainbow Mines	4.9	6.9	5.7	0.9	3
Spodue Mountain	6.2	8.4	7.2	0.9	3
Sugar Hill	3.3	7.7	3.3	1.5	12
Tucker Hill	3.9	5.8	4.9	0.7	5
Unknown Obsidian 2	7.4	7.4	NA	NA	1
Unknown Obsidian 10	6.2	6.2	NA	NA	1
TOTAL					**69**

Table 35. Summary of results of obsidian hydration analysis of artifacts from 35LK4131.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Sugar Hill	3.4	3.6	3.5	0.1	2
TOTAL					**2**

Table 36. Summary of results of obsidian hydration analysis of artifacts from 35LK4068.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.9	3.7	2.8	0.9	2
Blue Spring	3.0	6.3	4.6	1.6	2
Buck Mountain	6.1	6.1	NA	NA	1
Cowhead Lake	2.3	6.3	4.2	1.5	7
Drews Creek/Butcher Flat	4.8	5.2	5.0	0.2	2
East Medicine Lake	5.2	5.2	NA	NA	1
Sugar Hill	3.1	6.5	4.4	1.0	12
Unknown Obsidian 6	4.1	4.1	NA	NA	1
TOTAL					**28**

Table 37. Summary of results of obsidian hydration analysis of artifacts from 35LK4129.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Cowhead Lake	6.4	7.6	7.1	0.5	2
Drews Creek/Butcher Flat	5.4	5.4	NA	NA	1
Sugar Hill	4.7	4.7	NA	NA	1
TOTAL					**4**

Table 38. Summary of results of obsidian hydration analysis of artifacts from 35LK3920.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Beatys Butte	1.4	2.3	1.8	0.4	2
Blue Mountain	1.3	3.2	2.2	0.5	9
Blue Spring	2.5	3.9	3.5	0.6	4
Buck Mountain	1.0	6.5	3.5	1.3	43
Cowhead Lake	1.2	12.5	3.8	1.9	56
Drews Creek/Butcher Flat	2.9	6.5	4.3	1.4	4
East Medicine Lake	4.1	4.7	2.2	2.2	2
G/F/LIW/RS	3.7	4.3	2.9	1.7	3
Glass Mountain	1.1	1.1	NA	NA	1
Grasshopper Group	1.6	4.2	2.8	0.9	4
Massacre Lake/Guano Valley	4.5	4.9	4.7	0.2	2
Rainbow Mines	3.4	6.9	4.6	1.3	5
South Warners	3.9	4.0	4.0	0.0	2
Spodue Mountain	1.9	4.6	2.9	0.9	7
Sugar Hill	1.2	5.9	3.5	1.2	36
Tucker Hill	1.4	5.2	3.0	1.4	4
Unknown Obsidian 1	3.0	4.7	3.8	0.8	2
Unknown Obsidian 6	1.3	3.3	2.4	0.8	6
TOTAL					**192**

Table 39. Summary of results of obsidian hydration analysis of artifacts from 35LK4279.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.6	1.9	1.8	0.1	2
Buck Mountain	2.0	5.0	3.5	1.3	3
Cowhead Lake	4.9	5.1	5.0	0.1	2
Rainbow Mines	6.3	6.3	NA	NA	1
Sugar Hill	4.5	4.5	NA	NA	1
Unknown Obsidian 7	3.9	3.9	NA	NA	1
Unknown Obsidian 6	NA	NA	NA	NA	0
Unknown Vitrophyre 1	NA	NA	NA	NA	0
Unknown Vitrophyre 2	NA	NA	NA	NA	0
TOTAL					**10**

Table 40. Summary of results of obsidian hydration analysis of artifacts from 35LK4220.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.9	1.9	NA	NA	1
TOTAL					**1**

Table 41. Summary of results of obsidian hydration analysis of artifacts from 10/1819-AZW-4.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
McComb Butte	3.5	3.5	NA	NA	1
TOTAL					**1**

Table 42. Summary of results of obsidian hydration analysis of artifacts from 35LK4132.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.5	1.9	1.6	0.1	7
Cowhead Lake	2.5	2.5	2.5	0.0	2
Sugar Hill	1.7	3.3	2.7	0.7	3
TOTAL					**12**

Table 43. Summary of results of obsidian hydration analysis of artifacts from 35LK4221.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Badger Creek	NA	NA	NA	NA	0
Blue Mountain	1.2	3.4	2.2	0.8	11
Blue Spring	1.6	5.9	3.8	2.2	2
Buck Mountain	2.5	4.2	3.2	0.6	9
Cowhead Lake	1.1	8.5	3.9	2.0	11
GF/LIW/RS	5.0	5.0	NA	NA	1
Massacre Lake/Guano Valley	5.2	5.2	NA	NA	1
Spodue Mountain	5.0	5.0	NA	NA	1
Sugar Hill	3.0	6.7	4.8	1.5	3
Surveyor Spring	3.1	3.1	NA	NA	1
Unknown Obsidian 6	2.4	5.3	3.8	1.4	2
TOTAL					**42**

Table 44. Summary of results of obsidian hydration analysis of artifacts from 35KL1947.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.3	1.7	1.5	0.2	2
Blue Spring	2.6	2.6	NA	NA	1
TOTAL					**3**

Table 45. Summary of results of obsidian hydration analysis of artifacts from 35KL3262.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.3	4.9	2.3	0.7	194
Buck Mountain	3.0	6.5	3.8	1.7	8
Cougar Butte	2.1	5.2	3.5	1.8	6
Cowhead Lake	1.6	6.9	4.2	1.1	95
Drews C reek/Butcher Flat	4.4	4.4	4.4	0.0	2
East Medicine Lake	3.6	6.0	3.9	0.8	10
Grasshopper Group	2.9	5.3	3.7	0.9	6
Silver Lake/Sycan Marsh	1.8	3.8	2.4	0.9	6
Spodue Mountain	2.1	7.0	4.3	1.5	13
Sugar Hill	2.2	5.5	3.6	1.0	6
Unknown Obsidian 6	4.2	4.2	NA	NA	1
Unknown Obsidian 10	NA	NA	NA	NA	0
TOTAL					**347**

Table 46. Summary of results of obsidian hydration analysis of artifacts from 35KL3493.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D	TOTAL
Surveyor Spring	9.0	9.0	NA	NA	1
TOTAL					**1**

Table 47. Summary of results of obsidian hydration analysis of artifacts from 35KL3300.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.5	3.2	2.2	0.6	5
Cowhead Lake	4.9	6.1	5.5	0.6	2
GF/LIW/RS	4.9	4.9	NA	NA	1
Silver Lake/Sycan Marsh	NA	NA	NA	NA	0
Spodue Mountain	4.4	5.8	5.1	0.7	2
TOTAL					**10**

Table 48. Summary of results of obsidian hydration analysis of artifacts from 35KL3446.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.4	2.9	1.9	0.5	7
Glass Mountain	1.6	1.6	NA	NA	1
Sugar Hill	2.2	2.2	NA	NA	1
TOTAL					**9**

Table 49. Summary of results of obsidian hydration analysis of artifacts from 35KL3495.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	2.5	6.4	4.5	2.0	2
Cougar Butte	5.8	6.2	6.0	0.2	2
Cowhead Lake	1.6	6.5	4.3	1.9	6
East Medicine Lake	4.7	4.7	NA	NA	1
Tucker Hill	3.5	3.5	NA	NA	1
TOTAL					**12**

Table 50. Summary of results of obsidian hydration analysis of artifacts from 35KL3447.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.5	4.2	2.6	1.0	5
East Medicine Lake	2.0	6.5	4.0	1.7	8
Glass Mountain	2.0	2.0	NA	NA	1
Grasshopper Group	4.8	4.8	NA	NA	1
Silver Lake/Sycan Marsh	2.5	2.5	NA	NA	1
Spodue Mountain	1.8	2.6	2.2	0.4	2
TOTAL					**18**

Table 51. Summary of results of obsidian hydration analysis of artifacts from 35KL3449.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.6	3.4	2.3	0.6	8
Buck Mountain	1.6	6.3	3.1	1.7	5
Cowhead Lake	2.0	6.5	3.6	1.5	13
Drews Creek/Butcher Flat	2.4	2.4	NA	NA	1
East Medicine Lake	4.9	5.5	5.2	0.3	3
GF/LIW/RS	3.1	3.1	NA	NA	1
Glass Mountain	2.8	2.8	NA	NA	1
Grasshopper Group	4.8	6.1	5.3	0.5	4
Silver Lake/Sycan Marsh	3.6	3.6	NA	NA	1
Spodue Mountain	2.1	6.1	3.4	1.9	3
Sugar Hill	7.6	7.6	NA	NA	1
Tucker Hill	4.1	6.2	5.1	1.0	2
TOTAL					**43**

Table 52. Summary of results of obsidian hydration analysis of artifacts from 35KL3448.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	2.0	3.5	5.2	0.3	4
TOTAL					**4**

Table 53. Summary of results of obsidian hydration analysis of artifacts from 35KL3472.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Bue Mountain	2.2	4.6	3.1	1.0	3
Glass Mountain	3.2	3.2	NA	NA	1
TOTAL					**4**

Table 54. Summary of results of obsidian hydration analysis of artifacts from 35KL3307.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.8	1.8	NA	NA	1
Buck Mountain	2.2	6.0	4.0	1.5	4
Cougar Butte	5.1	5.1	NA	NA	1
Cowhead Lake	1.5	3.6	2.5	1.0	2
Wast Medicine Lake	NA	NA	NA	NA	0
Glass Mountain	1.8	1.8	NA	NA	1
Tucker Hill	4.0	4.0	NA	NA	1
TOTAL					**10**

Table 55. Summary of results of obsidian hydration analysis of artifacts from 35KL3451.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Buck Mountain	NA	NA	NA	NA	0
Cougar Butte	3.3	3.3	NA	NA	1
Cowhead Lake	2.9	3.1	3.0	0.1	2
Spodue Mountain	2.1	2.1	NA	NA	1
TOTAL					**4**

Table 56. Summary of results of obsidian hydration analysis of artifacts from 35KL3443.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	5.0	5.0	NA	NA	1
TOTAL					**1**

Table 57. Summary of results of obsidian hydration analysis of artifacts from 35KL3277.

OBSIDIAN SOURCE	HYDRATION RIM MEASUREMENTS (MICRONS)				
	MINIMUM	MAXIMUM	MEDIAN	S.D.	TOTAL
Blue Mountain	1.4	3.3	2.3	0.7	9
Cougar Butte	2.5	2.5	NA	NA	1
TOTAL					**10**

CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

Conclusions

> Every archaeologist has had the experience: you pick up a gleaming flake of obsidian from a site, look up at a vast dune field surrounded by low ranges of sandstone or other sedimentary rock, and wonder, how did this get here?
>
> The answer, of course, is either that some man or woman went to the primary or secondary geologic source of the obsidian and brought some home or that he or she obtained the source through some form of trade This dichotomy between direct acquisition and trade is a simple one. So simple, in fact, that it seems it would be easy to tell the difference between them archaeologically. But it is not. (Kelly 2011:189)

Over the last several decades, trace element provenance studies of obsidian have become an increasingly commonplace and invaluable component of archaeological research programs in Oregon and the Far Western United States. Obsidian frequently comprises a significant part of archaeological lithic assemblages, and the determination of the geologic sources of obsidian artifacts contributes a source of valuable information about the prehistoric patterns of procurement and mobility in these regions. While the geographic patterning of characterized obsidian artifacts and sources provides archaeologists with uniquely convincing evidence of long-distance direct procurement and/or the presence of prehistoric exchange systems, it can often (as is illustrated in the preceding quote by Kelly) be difficult to distinguish the precise mechanism of acquisition. These patterns also may yield clues about seasonal procurement ranges, the location of trade and travel routes, the presence of territorial or ethnic boundaries, differential access to goods, and the changes in these patterns through time. In addition, the determination of the chemical sources of artifacts provides essential information needed for obsidian hydration studies that often accompany artifact source investigations.

Many archaeological sites in the Far Western United States, including those associated with the Ruby Pipeline Project, also lack organic materials or temporally-diagnostic artifacts that can aid in establishing site chronologies. Under these circumstances, obsidian hydration dating methods can be used with considerable success to provide critical evidence about the ranges of occupation and relative ages of sites and artifacts. Although obsidian hydration dating methods have often failed to provide the precision that was once hoped for, they do provide crucial chronologic information that would simply not be available through any other techniques.

The obsidian studies associated with the Ruby Pipeline Project are among the most extensive ever carried out as part of an Oregon archaeological project and are exceeded in number only by the earlier PGT-PG&E Pipeline Expansion Project (Skinner 1995a, 1995b). In that project, the first extensive investigation of obsidian sources and artifacts in central Oregon not only proved invaluable for the interpretation of archaeological materials associated with the project but also revealed the presence of many new and poorly-known obsidian sources. Similarly, the obsidian provenance and hydration studies carried out as part of the Ruby Pipeline Project have provided a great deal of significant new information about the prehistoric use and procurement of obsidian sources in a region in which there was a paucity of regional provenance and hydration investigations available prior to the current investigation. The new data will prove invaluable as a baseline for future archaeological studies in the project region. Additionally, the trace element investigations of project artifacts have uncovered an unexpectedly large number of new and archaeologically-significant obsidian and FGV sources. Obsidian hydration analysis of artifacts from these unknown obsidian sources has further furnished clues about their temporal use that would not have been possible without these investigations.

Recommendations for Further Research

The trace element and hydration studies of the obsidian and FGV artifacts associated with the Ruby Pipeline Project present a unique opportunity for understanding regional procurement patterns and for exploring theoretical issues related to raw material procurement and provenance investigations. Data from project sites with large numbers of analyzed artifacts, particularly those from 35LK1231, may prove particularly important for further research investigations.

With that in mind, we recommend that the non-sensitive results of the obsidian and FGV studies outlined in this appendix be eventually placed into the public domain so that researchers will have access to the original project data upon which future investigations can be based.

1. *Unknown Obsidian Sources*. Of particular interest is in this project is the relatively large number of unknown obsidian sources that were identified. Although most of these sources appear to be minor ones with only a few examples appearing at project sites, their presence is quite intriguing. Further efforts into locating these sources could be explored using the relative frequencies of the unknown sources along the project transect and their presence in other regional sites.

2. *Unknown FGV Sources.* The characterization of fine-grained volcanic artifacts and FGV toolstone sources in the project area is the first attempt in this portion of the state to explore the prehistoric use of this variety of toolstone. Although several FGV sources were characterized as part of the current investigation, it is clear from the results that several other unknown and archaeologically-significant sources remain to be found.

3. *Obsidian Procurement Behavior at an Obsidian Quarry Site.* Site 35LK1231 is unique in that it contains not only a large number of characterized obsidian artifacts but is also located at a significant regional source of natural glass. The extraordinarily large range of OH measurements for artifacts from the site indicates a very long-term use of the resource and the combination of provenience and hydration data provide a unique opportunity to further investigate obsidian procurement activity at a major regional quarry source.

4. *Additional Geochemical Study of Individual Obsidian and FGV Sources.* Most of the obsidian and FGV sources encountered during project provenience studies are not particularly well-documented. Further investigation of these sources should focus on the identification of primary and secondary source boundaries (this latter topic is often largely overlooked in raw material studies) so that the consideration of procurement behavior can more accurately use realistic distances to sources. Given the prehistoric significance of the Surveyor Spring source, we recommend that any research related to the further study of project obsidian sources begin with this source of glass.

5. *Provenance Studies and Theoretical Issues*. The obsidian and FGV data presented in this report may be particularly useful in examining a variety of theoretical issues germane to the prehistoric procurement of raw material. Theoretical considerations of the fall-off and regression analysis of artifacts and their distance from sources, geographic approaches such as trend-surface analysis, the nature of sample size and artifact and source diversity, the relationship of sources and artifact types, and additional issues (see Table 2) can be explored in depth using the data from this project (for example, see Baxter 2015, Connolly 2015, Hodder 1974, Hodder and Orton 1979, Leonard and Jones 1989, Renfrew 1977, Thatcher 2001).

6. *Refinement of Regional Hydration Chronologies*. In many areas of the desert west, there are often few materials that can be used for the application of independent chronologic methods such as radiocarbon dating. In these instances, obsidian hydration dating continues to provide chronologic information that would simply not be available through any other means. Although hydration dating still presents many challenges in its application, the data presented in this report may prove invaluable to an understanding of how obsidian hydration methods may be applied in the region bisected by the Ruby Pipeline Project.

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Appendix A

Results of EDXRF Analysis of Obsidian and FGV Artifacts from Ruby Pipeline Project Sites

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3-01	139	31	25	120	12	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	4-01	107	66	18	93	12	NM	NM	534	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	28	NM			
35LK1231	11-01	147	34	26	124	11	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	20-01	149	32	27	124	11	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	27-01	151	31	27	127	13	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	28-01	157	32	27	132	12	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	36-01	149	32	27	122	11	NM	NM	262	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	39-01	152	33	25	124	10	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	48-01	105	32	36	174	10	NM	NM	1008	NM	NM	NM	Variety 5
		± 2	1	1	2	1	NM	NM	32	NM			
35LK1231	51-01	154	34	26	126	11	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	56-01	128	4	29	71	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK1231	57-01	142	30	26	119	11	NM	NM	209	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	58-01	153	34	25	125	12	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	64-01	139	31	22	117	11	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	66-01	110	47	20	108	13	NM	NM	620	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	71-01	151	33	26	124	11	NM	NM	218	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	74-01	154	35	27	129	12	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	75-01	153	34	26	121	11	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	79-01	129	53	25	119	11	NM	NM	606	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	83-01	122	31	31	211	17	NM	NM	607	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	84-01	141	33	24	121	11	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	85-01	157	35	25	129	11	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	86-01	157	34	25	125	12	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	88-01	108	3	71	318	27	NM	NM	51	NM	NM	NM	Parsnip Creek
		± 2	1	2	3	2	NM	NM	23	NM			
35LK1231	94-01	147	33	28	124	13	NM	NM	275	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	96-01	50	407	28	252	10	NM	NM	1123	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	34	NM			
35LK1231	102-01	138	30	26	119	10	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	103-01	133	3	58	390	50	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	104-01	110	4	30	72	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	111-01	150	3	64	413	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			
35LK1231	112-01	121	24	35	176	31	NM	NM	200	NM	NM	NM	Mosquito Lake
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	113-01	206	3	88	572	34	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			
35LK1231	119-01	144	32	28	122	11	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	125-01	152	32	26	122	10	NM	NM	203	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	134-01	108	3	29	71	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	135-01	142	4	61	417	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	24	NM			
35LK1231	136-01	142	29	25	124	12	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	138-01	147	31	25	122	11	NM	NM	229	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	139-01	155	33	27	126	13	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	140-01	153	33	27	124	12	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	141-01	57	389	25	269	10	NM	NM	1253	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			
35LK1231	142-01	137	31	24	117	12	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	151-01	173	2	87	622	74	NM	NM	0	NM	NM	NM	Long Valley
		± 3	1	2	4	2	NM	NM	23	NM			
35LK1231	182-01	146	33	26	124	12	NM	NM	270	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	197-01	156	33	24	124	12	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	25	NM			
35LK1231	203-01	148	33	28	122	12	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	204-01	155	33	28	125	12	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	209-01	143	31	23	118	10	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	227-01	149	33	26	120	12	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	238-01	134	31	25	118	13	NM	NM	266	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	241-01	158	32	28	128	12	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	248-01	34	505	25	182	4	NM	NM	910	NM	NM	NM	Unknown FGV
		± 2	4	2	3	2	NM	NM	36	NM			
35LK1231	250-01	147	31	27	122	12	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	257-01	143	31	27	122	11	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	263-01	143	3	62	487	51	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	22	NM			
35LK1231	264-01	149	33	26	122	12	NM	NM	296	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	265-01	145	31	26	123	11	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	268-01	112	76	19	99	10	NM	NM	620	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	27	NM			
35LK1231	269-01	119	22	38	174	30	NM	NM	184	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	271-01	145	34	27	122	11	NM	NM	266	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	270-01	56	397	28	273	9	NM	NM	1245	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	32	NM			
35LK1231	279-01	148	30	26	123	12	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	290-01	114	4	30	76	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	296-01	149	31	26	123	10	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	299-01	94	43	23	131	15	NM	NM	757	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	301-01	146	32	27	123	11	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	304-01	106	10	52	335	16	NM	NM	792	NM	NM	NM	Silver Lake/Sycan Marsh
		± 2	1	2	3	2	NM	NM	29	NM			
35LK1231	312-01	155	34	25	128	12	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	325-01	149	31	26	125	12	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	326-01	148	33	26	126	13	NM	NM	264	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	332-01	134	31	26	118	11	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	333-01	140	30	25	119	11	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	338-01	153	33	27	123	12	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	339-01	111	115	20	160	8	NM	NM	911	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	342-01	120	4	33	76	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	345-01	138	31	24	116	12	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	347-01	141	31	25	120	12	NM	NM	264	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	348-01	153	32	27	127	12	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	350-01	152	32	26	120	11	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	355-01	154	33	27	126	10	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	356-01	136	30	27	118	9	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	25	NM			
35LK1231	358-01	145	33	26	126	12	NM	NM	276	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	359-01	158	33	27	125	13	NM	NM	224	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	365-01	115	4	31	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	367-01	118	4	31	72	19	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK1231	369-01	147	32	25	125	10	NM	NM	280	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	56	NM			
35LK1231	370-01	144	33	26	123	12	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	371-01	140	30	26	118	11	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	375-01	149	32	26	120	12	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	376-01	152	34	25	125	12	NM	NM	273	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	379-01	155	33	26	124	14	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	380-01	146	32	27	122	13	NM	NM	262	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	382-01	151	33	27	124	11	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	384-01	137	33	27	121	12	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	385-01	145	33	26	122	11	NM	NM	267	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	386-01	152	33	27	124	12	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	389-01	154	33	27	124	12	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	390-01	151	35	28	127	10	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	393-01	141	30	26	119	11	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	396-01	125	24	38	179	31	NM	NM	194	NM	NM	NM	Mosquito Lake
		± 2	1	2	2	2	NM	NM	24	NM			
35LK1231	399-01	115	4	31	74	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	400-01	142	31	25	119	12	NM	NM	305	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	401-01	153	32	26	125	11	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	402-01	161	35	26	134	10	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	29	NM			
35LK1231	406-01	146	34	25	122	14	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	410-01	162	34	26	129	13	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	412-01	156	35	27	132	13	NM	NM	267	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	414-01	148	33	27	123	12	NM	NM	267	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	416-01	147	32	25	123	11	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	417-01	53	410	25	260	8	NM	NM	1165	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	35	NM			
35LK1231	420-01	61	423	30	280	9	NM	NM	1215	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	36	NM			
35LK1231	424-01	147	33	25	118	11	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	429-01	153	34	27	124	12	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	430-01	58	397	30	272	10	NM	NM	1102	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	34	NM			
35LK1231	431-01	110	28	31	193	18	NM	NM	558	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	433-01	25	558	26	180	22	NM	NM	588	NM	NM	NM	Unknown FGV
		± 2	5	2	3	2	NM	NM	37	NM			
35LK1231	435-01	156	33	27	125	11	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	436-01	151	35	28	127	12	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	438-01	150	32	27	126	13	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	440-01	141	30	25	119	11	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	443-01	150	32	27	125	12	NM	NM	282	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	453-01	143	31	26	121	12	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	458-01	107	28	32	186	18	NM	NM	574	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	459-01	147	31	27	122	12	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	460-01	115	106	17	160	10	NM	NM	916	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	462-01	110	4	29	70	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	467-01	141	29	25	120	11	NM	NM	206	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	473-01	150	33	26	123	12	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	474-01	150	33	28	122	10	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	476-01	135	30	25	117	10	NM	NM	201	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	478-01	143	32	25	122	11	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	481-01	119	60	39	177	8	NM	NM	836	NM	NM	NM	Quartz Mountain
		± 2	1	2	2	1	NM	NM	28	NM			
35LK1231	482-01	143	32	26	120	12	NM	NM	229	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	28	NM			
35LK1231	484-01	147	31	26	121	12	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	486-01	172	39	28	135	12	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	487-01	144	31	26	115	11	NM	NM	218	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	488-01	112	4	30	72	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	489-01	143	32	24	118	11	NM	NM	182	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	491-01	162	33	27	127	13	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	492-01	152	34	26	124	13	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	493-01	146	33	24	119	11	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	495-01	143	32	23	119	11	NM	NM	205	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	496-01	125	28	25	113	12	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	497-01	141	30	25	117	12	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	498-01	152	33	27	122	11	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	499-01	144	31	26	116	12	NM	NM	217	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	505-01	139	31	24	118	12	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	26	NM			
35LK1231	509-01	155	34	28	126	11	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	512-01	138	29	25	119	11	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	519-01	146	32	26	121	12	NM	NM	220	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	26	NM			
35LK1231	524-01	139	31	26	119	11	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	525-01	146	32	24	119	12	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	526-01	147	31	27	122	13	NM	NM	224	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	527-01	144	31	25	117	10	NM	NM	171	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	531-01	153	31	26	125	12	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	532-01	144	32	26	114	11	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	28	NM			
35LK1231	536-01	166	34	26	128	13	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	539-01	154	33	27	129	11	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	541-01	120	102	18	153	11	NM	NM	782	NM	NM	NM	Unknown FGV B
		± 2	2	2	2	2	NM	NM	32	NM			
35LK1231	546-01	146	32	24	121	12	NM	NM	215	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	547-01	152	33	26	125	13	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	548-01	151	35	25	127	10	NM	NM	273	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	551-01	152	33	27	123	10	NM	NM	175	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	553-01	141	30	25	120	12	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	558-01	155	32	27	126	11	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	557-01	146	32	27	117	11	NM	NM	202	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	559-01	138	32	24	116	11	NM	NM	214	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	560-01	150	31	26	118	9	NM	NM	201	NM	NM	NM	Surveyor Spring
		± 3	2	2	3	2	NM	NM	30	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	561-01	159	35	25	127	13	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	562-01	165	35	25	128	12	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	27	NM			
35LK1231	565-01	148	32	27	126	13	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	566-01	144	32	25	119	13	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	567-01	136	30	24	113	10	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	571-01	149	33	26	123	13	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	575-01	170	36	29	131	12	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	577-01	145	32	25	122	12	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	579-01	133	28	24	117	13	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	583-01	146	33	26	124	12	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	585-01	153	33	27	122	12	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	592-01	151	32	26	122	14	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	593-01	157	32	28	126	12	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	594-01	146	30	28	118	10	NM	NM	184	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	595-01	165	33	26	128	15	NM	NM	209	NM	NM	NM	Surveyor Spring
		± 3	2	2	3	2	NM	NM	30	NM			
35LK1231	598-01	142	31	25	118	11	NM	NM	201	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	28	NM			
35LK1231	599-01	166	34	26	128	13	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	600-01	149	34	26	125	10	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	605-01	142	31	23	117	9	NM	NM	199	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	606-01	150	32	27	122	11	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	608-01	132	29	24	114	12	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	24	NM			
35LK1231	611-01	173	38	28	133	12	NM	NM	263	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	613-01	146	34	26	121	12	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	615-01	146	33	27	120	10	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	617-01	144	32	25	117	10	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	618-01	138	30	24	116	9	NM	NM	198	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	30	NM			
35LK1231	619-01	144	30	24	120	11	NM	NM	224	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	620-01	146	31	25	119	11	NM	NM	203	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	621-01	149	31	26	122	12	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	623-01	140	31	27	119	11	NM	NM	211	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	625-01	154	33	26	124	13	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	626-01	152	32	27	123	12	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	627-01	153	34	26	126	12	NM	NM	262	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	629-01	150	32	27	123	13	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	633-01	143	32	27	122	11	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	634-01	144	33	26	121	11	NM	NM	182	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	27	NM			
35LK1231	635-01	151	33	26	124	13	NM	NM	262	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	636-01	153	34	24	122	11	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	638-01	148	31	26	122	13	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	639-01	158	35	26	128	12	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	640-01	141	32	28	120	11	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	641-01	150	35	23	125	12	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	642-01	140	30	23	118	10	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	644-01	154	34	26	123	13	NM	NM	229	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	645-01	149	32	25	122	11	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	646-01	136	31	23	113	13	NM	NM	190	NM	NM	NM	Surveyor Spring
		± 3	2	2	3	2	NM	NM	31	NM			
35LK1231	648-01	142	30	24	116	11	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	649-01	136	28	24	116	10	NM	NM	218	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	652-01	145	31	24	119	11	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	654-01	140	30	26	117	10	NM	NM	201	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	27	NM			
35LK1231	661-01	153	32	26	123	11	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	662-01	152	33	25	121	9	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	25	NM			
35LK1231	665-01	132	31	25	115	10	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	668-01	149	31	25	123	12	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	669-01	130	25	39	197	29	NM	NM	183	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	670-01	116	4	29	74	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	671-01	116	3	32	75	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	673-01	121	4	30	77	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	675-01	138	3	62	445	49	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK1231	677-01	150	32	24	126	13	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	682-01	147	33	25	122	12	NM	NM	203	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	684-01	140	32	26	121	12	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	687-01	115	202	13	149	8	NM	NM	927	NM	NM	NM	Beatys Butte
		± 2	3	1	2	1	NM	NM	32	NM			
35LK1231	688-01	152	35	26	124	12	NM	NM	290	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	689-01	119	209	14	156	10	NM	NM	998	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	691-01	110	4	29	70	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	692-01	115	3	30	73	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	24	NM			
35LK1231	693-01	150	33	27	122	12	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	696-01	150	31	26	123	12	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	698-01	147	33	25	122	12	NM	NM	224	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	707-01	147	32	25	123	13	NM	NM	274	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	709-01	157	32	27	126	13	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	710-01	142	35	26	121	14	NM	NM	221	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	711-01	50	229	67	361	22	NM	NM	980	NM	NM	NM	Unknown FGV
		± 2	3	2	3	2	NM	NM	35	NM			
35LK1231	712-01	135	30	24	113	12	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	713-01	151	33	25	123	12	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	715-01	150	3	63	484	50	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	22	NM			
35LK1231	716-01	151	34	24	122	11	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	724-01	153	34	27	123	12	NM	NM	277	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	725-01	149	32	27	123	10	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	732-01	145	34	25	120	10	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	734-01	151	33	26	126	11	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	735-01	153	33	26	128	10	NM	NM	281	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	745-01	102	68	17	90	11	NM	NM	592	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	747-01	113	57	20	86	12	NM	NM	497	NM	NM	NM	Buck Mountain?
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	749-01	154	33	26	122	12	NM	NM	216	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	751-01	121	4	33	77	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	754-01	136	32	24	121	12	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	756-01	139	30	26	119	12	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	757-01	161	35	26	128	13	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	758-01	118	68	20	127	13	NM	NM	778	NM	NM	NM	Buck Mountain?
		± 2	2	1	2	1	NM	NM	35	NM			
35LK1231	768-01	141	32	23	122	12	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	26	NM			
35LK1231	785-01	164	36	28	130	12	NM	NM	276	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	788-01	204	2	90	573	32	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			
35LK1231	794-01	156	32	25	126	13	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	805-01	131	53	23	114	13	NM	NM	591	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	806-01	151	32	27	123	11	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	814-01	202	0	86	569	33	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	821-01	118	9	26	75	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	822-01	112	4	31	70	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	25	NM			
35LK1231	823-01	112	3	31	73	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK1231	824-01	103	64	17	92	12	NM	NM	649	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK1231	825-01	206	2	87	583	31	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	4	2	NM	NM	25	NM			
35LK1231	826-01	149	32	27	123	12	NM	NM	227	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	827-01	117	164	15	157	11	NM	NM	871	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	31	NM			
35LK1231	829-01	110	3	29	70	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	835-01	145	30	27	121	11	NM	NM	266	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	836-01	152	33	27	125	11	NM	NM	264	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	837-01	146	31	25	119	12	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	841-01	147	32	26	123	13	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	846-01	102	66	18	92	11	NM	NM	609	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK1231	847-01	150	33	27	121	13	NM	NM	259	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	854-01	152	33	28	123	10	NM	NM	271	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	858-01	110	5	31	71	17	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	26	NM			
35LK1231	862-01	106	3	28	69	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	863-01	107	5	29	69	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	868-01	141	30	24	119	9	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	876-01	140	31	25	120	13	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	880-01	147	31	26	122	11	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	885-01	158	32	25	129	13	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	887-01	148	33	28	121	12	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	894-01	103	149	19	173	11	NM	NM	931	NM	NM	NM	Unknown FGV E
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	896-01	149	33	26	121	12	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	897-01	149	4	62	444	47	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			
35LK1231	898-01	144	32	26	122	12	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	899-01	206	3	89	567	30	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	900-01	105	63	17	91	11	NM	NM	559	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK1231	901-01	110	4	30	73	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	0	NM			
35LK1231	972-01-1	99	3	29	69	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	2	NM	NM	22	NM			
35LK1231	1008-02-1	147	34	26	123	12	NM	NM	264	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1050-01-2	162	36	27	131	12	NM	NM	281	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1063-01-S1	110	4	31	73	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	20	NM			
35LK1231	1064-01	219	2	89	602	32	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	4	2	NM	NM	22	NM			
35LK1231	1073-01-2	143	31	26	119	12	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1074-02	152	33	26	125	12	NM	NM	259	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1138-02	143	31	26	121	11	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1143-02-1	146	32	25	119	12	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1202-01	105	4	30	69	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK1231	1203-01	118	5	30	76	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	1204-01	139	30	26	119	12	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1207-01	124	4	32	77	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	1208-01	56	396	27	268	10	NM	NM	1173	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	37	NM			
35LK1231	1220-02-1	139	30	25	118	12	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1229-02-1	152	33	26	124	12	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1235-03-1	218	2	93	590	32	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			
35LK1231	1237-04	145	34	25	122	12	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1242-02	159	35	27	130	13	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1243-02	148	32	26	123	11	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1247-02-1	158	34	27	128	13	NM	NM	287	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1247-02-2	152	36	27	124	12	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	1247-02-3	153	33	26	125	13	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1247-02-4	153	33	28	124	12	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	1248-02	147	30	27	122	13	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	27	NM			
35LK1231	1248-03-1	157	33	26	126	11	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1248-03-2	156	34	27	122	13	NM	NM	189	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	1252-02	159	34	28	128	13	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1253-02	147	32	25	124	12	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1256-03-1	149	32	26	125	11	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1263-03	160	32	26	127	13	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1263-06-1	148	33	26	121	12	NM	NM	229	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1263-06	155	33	26	124	12	NM	NM	229	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1271-03	142	31	25	117	11	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1281-03	160	36	26	126	13	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1283-02-1	157	35	27	126	9	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	1283-02-2	150	33	28	125	13	NM	NM	267	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	1283-03-2	159	34	28	126	11	NM	NM	216	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	1283-03-4	149	33	24	125	12	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1284-04	146	31	27	120	13	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1298-02-1	151	32	29	123	12	NM	NM	207	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	1309-04	151	32	26	124	14	NM	NM	220	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	28	NM			
35LK1231	1335-02	150	31	25	123	13	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1343-03	140	31	25	117	13	NM	NM	278	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1344-04	154	36	25	128	13	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	31	NM			
35LK1231	1345-02-3	126	84	18	152	10	NM	NM	1001	NM	NM	NM	Badger Creek
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	1345-03	151	33	25	124	12	NM	NM	273	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1345-04	150	33	27	124	11	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1348-02-1	211	2	90	583	32	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	22	NM			
35LK1231	1348-03	103	3	29	67	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	1349-01	153	33	27	129	12	NM	NM	287	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	1353-02-2	149	32	25	122	11	NM	NM	224	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1356-01	114	3	30	73	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK1231	1356-02	152	34	26	125	11	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	22	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1356-07	44	461	26	221	7	NM	NM	1034	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	35	NM			
35LK1231	1356-09-1	149	34	26	126	12	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1356-10	152	34	28	122	11	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1356-11	138	29	24	119	12	NM	NM	189	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	1365-02	143	30	25	118	12	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1365-05	150	32	25	122	13	NM	NM	224	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	1367-01	145	31	26	122	12	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1370-04	138	31	26	118	11	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1372-02	150	32	28	122	12	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1372-04	140	31	25	116	12	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	1375-03	148	31	27	122	11	NM	NM	263	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1381-03-1	144	31	26	122	11	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1381-03-2	167	36	29	132	13	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1381-03-3	153	33	26	124	12	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1386-04	155	35	26	133	11	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	1386-05	149	35	25	123	13	NM	NM	270	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1386-06	135	30	25	114	10	NM	NM	282	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	24	NM			
35LK1231	1386-08	148	32	24	121	10	NM	NM	270	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1387-06	46	445	28	229	9	NM	NM	1192	NM	NM	NM	Dismal Spring FGV
		± 2	4	1	3	2	NM	NM	33	NM			
35LK1231	1388-03	112	4	29	70	16	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	30	NM			
35LK1231	1388-06	131	54	22	121	11	NM	NM	574	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	1389-02-1	145	33	25	123	13	NM	NM	259	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	1389-02-2	145	33	25	121	12	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1389-02-3	154	36	26	128	12	NM	NM	282	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1389-02-4	115	4	31	71	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	0	NM			
35LK1231	1389-05	145	32	26	122	13	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1391-02-2	55	410	26	252	8	NM	NM	1046	NM	NM	NM	Dismal Spring FGV
		± 2	5	2	4	2	NM	NM	44	NM			
35LK1231	1391-04	124	170	14	163	8	NM	NM	932	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	31	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1391-05	162	37	28	131	14	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1391-08	145	32	25	124	12	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1393-02-1	138	32	25	118	11	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1393-03	155	35	28	128	11	NM	NM	269	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1393-04	148	32	25	120	11	NM	NM	269	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1394-02-1	103	2	29	66	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	23	NM			
35LK1231	1395-02	146	33	26	121	12	NM	NM	276	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1395-05-1	148	35	25	122	10	NM	NM	183	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	1397-03	159	32	27	127	12	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	23	NM			
35LK1231	1397-09	137	27	39	199	31	NM	NM	217	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1398-02-1	140	32	26	117	10	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	26	NM			
35LK1231	1408-03	148	32	26	120	12	NM	NM	215	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1411-02	143	31	24	119	10	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1411-04	146	32	26	121	10	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1412-02-1	148	32	27	119	11	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1413-03	152	32	26	127	12	NM	NM	279	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1414-02-1	139	30	26	119	12	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1415-04	141	30	25	121	10	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1416-02-1	146	32	25	121	11	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1417-02	143	32	25	117	11	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1422-02-2	156	33	26	126	12	NM	NM	211	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1423-02	104	69	18	95	9	NM	NM	695	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	27	NM			
35LK1231	1424-02-1	138	31	25	116	11	NM	NM	278	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1425-01	164	34	27	133	12	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1425-02-2	155	34	27	124	10	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	1426-03	146	32	25	120	11	NM	NM	270	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	1429-03	151	33	27	124	12	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1431-02	148	30	27	122	12	NM	NM	269	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1431-03-1	144	32	26	120	10	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1431-04	222	2	90	609	31	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	4	2	NM	NM	23	NM			
35LK1231	1432-02	151	32	26	124	13	NM	NM	259	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1437-02	148	33	25	124	13	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1438-03	153	33	27	126	11	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1442-03	149	33	25	123	11	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1444-03	142	30	26	120	11	NM	NM	270	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1450-02-1	147	32	27	122	13	NM	NM	218	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1453-03	150	33	25	122	11	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1455-02	156	34	27	127	12	NM	NM	229	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1456-03	148	32	25	123	12	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1461-02-1	147	34	26	119	10	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	1461-02-2	149	34	28	125	11	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1462-03	151	32	26	124	11	NM	NM	192	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1467-03	152	32	25	123	11	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	1479-03-1	152	33	27	124	13	NM	NM	229	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1481-03	145	32	24	122	12	NM	NM	211	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	1483-02	157	34	27	129	12	NM	NM	289	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	1483-03	153	35	27	127	12	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1483-04	155	33	27	125	13	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1483-06-1	154	36	27	126	14	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1483-08	159	36	25	128	12	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	1483-09	159	34	26	125	11	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1484-02	152	31	26	126	13	NM	NM	270	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1484-04-1	152	33	27	124	13	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	1484-06	118	4	32	76	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	1487-02-1	156	34	28	126	11	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1487-03	139	31	26	123	13	NM	NM	300	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1489-03	158	36	26	130	12	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1490-05	151	32	26	124	13	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	27	NM			
35LK1231	1490-13	153	33	26	125	13	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1490-15	98	178	19	181	9	NM	NM	918	NM	NM	NM	Unknown FGV C
		± 2	2	1	2	2	NM	NM	30	NM			
35LK1231	1491-08	147	33	24	124	12	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1491-12	101	4	28	69	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	1491-14-01	152	34	26	127	12	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1492-03	154	33	27	125	12	NM	NM	193	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1496-02	136	30	24	115	10	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	24	NM			
35LK1231	1497-07-01	149	31	23	118	10	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	1498-05	138	31	23	115	10	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	1498-06	110	4	29	73	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	1505-06	160	35	27	130	14	NM	NM	217	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	1506-02	101	39	42	149	17	NM	NM	1327	NM	NM	NM	Tank Creek
		± 2	1	1	2	1	NM	NM	29	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1509-02-08	150	2	59	355	18	NM	NM	0	NM	NM	NM	BS/PP/FM
		± 2	1	2	3	2	NM	NM	0	NM			
35LK1231	1510-03	146	31	26	122	11	NM	NM	288	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1510-04	147	32	26	121	11	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1511-02	144	32	26	121	12	NM	NM	269	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	1512-02-06	146	32	26	121	12	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1514-02	155	33	27	124	11	NM	NM	278	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1514-03-3	125	29	23	114	12	NM	NM	259	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1515-03	137	31	26	121	12	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	1517-02	163	35	27	131	12	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1518-02	118	4	31	73	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	1518-05	153	33	25	124	12	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1519-02	143	33	26	122	12	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1519-04	134	2	61	406	50	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			
35LK1231	1519-05-08	152	34	26	126	14	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1519-05-13	148	32	26	122	12	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1522-01-01	144	33	25	122	11	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1524-04	145	32	26	122	13	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1525-02	151	32	26	123	13	NM	NM	211	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1525-04-03	150	32	27	125	12	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1525-07	149	31	27	122	12	NM	NM	205	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1526-02-06	142	35	25	122	11	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1526-02-1	146	32	25	121	12	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1526-04	153	33	27	124	11	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1526-05	152	33	26	128	11	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1526-06	143	31	28	121	11	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	1529-02-2	147	31	27	123	12	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1529-03-01	158	35	26	127	12	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	26	NM			
35LK1231	1529-04	153	4	62	449	50	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1529-3-7	150	32	26	121	12	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1530-03-1	137	30	22	116	12	NM	NM	262	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	1531-03-01	149	33	26	126	11	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1531-03-02	149	30	23	118	10	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	1561-02	147	31	26	120	12	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1564-04	144	30	24	117	12	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1571-03	102	4	27	67	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	24	NM			
35LK1231	1574-02	151	32	27	124	12	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1582-03	162	35	26	131	12	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1599-02	147	32	26	122	10	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	1612-03	148	33	28	122	13	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1621-03	145	33	24	122	11	NM	NM	274	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1638-02-01	50	410	28	245	7	NM	NM	1112	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	35	NM			
35LK1231	1656-04-1	145	31	26	118	12	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1662-02	141	31	24	118	12	NM	NM	284	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	1675-03	155	33	25	122	9	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	1676-03	50	404	28	249	10	NM	NM	1221	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			
35LK1231	1676-04	143	31	27	119	11	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1683-03	149	33	24	121	11	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1690-02-1	53	403	25	244	9	NM	NM	1187	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	35	NM			
35LK1231	1690-03	227	24	43	145	25	NM	NM	NM	NM	NM	NM	Hawks Valley *
		± 3	1	2	2	2	NM	NM	NM	NM			
35LK1231	1690-04	157	35	27	127	13	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1692-03	139	30	24	117	11	NM	NM	264	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1692-04	141	31	23	117	12	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1693-03	143	31	26	123	11	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1694-03-01	144	31	25	124	11	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1694-04	162	34	26	126	12	NM	NM	227	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	1697-02-04	157	35	27	128	10	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1701-03	143	32	24	119	11	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1702-03	144	32	26	119	14	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1734-03	108	9	29	75	17	NM	NM	59	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1745-05	94	45	25	65	10	NM	NM	230	NM	NM	NM	Tucker Hill
		± 2	1	1	1	1	NM	NM	25	NM			
35LK1231	1745-08-01	146	32	26	121	10	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1750-02-3	114	4	33	73	19	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	32	NM			
35LK1231	1751-03-3	149	32	25	122	12	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1766-03-01	134	3	60	473	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 3	1	2	4	2	NM	NM	0	NM			
35LK1231	1767-01-01	146	32	25	121	10	NM	NM	263	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1768-01	151	32	23	120	12	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1768-02	129	26	37	185	32	NM	NM	221	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	23	NM			
35LK1231	1769-05	152	35	26	127	12	NM	NM	277	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1769-07	115	60	18	91	11	NM	NM	530	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	27	NM			
35LK1231	1770-02	154	31	27	126	12	NM	NM	269	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1770-03	163	36	29	134	11	NM	NM	215	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1770-04	145	34	27	123	12	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1770-07	157	34	25	128	13	NM	NM	269	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	1770-11-26	150	33	24	119	10	NM	NM	184	NM	NM	NM	Surveyor Spring
		± 3	2	2	3	2	NM	NM	29	NM			
35LK1231	1771-02	119	4	30	77	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1771-03	139	33	25	119	11	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1771-05-8	144	34	26	122	12	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1771-05-10	132	30	26	114	11	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1771-05-12	148	30	25	119	11	NM	NM	264	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1772-01	150	32	27	122	14	NM	NM	216	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1773-02-1	105	5	30	70	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK1231	1774-02-01	143	30	26	117	12	NM	NM	287	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	1780-02	146	32	25	122	11	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1780-07	122	4	31	76	17	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	26	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1780-08	115	30	32	198	17	NM	NM	604	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	1781-05-09	147	32	24	121	12	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1781-05-12	60	417	27	275	10	NM	NM	1162	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	34	NM			
35LK1231	1781-05-13	154	33	26	124	13	NM	NM	229	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	30	NM			
35LK1231	1782-02	149	36	26	125	12	NM	NM	206	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1782-03	123	27	24	110	13	NM	NM	291	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	24	NM			
35LK1231	1782-04	138	31	27	120	10	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1782-06	147	31	25	122	11	NM	NM	277	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	1783-05	145	33	27	122	12	NM	NM	262	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1785-01	148	32	26	124	13	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1787-03	153	33	25	124	12	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1801-01	100	19	25	117	17	NM	NM	140	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1802-01	116	3	32	76	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	1803-01	142	28	27	120	13	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1804-01	127	25	39	178	31	NM	NM	204	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	1805-01	161	36	27	132	12	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1806-01	138	3	62	458	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK1231	1807-01	224	2	94	616	30	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	4	2	NM	NM	0	NM			
35LK1231	1808-01	217	2	89	598	31	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	4	2	NM	NM	0	NM			
35LK1231	1809-01	113	5	31	73	16	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1812-02	164	35	26	132	12	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	1812-04	146	34	26	123	12	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1814-03	131	30	22	113	10	NM	NM	214	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	1814-05	146	34	27	123	11	NM	NM	210	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1817-02-01	140	32	25	118	11	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1818-03	146	34	27	122	13	NM	NM	210	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1822-03	148	81	28	218	9	NM	NM	730	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	31	NM			
35LK1231	1822-04	146	31	25	122	10	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1825-03	156	35	23	121	11	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 3	2	2	3	2	NM	NM	29	NM			
35LK1231	1825-04	153	33	27	127	14	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1825-05-2	134	30	26	116	11	NM	NM	185	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1827-01	162	34	26	132	12	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	1827-06-6	142	30	25	123	13	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	2	2	2	NM	NM	NM	NM			
35LK1231	1848-01	137	2	61	487	52	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK1231	1850-01	112	4	30	72	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK1231	1853-01	148	32	26	118	13	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1857-01	148	32	26	122	11	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1859-01	146	32	27	122	11	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1862-01	144	32	24	120	12	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1867-01	107	4	30	70	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK1231	1871-01	232	2	91	617	30	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	21	NM			
35LK1231	1876-01	150	32	25	124	11	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1879-01	133	29	24	114	11	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1880-01	138	30	27	118	11	NM	NM	271	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	1881-01	92	4	27	63	14	NM	NM	0	NM	NM	NM	Unknown FGV
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	1882-01	145	31	25	122	11	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1883-01	118	4	32	72	17	NM	NM	[3]	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	1887-01	145	30	27	120	12	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1892-01	165	35	28	131	13	NM	NM	221	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1895-01	137	4	61	383	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			
35LK1231	1896-01	132	26	38	184	30	NM	NM	158	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1899-01	143	32	24	121	13	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1902-01	134	58	23	121	12	NM	NM	594	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	34	NM			
35LK1231	1903-01	144	32	25	123	13	NM	NM	262	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1908-01	135	31	26	116	11	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	1910-01	138	4	59	431	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1915-01	149	3	64	460	47	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			
35LK1231	1917-01	107	4	31	69	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK1231	1921-01	120	124	19	173	8	NM	NM	962	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	35	NM			
35LK1231	1922-01	99	65	25	91	11	NM	NM	725	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	1923-01	150	32	26	126	13	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1924-01	167	37	25	129	10	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	1925-01	118	204	14	151	10	NM	NM	952	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	33	NM			
35LK1231	1926-01	115	5	30	77	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	20	NM			
35LK1231	1927-01	146	34	25	122	12	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1928-01	148	33	27	125	12	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1936-01	149	3	63	475	51	NM	NM	0	NM	NM	NM	Unknown Obsidian 1 *
		± 2	1	2	3	2	NM	NM	23	NM			
35LK1231	1938-01	208	2	91	580	32	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			
35LK1231	1942-01	151	31	28	125	11	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1943-01	155	33	27	125	11	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1944-01	153	33	25	124	11	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1946-01	146	31	25	121	12	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	27	NM			
35LK1231	1947-01	155	33	27	130	13	NM	NM	294	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1950-01	153	33	26	129	12	NM	NM	291	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1951-01	147	32	27	122	12	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1953-01	144	32	25	120	13	NM	NM	277	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1955-01	140	28	27	120	12	NM	NM	281	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1956-01	115	7	30	76	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	1965-01	151	33	27	122	12	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1967-01	149	32	27	124	13	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1969-01	146	31	25	121	12	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	1974-01	143	32	25	119	12	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	1975-01	107	3	30	70	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK1231	1984-01	121	4	32	77	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	1987-01	155	3	63	427	49	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	22	NM			
35LK1231	1991-01	111	3	30	69	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	1993-01	158	35	28	130	13	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	1995-01	123	5	31	77	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	2002-01	118	4	30	74	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	2015-01	150	33	27	123	12	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2033-01	142	30	25	117	11	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2036-01	153	33	27	126	12	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2037-01	148	32	26	121	11	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2042-01	152	35	27	124	12	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2043-01	118	4	30	76	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	2044-01	121	4	31	76	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	2045-01	143	2	61	428	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK1231	2055-01	146	32	27	119	12	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2057-01	148	32	24	120	13	NM	NM	281	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2061-01	148	32	27	124	13	NM	NM	287	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2062-01	53	425	28	257	9	NM	NM	1202	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			
35LK1231	2066-01	143	32	26	119	11	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2068-01	104	72	18	95	10	NM	NM	638	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	31	NM			
35LK1231	2071-01	154	33	27	120	11	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	2093-01	141	32	25	119	12	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2097-01	215	2	89	581	32	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	23	NM			
35LK1231	2098-01	147	32	27	122	12	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2102-01	155	32	26	123	12	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2104-01	146	32	26	122	11	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2107-01	101	56	24	70	10	NM	NM	231	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2111-01	93	47	22	63	10	NM	NM	242	NM	NM	NM	Tucker Hill
		± 2	1	1	1	1	NM	NM	23	NM			
35LK1231	2113-01	126	10	28	88	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2118-01	155	32	27	122	11	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2122-01	163	35	27	128	13	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2130-01	150	33	25	125	13	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2134-01	118	106	17	161	10	NM	NM	939	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	38	NM			
35LK1231	2138-01	160	35	27	135	10	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	2162-01	150	3	64	438	47	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	22	NM			
35LK1231	2167-01	144	33	25	116	12	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2173-01	148	32	26	123	10	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2176-01	111	70	20	131	10	NM	NM	854	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	28	NM			
35LK1231	2177-01	107	27	33	187	17	NM	NM	583	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	2180-01	112	75	22	134	10	NM	NM	820	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	28	NM			
35LK1231	2181-01	109	4	30	68	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	25	NM			
35LK1231	2182-01	142	31	24	120	11	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2192-01	116	4	32	77	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2195-01	147	34	27	123	13	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2199-01	141	3	63	540	49	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	26	NM			
35LK1231	2206-01	159	36	27	125	13	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	2207-01	165	37	28	132	12	NM	NM	267	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	2217-01	147	32	25	134	12	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	2218-01	143	31	28	121	11	NM	NM	270	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2221-01	171	36	28	133	13	NM	NM	267	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2224-01	110	66	19	96	10	NM	NM	615	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	2225-01	148	32	27	122	12	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	29	NM			
35LK1231	2236-01	148	31	26	121	13	NM	NM	206	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2243-01	111	4	31	71	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	23	NM			
35LK1231	2249-01	157	33	28	127	12	NM	NM	227	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2253-01	150	33	26	121	13	NM	NM	266	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2256-01	94	176	20	178	9	NM	NM	1008	NM	NM	NM	Unknown FGV C
		± 2	2	1	2	1	NM	NM	30	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2262-01	138	3	61	415	49	NM	NM	NM	NM	NM	NM	Unknown Obsidian 1 *
		± 2	1	2	3	2	NM	NM	NM	NM			
35LK1231	2265-01	141	31	25	119	13	NM	NM	216	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2274-01	154	33	27	126	12	NM	NM	267	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2276-01	159	36	26	131	11	NM	NM	263	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	2281-01	198	93	31	192	17	NM	NM	608	NM	NM	NM	Coyote Spring FGV
		± 3	2	2	2	1	NM	NM	27	NM			
35LK1231	2289-01	97	63	16	92	11	NM	NM	684	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	2290-01	157	35	27	131	12	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK1231	2294-01	145	34	25	122	12	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2308-01	147	30	25	120	12	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2311-01	165	36	26	135	11	NM	NM	302	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	2314-01	137	30	25	119	11	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2315-01	138	31	25	118	9	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2318-01	149	33	27	125	11	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2322-01	119	4	30	76	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2323-01	149	32	27	123	12	NM	NM	288	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2324-01	115	76	19	135	11	NM	NM	870	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	27	NM			
35LK1231	2326-01	56	409	26	261	8	NM	NM	1123	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	35	NM			
35LK1231	2332-01	144	32	25	121	13	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2337-01	96	62	17	88	11	NM	NM	615	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	31	NM			
35LK1231	2340-01	53	391	27	265	9	NM	NM	1232	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			
35LK1231	2345-01	141	31	25	120	11	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2348-01	139	3	61	414	50	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			
35LK1231	2352-01	122	4	32	77	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2356-01	153	34	29	128	12	NM	NM	286	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2359-01	121	4	32	78	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	2364-01	150	32	26	122	12	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	2365-01	119	29	24	112	11	NM	NM	276	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	24	NM			
35LK1231	2366-01	152	3	64	473	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2368-01	134	27	38	194	29	NM	NM	207	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2373-01	122	24	39	180	31	NM	NM	179	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	2375-01	149	33	24	124	13	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2379-01	183	87	29	176	17	NM	NM	543	NM	NM	NM	Coyote Spring FGV
		± 3	2	2	2	2	NM	NM	27	NM			
35LK1231	2381-01	146	32	27	119	12	NM	NM	217	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2389-01	147	31	25	123	11	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2393-01	154	31	27	126	12	NM	NM	267	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2394-01	137	27	41	193	30	NM	NM	210	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2396-01	118	4	31	76	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	2397-01	55	414	30	260	10	NM	NM	1121	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	36	NM			
35LK1231	2400-01	110	72	18	98	10	NM	NM	686	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	30	NM			
35LK1231	2402-01	95	18	23	115	19	NM	NM	130	NM	NM	NM	Unknown Obsidian 2 *
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2415-01	141	32	25	122	11	NM	NM	218	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2425-01	109	4	31	69	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2430-01	141	2	66	438	52	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK1231	2434-01	151	35	26	126	11	NM	NM	279	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2438-01	149	31	26	122	12	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2442-01	118	4	32	76	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	2450-01	148	33	25	121	12	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2451-01	143	30	26	118	11	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	2455-01	47	438	27	231	9	NM	NM	1039	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	35	NM			
35LK1231	2459-01	75	144	28	152	12	NM	NM	922	NM	NM	NM	Unknown FGV
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	2464-01	150	33	26	123	12	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2469-01	162	35	26	134	12	NM	NM	275	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2471-01	116	4	31	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	2496-01	143	28	26	116	11	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2497-01	110	3	30	73	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	2500-01	140	33	26	117	9	NM	NM	227	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2502-01	46	426	28	233	10	NM	NM	1120	NM	NM	NM	Dismal Spring FGV
		± 2	4	1	3	2	NM	NM	33	NM			
35LK1231	2503-01	96	227	22	192	11	NM	NM	935	NM	NM	NM	Unknown FGV
		± 2	3	1	2	2	NM	NM	31	NM			
35LK1231	2504-01	118	4	31	76	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	2505-01	150	31	27	121	10	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	2506-01	110	115	20	161	10	NM	NM	977	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	2512-01	106	69	18	96	11	NM	NM	687	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	28	NM			
35LK1231	2519-01	124	25	39	183	33	NM	NM	185	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	2555-02	135	27	40	189	28	NM	NM	198	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2568-02-19	134	29	25	114	11	NM	NM	219	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	2585-01	141	31	28	122	12	NM	NM	266	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2586-01	145	32	26	124	13	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2587-01	101	171	20	181	10	NM	NM	972	NM	NM	NM	Unknown FGV C
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	2589-01	156	32	27	126	11	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2592-01	97	15	26	84	14	NM	NM	177	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2596-01	137	3	59	446	50	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK1231	2600-01	189	0	90	666	72	NM	NM	0	NM	NM	NM	Long Valley
		± 3	1	2	4	2	NM	NM	0	NM			
35LK1231	2605-01	153	33	27	123	12	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2610-01	123	24	37	181	30	NM	NM	191	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2613-01	144	31	26	123	12	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2619-01	162	35	25	130	13	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2621-01	145	31	25	119	11	NM	NM	294	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2626-01	104	72	17	97	8	NM	NM	674	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	30	NM			
35LK1231	2629-01	161	34	26	130	12	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	2630-01	137	31	26	121	12	NM	NM	273	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2632-01	139	31	24	118	11	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2633-01	125	52	24	117	10	NM	NM	617	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	30	NM			
35LK1231	2637-01	144	31	27	119	11	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2638-01	113	4	30	72	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2639-01	142	32	25	122	12	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	2645-01	146	31	27	118	11	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2647-01	143	31	24	119	13	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2650-01	121	3	30	75	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	2652-01	144	31	25	117	11	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2654-01	143	31	25	120	11	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2657-01	111	0	71	286	26	NM	NM	0	NM	NM	NM	Parsnip Creek
		± 2	1	2	3	2	NM	NM	22	NM			
35LK1231	2659-01	145	33	26	120	11	NM	NM	266	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2662-01	154	34	27	123	9	NM	NM	224	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2668-01	164	34	27	129	11	NM	NM	283	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2672-01	136	27	41	195	30	NM	NM	221	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	1	NM	NM	27	NM			
35LK1231	2673-01	140	3	61	433	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	22	NM			
35LK1231	2674-01	152	2	64	462	49	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK1231	2676-01	168	36	26	132	13	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2680-01	115	4	30	74	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	20	NM			
35LK1231	2681-01	55	377	27	261	10	NM	NM	1231	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			
35LK1231	2682-01	117	5	31	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	2683-01	130	27	38	191	33	NM	NM	200	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2684-01	116	4	31	73	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	2688-01	152	33	26	122	11	NM	NM	277	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2693-01	152	33	28	127	12	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	23	NM			
35LK1231	2695-01	163	36	27	125	9	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	27	NM			
35LK1231	2696-01	164	33	25	125	11	NM	NM	209	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	2697-01	151	34	26	126	12	NM	NM	209	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2702-01	163	36	27	127	11	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	2709-01	137	30	28	114	12	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2710-01	152	32	27	127	12	NM	NM	201	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2711-01	154	34	25	123	11	NM	NM	274	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2713-01	153	36	24	125	10	NM	NM	229	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	2714-01	149	33	24	121	11	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2716-01	152	33	25	123	12	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2723-01	157	34	27	124	12	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	2731-01	151	33	27	124	11	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2733-01	158	34	26	129	12	NM	NM	273	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2736-01	147	32	27	121	14	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2744-01	152	33	27	124	12	NM	NM	220	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2747-01	148	31	27	123	12	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2748-01	149	33	24	122	12	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	2749-01	144	32	25	121	11	NM	NM	197	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2753-01	161	35	25	127	13	NM	NM	222	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	28	NM			
35LK1231	2756-01	147	30	25	122	14	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	24	NM			
35LK1231	2757-01	153	34	26	124	12	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2758-01	149	33	27	120	11	NM	NM	212	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	2778-01	148	32	26	122	11	NM	NM	198	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	2786-01	158	35	27	128	11	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2791-01	153	33	28	125	11	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	2792-01	149	33	25	123	13	NM	NM	216	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	23	NM			
35LK1231	2793-01	153	34	26	123	12	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2796-01	157	34	27	127	10	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2798-01	163	36	29	130	12	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2800-01	153	32	25	124	12	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	2802-01	148	32	28	122	10	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	26	NM			
35LK1231	2813-01	153	34	26	125	13	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	2815-01	152	34	28	125	11	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2822-01	153	32	26	126	12	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2825-01	141	30	26	118	13	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2826-01	156	32	25	125	13	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2834-01	154	32	26	125	12	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2835-01	141	32	25	120	12	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2839-01	144	32	27	122	12	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2846-01	148	31	26	121	10	NM	NM	217	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2847-01	150	32	26	124	13	NM	NM	216	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2848-01	150	32	27	121	12	NM	NM	190	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2851-01	153	34	25	127	13	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2852-01	142	31	25	117	12	NM	NM	200	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	2854-01	147	36	27	126	11	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2860-01	149	31	28	122	13	NM	NM	221	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	2863-01	148	34	26	121	12	NM	NM	220	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2864-01	145	33	26	120	10	NM	NM	201	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	29	NM			
35LK1231	2881-01	121	26	23	108	10	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2884-01	144	31	26	124	14	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2889-01	137	31	26	117	11	NM	NM	212	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	2899-01	149	33	25	121	11	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2901-01	152	34	26	123	10	NM	NM	222	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	2908-01	142	31	25	117	12	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	2909-01	149	31	23	120	13	NM	NM	172	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	2913-01	156	33	27	124	11	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2916-01	155	32	27	127	13	NM	NM	276	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2934-01	142	30	25	117	13	NM	NM	207	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	28	NM			
35LK1231	2936-01	163	35	27	132	12	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2938-01	146	32	25	123	12	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2939-01	149	31	24	120	11	NM	NM	176	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	2942-01	157	33	26	126	13	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	2958-01	153	33	28	126	11	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	2963-01	59	331	25	244	9	NM	NM	1263	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			
35LK1231	2964-01	141	30	23	116	11	NM	NM	206	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	2967-01	141	29	25	120	10	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	2971-01	50	357	25	252	11	NM	NM	1260	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	33	NM			
35LK1231	2983-01	77	23	49	80	11	NM	NM	977	NM	NM	NM	Glass Buttes 1
		± 2	1	1	2	1	NM	NM	29	NM			
35LK1231	2984-01	159	34	28	127	13	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2985-01	149	34	27	122	13	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	2992-01	149	33	26	122	11	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	2994-01	154	33	27	125	11	NM	NM	214	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	2995-01	144	31	23	118	12	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	3001-01	136	30	24	116	15	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	3006-01	162	35	26	126	13	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	3015-01	162	34	24	127	10	NM	NM	225	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3016-01	152	32	26	126	12	NM	NM	216	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3020-01	162	34	27	127	12	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3022-01	144	32	26	120	11	NM	NM	270	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3023-01	145	32	27	123	11	NM	NM	276	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3025-01	130	30	24	116	12	NM	NM	217	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	27	NM			
35LK1231	3028-01	155	33	27	125	9	NM	NM	222	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	3030-01	140	31	27	118	12	NM	NM	205	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	3033-01	164	36	28	132	12	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3036-01	142	32	26	121	11	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3040-01	148	33	26	123	13	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	27	NM			
35LK1231	3055-01	146	30	25	118	13	NM	NM	208	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	25	NM			
35LK1231	3056-01	150	30	27	121	10	NM	NM	207	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	29	NM			
35LK1231	3080-01	161	34	26	128	12	NM	NM	214	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	3082-01	150	32	27	125	13	NM	NM	159	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	29	NM			
35LK1231	3084-01	152	32	25	122	11	NM	NM	195	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3099-01	158	34	24	127	12	NM	NM	220	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3100-01	143	31	25	121	12	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3110-01	139	31	24	118	11	NM	NM	210	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	3120-01	143	31	25	118	12	NM	NM	206	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	28	NM			
35LK1231	3123-01	145	31	24	119	10	NM	NM	218	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	3127-01	113	3	29	76	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	3145-01	156	35	26	133	10	NM	NM	263	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	3147-01	141	32	26	122	11	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3148-01	145	32	24	118	11	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	3154-01	162	35	27	128	12	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3158-01	154	33	26	124	11	NM	NM	266	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3161-01	142	33	26	121	12	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3162-01	150	33	26	123	13	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3174-01	100	66	15	93	11	NM	NM	589	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	28	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3181-01	143	28	25	119	11	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3188-01	151	32	27	129	10	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3191-01	139	30	26	115	11	NM	NM	214	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3193-01	148	32	26	124	13	NM	NM	245	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	3194-01	156	32	25	125	13	NM	NM	201	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	3197-01	112	4	31	72	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK1231	3198-01	154	35	26	123	12	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	3212-01	156	33	26	124	13	NM	NM	216	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3218-01	151	32	26	126	12	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3222-01	142	31	26	117	11	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3223-01	143	31	27	120	10	NM	NM	240	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	3231-01	136	30	24	114	10	NM	NM	227	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	3238-01	149	33	27	122	14	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3251-01	163	35	26	132	12	NM	NM	266	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			

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

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3252-01	155	32	28	125	13	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3254-01	149	32	28	125	11	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3257-01	152	34	26	124	13	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3266-01	150	32	24	122	13	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3267-01	96	28	25	107	12	NM	NM	367	NM	NM	NM	Unknown Obsidian 2?
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	3272-01	167	36	27	130	11	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3284-01	140	31	25	116	11	NM	NM	214	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	3290-01	142	33	24	121	11	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3300-01	145	34	25	121	12	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3306-01	147	32	27	124	15	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3312-01	138	30	27	119	14	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3313-01	142	29	25	116	13	NM	NM	200	NM	NM	NM	Surveyor Spring
		± 3	2	2	3	2	NM	NM	30	NM			
35LK1231	3326-01	152	33	27	127	12	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3331-01	152	32	27	126	11	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3332-01	148	32	24	120	10	NM	NM	222	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3337-01	146	33	25	123	10	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	3340-01	150	34	27	123	13	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3341-01	146	32	25	122	14	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3342-01	152	33	26	124	14	NM	NM	207	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3350-01	114	3	31	74	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	3352-01	117	4	31	75	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	3353-01	152	32	25	121	11	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK1231	3354-03	147	30	24	119	12	NM	NM	224	NM	NM	NM	Surveyor Spring
		± 3	2	2	3	2	NM	NM	30	NM			
35LK1231	3354-05	146	33	26	120	11	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3355-02	146	31	27	117	12	NM	NM	227	NM	NM	NM	Surveyor Spring
		± 3	2	2	2	2	NM	NM	28	NM			
35LK1231	3361-02	137	31	24	120	10	NM	NM	269	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	3361-03	145	32	26	121	11	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3367-02	106	68	16	95	10	NM	NM	669	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3368-01	152	31	25	121	12	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	3374-01-1	143	31	24	120	12	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3375-02	140	31	26	116	11	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	28	NM			
35LK1231	3380-02	142	33	23	119	13	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	3394-01	144	31	25	120	12	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	3396-01	120	4	32	75	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	3400-01	104	67	17	94	10	NM	NM	656	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	28	NM			
35LK1231	3403-01	144	3	64	453	51	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	22	NM			
35LK1231	3407-01	113	4	31	73	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK1231	3408-01	114	5	30	75	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK1231	3410-01	146	3	64	433	49	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			
35LK1231	3411-01	141	32	26	117	13	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3413-01	160	34	25	127	11	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3414-01	113	28	32	194	17	NM	NM	569	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	27	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3416-01	126	177	14	163	10	NM	NM	908	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	28	NM			
35LK1231	3417-01	101	75	20	99	11	NM	NM	600	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	28	NM			
35LK1231	3419-01	115	5	32	75	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3422-01	147	2	63	477	45	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	24	NM			
35LK1231	3423-01	140	31	24	119	10	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	3425-01	140	31	23	120	9	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	3427-01	127	30	23	112	10	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	29	NM			
35LK1231	3429-01	146	4	62	440	46	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			
35LK1231	3433-01	158	33	27	131	13	NM	NM	207	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	3437-01	155	33	27	123	12	NM	NM	208	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3441-01	150	32	27	122	13	NM	NM	213	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3444-01	154	33	27	124	14	NM	NM	207	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3447-01	151	34	26	127	10	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3450-01	159	35	26	126	11	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3452-01	123	175	14	167	9	NM	NM	923	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	3458-01	128	183	12	166	9	NM	NM	930	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	3471-03	123	174	15	160	10	NM	NM	896	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	29	NM			
35LK1231	3471-04	113	5	31	76	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	3475-01	141	31	25	121	13	NM	NM	267	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	3480-01	157	34	28	127	11	NM	NM	226	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3482-01	146	33	26	122	11	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3489-01	144	31	26	120	11	NM	NM	215	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	3490-01	159	35	27	130	12	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3493-01	135	28	24	114	11	NM	NM	207	NM	NM	NM	Surveyor Spring
		± 3	2	2	3	2	NM	NM	31	NM			
35LK1231	3499-01	165	35	27	129	12	NM	NM	217	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3501-01	165	37	27	132	13	NM	NM	224	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3503-01	145	32	26	120	10	NM	NM	198	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	3507-01	152	33	28	123	11	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3513-01	153	32	27	125	12	NM	NM	281	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	25	NM			
35LK1231	3516-01	121	29	32	203	17	NM	NM	578	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK1231	3521-01	139	28	26	116	12	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	27	NM			
35LK1231	3522-01	150	33	27	124	13	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3523-01	128	24	38	181	31	NM	NM	190	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	24	NM			
35LK1231	3528-01	148	3	63	448	49	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	21	NM			
35LK1231	3548-01	146	32	26	119	13	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3551-01	155	35	28	126	11	NM	NM	211	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3557-01	142	32	24	116	10	NM	NM	207	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	3563-01	150	34	25	122	11	NM	NM	206	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	25	NM			
35LK1231	3568-01	162	36	27	131	12	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	3578-01	140	30	26	122	11	NM	NM	210	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	27	NM			
35LK1231	3581-01	153	33	26	125	12	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	3583-01	142	31	25	120	13	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3588-01	100	64	17	90	11	NM	NM	622	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK1231	3590-01	153	34	27	125	13	NM	NM	220	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3597-01	136	28	24	113	12	NM	NM	184	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK1231	3601-01	97	64	17	88	11	NM	NM	632	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	31	NM			
35LK1231	3605-01	140	31	23	118	12	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	27	NM			
35LK1231	3610-01	141	32	26	119	11	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3611-01	154	36	26	132	13	NM	NM	256	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3612-01	145	32	25	124	10	NM	NM	227	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK1231	3617-01	114	4	32	75	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK1231	3620-01	170	38	27	134	13	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3626-01	174	2	88	627	73	NM	NM	0	NM	NM	NM	Long Valley
		± 2	1	2	4	2	NM	NM	0	NM			
35LK1231	3634-01	107	4	30	67	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK1231	3636-01	150	31	25	121	12	NM	NM	211	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK1231	3646-01	151	33	26	125	13	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK1231	3658-01	149	33	27	123	13	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK1231	3661-01	143	32	25	119	12	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3666-01	114	77	19	138	11	NM	NM	791	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	28	NM			
35LK1231	3667-01	159	34	28	126	12	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK1231	3668-01	129	25	39	191	29	NM	NM	189	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	24	NM			
35LK3856	3-01	154	35	26	131	13	NM	NM	297	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3856	11-01	152	34	25	131	10	NM	NM	274	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3856	13-01	147	35	27	128	11	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3856	15-01	118	4	31	76	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3856	18-01	156	35	25	133	12	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3856	19-01	115	4	30	75	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3856	20-01	157	36	26	128	10	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3856	21-01	158	34	27	132	11	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3856	22-01	59	435	29	272	9	NM	NM	1174	NM	NM	NM	Dismal Spring FGV
		± 2	4	1	3	1	NM	NM	34	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3856	23-01	162	37	27	135	12	NM	NM	276	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3856	25-01	167	37	29	137	12	NM	NM	269	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3856	26-01	152	34	27	131	12	NM	NM	277	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3931	1-01	110	4	31	72	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3931	2-01	154	34	26	128	13	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3931	3-01	154	34	26	126	12	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3931	4-01	111	4	32	72	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	23	NM			
35LK3931	5-01	109	3	30	70	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3931	6-01	154	33	25	126	13	NM	NM	282	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3931	7-01	146	33	28	124	13	NM	NM	262	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3931	8-01	144	30	25	121	12	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	26	NM			
35LK3931	9-01	157	35	26	128	14	NM	NM	223	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3931	10-01	147	34	24	124	13	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	33	NM			
35LK3931	11-01	112	3	30	72	19	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	28	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3931	12-01	149	31	26	121	12	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3931	13-01	144	31	25	118	12	NM	NM	222	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK3931	14-01	152	32	25	125	12	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3931	15-01	153	32	27	126	12	NM	NM	235	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3931	16-01	152	34	26	126	11	NM	NM	274	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3931	17-01	148	33	27	127	12	NM	NM	263	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3931	18-01	112	3	32	73	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3931	19-01	146	31	27	120	13	NM	NM	239	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3931	20-01	113	4	31	72	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3931	21-01	107	6	31	73	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3931	22-01	104	4	30	69	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3931	23-01	111	4	31	72	18	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3931	24-01	146	30	25	122	12	NM	NM	231	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK3931	25-01	137	31	26	119	11	NM	NM	279	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3931	26-01	146	32	26	122	11	NM	NM	286	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3931	27-01	147	34	26	122	14	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3931	28-01	113	5	30	72	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	23	NM			
35LK3931	29-01	143	3	61	403	50	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	27	NM			
35LK3931	32-01	137	30	26	116	12	NM	NM	246	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	27	NM			
35LK3931	32-02	153	35	28	125	12	NM	NM	285	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3931	34-01	142	32	25	119	13	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3931	35-01	119	3	32	74	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3931	36-01-1	147	32	26	120	12	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3931	39-01	141	31	26	120	9	NM	NM	277	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3931	101-02-1	149	31	26	122	12	NM	NM	268	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3931	103-02-1	107	4	30	70	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3931	111-02-1	156	33	26	124	13	NM	NM	212	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3931	121-02	142	33	26	123	11	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3931	122-02-1	150	32	27	124	14	NM	NM	248	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	33	NM			
35LK3931	125-02-1	113	4	30	73	18	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3931	127-02-1	154	33	26	125	12	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3931	138-03	141	31	24	118	10	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3931	143-02-1	164	35	27	129	11	NM	NM	230	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3931	151-02-1	151	33	28	124	11	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3931	156-02-1	159	34	27	124	11	NM	NM	228	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3931	166-01	109	4	29	70	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3842	8-01	151	34	26	127	11	NM	NM	277	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3842	9-01	143	3	63	477	49	NM	NM	NM	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	NM	NM			
35LK3842	10-01	140	31	24	119	11	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3842	13-01	147	32	25	121	11	NM	NM	227	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3842	14-01	150	34	27	122	11	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3842	15-01	151	34	27	122	12	NM	NM	283	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3842	16-01	39	477	26	203	7	NM	NM	980	NM	NM	NM	Pope Spring FGV
		± 2	4	2	3	2	NM	NM	36	NM			
35LK3842	17-01	121	4	32	75	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3842	18-01	145	32	25	119	12	NM	NM	278	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3842	19-01	150	32	26	122	12	NM	NM	237	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3842	20-01	149	3	64	476	52	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	25	NM			
35LK3842	21-01	109	4	31	68	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3842	22-01	119	4	31	71	18	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35LK3842	23-01	143	3	62	409	50	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK3842	24-01	138	2	64	453	51	NM	NM	NM	NM	NM	NM	Unknown Obsidian 1 *
		± 2	1	2	3	2	NM	NM	NM	NM			
35LK3842	25-01	114	5	31	71	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3842	34-01	112	5	33	74	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3842	37-01	116	3	31	74	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	25	NM			
35LK3842	38-01	198	2	101	662	83	NM	NM	0	NM	NM	NM	Long Valley
		± 3	1	2	4	2	NM	NM	21	NM			
35LK3842	41-01	60	438	26	273	9	NM	NM	1221	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3842	53-01	57	387	27	267	9	NM	NM	1205	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			
35LK3842	55-01	44	431	27	228	8	NM	NM	1127	NM	NM	NM	Dismal Spring FGV
		± 2	4	1	3	2	NM	NM	34	NM			
35LK3842	58-01	60	400	27	276	7	NM	NM	1183	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			
35LK3842	61-01	59	412	27	279	10	NM	NM	1214	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			
35LK3842	62-01	106	3	30	67	16	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3842	63-01	181	0	91	661	76	NM	NM	0	NM	NM	NM	Long Valley
		± 2	1	2	4	2	NM	NM	0	NM			
35LK3842	64-01	113	4	31	72	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3842	65-01	93	19	25	108	17	NM	NM	105	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	2	NM	NM	24	NM			
35LK3842	66-01	148	33	24	125	13	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	2	NM	NM	26	NM			
35LK3842	68-01	153	33	26	122	12	NM	NM	212	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3842	69-01	115	4	31	73	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3842	70-01	147	2	63	432	51	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK3842	71-01	147	33	26	124	12	NM	NM	250	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3842	72-01	90	18	25	110	18	NM	NM	133	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	2	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3842	73-01	88	16	24	108	15	NM	NM	117	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3842	76-01	112	4	31	72	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	20	NM			
35LK3842	77-01	62	414	28	282	8	NM	NM	1153	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	35	NM			
35LK3842	79-01	103	63	17	86	11	NM	NM	548	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3842	80-01	190	80	33	171	19	NM	NM	524	NM	NM	NM	Coyote Spring FGV
		± 3	2	1	2	1	NM	NM	27	NM			
35LK3842	82-01	100	11	28	79	15	NM	NM	89	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3842	96-01	110	4	30	69	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	0	NM			
35LK3842	97-01	143	32	24	121	10	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3842	109-01	110	4	30	72	18	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3842	117-01-1	61	411	27	277	9	NM	NM	1296	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	1	NM	NM	33	NM			
35LK3842	119-01-1	145	2	63	472	49	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	22	NM			
35LK3842	235-01	58	394	27	269	9	NM	NM	1185	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			
35LK3842	241-01	124	9	27	77	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3842	242-01	180	0	85	641	78	NM	NM	0	NM	NM	NM	Long Valley
		± 2	1	2	3	2	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3842	247-01	56	374	26	262	10	NM	NM	1138	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	36	NM			
35LK3842	248-01	142	31	24	118	12	NM	NM	247	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3842	254-01	216	2	90	586	32	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			
35LK3842	255-01	56	378	25	266	11	NM	NM	1196	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			
35LK3842	256-01	126	177	19	185	13	NM	NM	1253	NM	NM	NM	Unknown FGV
		± 2	2	1	2	1	NM	NM	34	NM			
35LK3842	266-01	59	402	28	270	9	NM	NM	1125	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	33	NM			
35LK3842	285-01	152	32	25	124	11	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3842	296-01	58	402	26	269	10	NM	NM	1078	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	32	NM			
35LK3842	305-01	151	33	26	123	11	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3842	307-01	128	3	57	389	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	21	NM			
35LK3842	309-01	110	4	30	70	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3842	324-01	109	4	30	70	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3842	333-01	112	3	32	71	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK3842	355-01	57	394	27	270	10	NM	NM	1178	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3842	430-01	146	31	24	118	10	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3842	476-01	213	2	89	582	33	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			
35LK3842	492-01	97	65	19	92	10	NM	NM	598	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3842	507-01	146	32	25	123	10	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3842	508-01	58	396	29	272	8	NM	NM	1202	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			
35LK3842	522-01	111	4	32	71	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3842	532-01	147	31	25	122	12	NM	NM	236	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3842	574-01	87	16	24	119	17	NM	NM	146	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3842	585-01	184	2	96	643	80	NM	NM	0	NM	NM	NM	Long Valley *
		± 2	1	2	3	2	NM	NM	0	NM			
35LK3842	591-01	142	4	62	434	50	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	25	NM			
35LK3842	594-01	113	4	30	72	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3842	595-01	99	60	18	84	9	NM	NM	542	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3842	596-01	150	32	27	122	11	NM	NM	273	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3842	597-01	141	32	26	119	11	NM	NM	265	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3842	598-01	110	4	30	71	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3842	599-01	106	4	30	69	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3842	602-01	103	62	16	88	12	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3842	603-01	109	4	31	71	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3842	607-01	108	5	30	70	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3327	1-01	164	37	27	129	12	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3327	2-01	114	5	31	77	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3327	3-01	97	43	23	114	16	NM	NM	794	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	34	NM			
35LK3327	4-01	150	34	24	126	14	NM	NM	284	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3327	5-01	114	4	30	73	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3327	6-01	155	35	27	130	12	NM	NM	254	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3327	7-01	151	33	26	124	11	NM	NM	218	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	34	NM			
35LK3327	8-01	123	81	20	140	12	NM	NM	926	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3327	9-01	107	10	29	78	15	NM	NM	68	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3327	10-01	120	173	15	162	9	NM	NM	1017	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3327	11-01	212	3	90	589	33	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			
35LK3327	13-01	116	5	32	73	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	0	NM			
35LK3327	16-01	102	66	18	92	10	NM	NM	657	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3327	17-01	144	32	27	122	12	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3327	18-01	114	4	31	80	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3327	21-01	89	18	24	121	16	NM	NM	166	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3327	22-01	149	33	26	126	14	NM	NM	252	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3327	23-01	112	4	31	72	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3327	25-01	111	3	31	72	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3327	27-01	109	4	31	70	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3327	28-01	105	65	17	94	11	NM	NM	670	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3327	29-01	149	31	27	126	12	NM	NM	259	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3327	31-01	153	33	26	127	14	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3327	34-01	123	51	22	115	13	NM	NM	575	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3327	36-01	138	87	20	151	11	NM	NM	992	NM	NM	NM	Badger Creek
		± 2	2	1	2	1	NM	NM	32	NM			
35LK3327	38-01	127	53	22	113	12	NM	NM	616	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3327	41-01	107	4	30	69	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3327	42-01	93	17	24	111	17	NM	NM	130	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3327	48-01-1	151	32	26	124	13	NM	NM	223	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3327	50-01-1	51	454	27	247	8	NM	NM	1195	NM	NM	NM	Dismal Spring FGV
		± 2	4	1	3	2	NM	NM	34	NM			
35LK3327	57-01-1	155	36	27	133	13	NM	NM	275	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3327	104-04	91	19	25	109	17	NM	NM	108	NM	NM	NM	Unknown Obsidian 2
		± 2	1	2	2	2	NM	NM	28	NM			
35LK3327	108-04	118	4	32	77	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3327	110-03	159	34	26	127	12	NM	NM	253	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3327	124-02	163	34	26	131	13	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3327	126-02	144	31	25	122	11	NM	NM	244	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3327	128-04	152	51	38	291	17	NM	NM	787	NM	NM	NM	Unknown FGV
		± 2	1	2	3	1	NM	NM	30	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3327	137-02	160	33	25	128	13	NM	NM	233	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	2	NM	NM	27	NM			
35LK3327	138-03	72	285	36	290	14	NM	NM	934	NM	NM	NM	Pope Spring B FGV
		± 2	3	2	3	2	NM	NM	31	NM			
35LK3327	153-03	88	19	24	107	18	NM	NM	NM	NM	NM	NM	Unknown Obsidian 2 *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3327	177-02-1	76	319	39	300	14	NM	NM	966	NM	NM	NM	Pope Spring B FGV
		± 2	3	2	3	2	NM	NM	32	NM			
35LK3327	186-02	151	34	27	127	12	NM	NM	234	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3327	207-03	154	33	25	127	12	NM	NM	249	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3327	215-03-1	137	30	26	119	10	NM	NM	242	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	26	NM			
35LK3327	239-04	36	481	26	197	7	NM	NM	1085	NM	NM	NM	Pope Spring FGV
		± 1	4	1	3	2	NM	NM	34	NM			
35LK3327	243-02	147	33	27	127	13	NM	NM	261	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3327	245-03	140	31	26	122	11	NM	NM	277	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3327	248-04	123	51	23	114	12	NM	NM	632	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3327	257-05	75	298	43	290	14	NM	NM	925	NM	NM	NM	Pope Spring B FGV
		± 2	3	2	3	2	NM	NM	33	NM			
35LK3327	267-03	115	4	32	75	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3327	275-02-1	153	32	25	128	13	NM	NM	301	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3327	289-02	158	35	27	126	13	NM	NM	257	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3327	292-02-1	74	293	36	287	13	NM	NM	926	NM	NM	NM	Pope Spring B FGV
		± 2	3	2	3	2	NM	NM	32	NM			
35LK3327	293-03	112	172	15	153	10	NM	NM	NM	NM	NM	NM	Beatys Butte *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3327	307-02	117	120	17	165	9	NM	NM	959	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3327	310-02-S1	56	427	28	261	10	NM	NM	1194	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			
35LK3327	317-02-3	57	443	27	260	10	NM	NM	1237	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			
35LK3327	325-02-1	156	35	25	128	12	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3327	351-01	107	12	29	80	17	NM	NM	90	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4161	1-01	155	32	27	125	14	NM	NM	229	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK4161	2-01	169	36	27	135	12	NM	NM	273	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4161	3-01	128	5	33	79	17	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4161	4-01	110	5	31	71	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4161	5-01	113	4	30	76	17	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4161	6-01	113	4	31	75	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4161	7-01	117	4	31	74	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4161	8-01	119	3	31	78	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4161	15-01	113	3	32	75	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK4161	16-01	111	4	30	71	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK4161	18-01	115	5	30	74	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4140	1-01	94	4	68	507	25	NM	NM	345	NM	NM	NM	Unknown Obsidian 4
		± 2	1	2	3	2	NM	NM	25	NM			
35LK4140	2-01	120	5	31	77	19	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	20	NM			
35LK4140	3-01	98	19	26	112	19	NM	NM	136	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4140	4-01	149	3	63	416	51	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	22	NM			
35LK4140	5-01	142	31	25	119	15	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 3	1	2	2	2	NM	NM	28	NM			
35LK4140	6-01	113	6	31	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK4140	7-01	148	33	26	124	12	NM	NM	243	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4140	8-01	93	20	24	114	15	NM	NM	144	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4140	9-01	94	19	26	111	17	NM	NM	147	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	23	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4140	10-01	117	4	30	75	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4140	11-01	108	4	31	72	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4140	12-01	48	513	49	345	39	NM	NM	1180	NM	NM	NM	Unknown FGV
		± 2	4	2	4	2	NM	NM	38	NM			
35LK4140	13-01	108	6	60	617	50	NM	NM	0	NM	NM	NM	Not FGV
		± 2	1	2	4	2	NM	NM	23	NM			
35LK4140	14-01	59	406	27	277	11	NM	NM	1326	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			
35LK4140	17-01	92	18	25	116	18	NM	NM	153	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4140	18-01	118	72	21	134	13	NM	NM	901	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4140	19-01	54	381	29	269	10	NM	NM	1357	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			
35LK4140	21-01	115	3	74	366	26	NM	NM	61	NM	NM	NM	Parsnip Creek
		± 2	1	2	3	2	NM	NM	22	NM			
35LK4140	22-01	104	46	24	68	11	NM	NM	NM	NM	NM	NM	Tucker Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4140	23-01	152	34	26	125	12	NM	NM	276	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4140	24-01	129	53	22	118	13	NM	NM	625	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4140	25-01	108	61	18	90	9	NM	NM	583	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4140	26-01	216	2	93	597	33	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4140	27-01	92	18	24	114	18	NM	NM	192	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	2	NM	NM	25	NM			
35LK4140	28-01	115	4	32	72	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	0	NM			
35LK4140	29-01	122	80	20	141	11	NM	NM	898	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	30	NM			
35LK4140	31-01	160	35	28	130	13	NM	NM	272	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4140	32-01	125	51	23	117	12	NM	NM	614	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4140	33-01	156	34	28	127	13	NM	NM	302	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK4140	34-01	147	32	28	127	12	NM	NM	260	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK4140	35-01	58	411	27	287	11	NM	NM	1323	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	1	NM	NM	31	NM			
35LK4140	37-01	110	3	31	73	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4140	40-01	55	636	21	244	14	NM	NM	1290	NM	NM	NM	Unknown FGV
		± 2	4	1	3	2	NM	NM	36	NM			
35LK4140	41-01	117	5	32	75	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	20	NM			
35LK4140	43-01	48	481	30	242	8	NM	NM	1136	NM	NM	NM	Unknown FGV
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4140	44-01	54	630	22	216	11	NM	NM	1103	NM	NM	NM	Unknown FGV
		± 2	5	2	3	2	NM	NM	38	NM			
35LK4140	45-01	217	2	92	593	35	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4140	46-01	162	25	66	246	17	NM	NM	131	NM	NM	NM	Unknown Obsidian 5
		± 2	1	2	2	2	NM	NM	25	NM			
35LK4140	47-01	103	5	31	69	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	2	2	2	NM	NM	21	NM			
35LK4140	48-01	161	38	27	130	12	NM	NM	284	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4140	49-01	218	0	91	594	34	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	23	NM			
35LK4140	50-01	155	34	26	128	12	NM	NM	306	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4140	51-01	119	4	30	75	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK4140	52-01	122	5	34	77	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4140	53-01-1	105	6	31	71	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4140	53-01-2	108	4	31	71	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK4140	53-01-3	108	4	30	73	17	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4140	59-01-2	112	6	31	73	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	23	NM			
35LK4140	59-01-3	117	4	31	76	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3337	1-01	108	28	33	189	18	NM	NM	604	NM	NM	NM	Blue Spring
		± 2	1	1	2	2	NM	NM	30	NM			
35LK3337	2-01	148	33	27	122	13	NM	NM	251	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	30	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3337	3-01	110	62	20	97	12	NM	NM	605	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	34	NM			
35LK3337	4-01	113	4	30	71	19	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3337	5-01	148	31	24	122	13	NM	NM	211	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3337	6-01	109	4	31	68	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3337	7-01	117	180	13	159	8	NM	NM	955	NM	NM	NM	Beatys Butte *
		± 2	2	1	2	1	NM	NM	36	NM			
35LK3337	8-01	110	3	31	72	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	2	NM	NM	23	NM			
35LK3337	9-01	132	34	24	99	13	NM	NM	331	NM	NM	NM	Unknown Obsidian 6 *
		± 2	1	1	2	1	NM	NM	34	NM			
35LK3337	10-01	109	4	30	70	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3337	11-01	105	4	30	74	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3337	12-01	96	45	24	67	13	NM	NM	259	NM	NM	NM	Tucker Hill
		± 2	1	1	1	1	NM	NM	28	NM			
35LK3337	13-01	90	19	24	107	17	NM	NM	147	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3337	14-01	147	33	27	122	12	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3337	15-01	54	383	26	258	9	NM	NM	1236	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	33	NM			
35LK3337	16-01	215	2	90	583	30	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3337	17-01	107	10	27	78	15	NM	NM	47	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK3337	18-01	122	10	28	78	13	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3337	19-01	49	442	27	242	8	NM	NM	1073	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	35	NM			
35LK3337	20-01	43	434	29	219	8	NM	NM	975	NM	NM	NM	Dismal Spring FGV
		± 2	4	2	3	2	NM	NM	37	NM			
35LK3337	21-01	115	5	32	72	19	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	20	NM			
35LK3337	22-01	121	68	21	131	11	NM	NM	NM	NM	NM	NM	Rainbow Mines *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	23-01	120	3	32	76	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3337	24-01	128	24	41	184	32	NM	NM	185	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	26	NM			
35LK3337	25-01	111	4	31	71	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3337	26-01	141	88	18	155	11	NM	NM	972	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3337	27-01	118	2	77	288	26	NM	NM	50	NM	NM	NM	Parsnip Creek
		± 2	1	2	2	2	NM	NM	25	NM			
35LK3337	29-01	113	28	33	190	18	NM	NM	604	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3337	30-01	130	55	23	116	12	NM	NM	585	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	35	NM			
35LK3337	32-01	144	30	26	123	11	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3337	34-01	109	4	31	72	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	24	NM			
35LK3337	36-01	160	34	27	130	13	NM	NM	232	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3337	38-01	113	3	33	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	20	NM			
35LK3337	39-01	150	34	26	127	13	NM	NM	259	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3337	40-01	112	19	19	84	12	NM	NM	51	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3337	41-01	116	100	19	152	8	NM	NM	952	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	33	NM			
35LK3337	42-01	101	65	17	91	10	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	48-03-1	115	4	30	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK3337	60-01	119	4	31	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3337	62-01	90	6	65	506	23	NM	NM	391	NM	NM	NM	Unknown Obsidian 4
		± 2	1	2	3	2	NM	NM	26	NM			
35LK3337	64-03	114	3	31	71	16	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	24	NM			
35LK3337	65-01-1	106	28	34	187	16	NM	NM	543	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3337	67-01-1	149	32	25	123	10	NM	NM	236	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3337	98-05	114	10	30	80	16	NM	NM	69	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3337	201-01	108	4	31	69	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3337	202-01	150	33	26	124	13	NM	NM	248	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3337	203-01	95	44	25	66	11	NM	NM	275	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3337	204-01	119	163	14	155	10	NM	NM	NM	NM	NM	NM	Beatys Butte *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3337	205-01	121	50	23	113	12	NM	NM	597	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3337	283-02	207	2	88	573	32	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley *
		± 3	1	2	3	2	NM	NM	28	NM			
35LK3337	283-03	98	47	23	67	11	NM	NM	244	NM	NM	NM	Tucker Hill *
		± 2	1	1	1	1	NM	NM	28	NM			
35LK3337	283-04	144	32	25	120	11	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	284-02	62	641	19	212	13	NM	NM	1242	NM	NM	NM	Unknown FGV
		± 2	4	1	3	2	NM	NM	35	NM			
35LK3337	284-03	114	28	33	191	15	NM	NM	NM	NM	NM	NM	Blue Spring *
		± 2	1	1	2	2	NM	NM	NM	NM			
35LK3337	284-04	91	68	21	67	13	NM	NM	NM	NM	NM	NM	McComb Butte *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3337	284-05	106	3	32	71	19	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3337	284-07	201	2	87	578	34	NM	NM	NM	NM	NM	NM	Massacre Lake/Guano Valley *
		± 3	1	2	3	2	NM	NM	NM	NM			
35LK3337	284-08	213	0	91	586	33	NM	NM	NM	NM	NM	NM	Massacre Lake/Guano Valley *
		± 3	1	2	3	2	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3337	290-02	110	4	30	76	18	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3337	291-03	127	70	23	131	12	NM	NM	NM	NM	NM	NM	Rainbow Mines *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3337	291-04	154	33	27	123	11	NM	NM	241	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3337	291-05	207	3	91	582	32	NM	NM	NM	NM	NM	NM	Massacre Lake/Guano Valley *
		± 3	1	2	3	2	NM	NM	NM	NM			
35LK3337	291-06	109	71	20	131	11	NM	NM	NM	NM	NM	NM	Rainbow Mines *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3337	295-01	110	6	31	74	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	26	NM			
35LK3337	295-02	99	60	16	86	10	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	295-04	154	32	29	126	12	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	295-05	99	4	31	68	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	295-08	103	59	17	84	12	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	2	NM	NM	NM	NM			
35LK3337	296-02	128	24	37	176	30	NM	NM	NM	NM	NM	NM	Mosquito Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35LK3337	296-04	160	35	27	127	14	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	301-03	148	33	26	128	12	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	301-06	106	4	30	69	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	0	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3337	302-02	209	3	89	585	33	NM	NM	NM	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	NM	NM			
35LK3337	305-01	86	5	61	463	22	NM	NM	NM	NM	NM	NM	Unknown Obsidian 4 *
		± 2	1	2	3	2	NM	NM	NM	NM			
35LK3337	306-02	100	47	23	67	11	NM	NM	NM	NM	NM	NM	Tucker Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	306-03	89	18	25	106	16	NM	NM	138	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3337	306-06	108	64	17	92	12	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	306-06-1	119	4	32	77	19	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3337	306-06-2	196	2	87	574	34	NM	NM	NM	NM	NM	NM	Massacre Lake/Guano Valley *
		± 2	1	1	3	1	NM	NM	NM	NM			
35LK3337	306-06-3	114	4	32	73	19	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 1	0	1	1	1	NM	NM	NM	NM			
35LK3337	307-05	227	2	95	610	34	NM	NM	NM	NM	NM	NM	Massacre Lake/Guano Valley *
		± 3	1	2	3	2	NM	NM	NM	NM			
35LK3337	312-03	114	4	31	74	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3337	312-03-1	105	4	30	70	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	312-03-2	137	31	26	122	14	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	312-03-3	111	4	31	72	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3337	312-03-4	140	3	63	431	53	NM	NM	NM	NM	NM	NM	Unknown Obsidian 1 *
		± 2	1	2	3	2	NM	NM	NM	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3337	312-03-5	115	63	19	124	13	NM	NM	NM	NM	NM	NM	Sugar Hill? *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	317-16	104	68	16	96	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	320-04	102	74	18	94	12	NM	NM	669	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3337	334-02	169	35	27	143	13	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 3	2	2	2	2	NM	NM	NM	NM			
35LK3337	335-03	96	63	18	90	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	343-04	109	4	31	72	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3337	357-01	105	154	20	178	9	NM	NM	975	NM	NM	NM	Unknown FGV E *
		± 2	2	1	2	1	NM	NM	35	NM			
35LK3337	358-01	109	4	30	72	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	359-01	144	3	65	449	52	NM	NM	NM	NM	NM	NM	Unknown Obsidian 1 *
		± 2	1	2	3	2	NM	NM	NM	NM			
35LK3337	360-01	98	46	24	67	10	NM	NM	238	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3337	361-01	88	19	25	104	15	NM	NM	155	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3337	362-01	156	36	26	130	13	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3337	363-01	106	68	17	94	13	NM	NM	656	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3337	364-01	110	4	31	73	17	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3337	366-01	98	65	16	93	10	NM	NM	681	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3337	367-01	111	10	52	338	17	NM	NM	813	NM	NM	NM	Silver Lake/Sycan Marsh
		± 2	1	2	3	1	NM	NM	33	NM			
35LK3337	368-01	91	5	64	472	23	NM	NM	315	NM	NM	NM	Unknown Obsidian 4
		± 2	1	2	3	2	NM	NM	25	NM			
35LK3337	370-01	108	3	31	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3337	371-01	143	30	27	127	13	NM	NM	327	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3337	372-01	93	7	68	508	23	NM	NM	NM	NM	NM	NM	Unknown Obsidian 4 *
		± 2	1	2	3	2	NM	NM	NM	NM			
35LK3337	374-01	123	10	27	77	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3337	375-01	121	78	19	137	10	NM	NM	NM	NM	NM	NM	Rainbow Mines *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3337	377-01	95	44	23	115	16	NM	NM	820	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3337	378-01	91	46	24	67	10	NM	NM	298	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3337	380-01	119	49	22	112	11	NM	NM	575	NM	NM	NM	Sugar Hill
		± 2	2	1	2	2	NM	NM	29	NM			
35LK3337	381-01	102	13	26	84	14	NM	NM	118	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3337	382-01	154	34	26	129	10	NM	NM	279	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3337	383-01	146	33	26	124	11	NM	NM	258	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3337	384-01	150	3	64	437	53	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	0	NM			
35LK3337	385-01	116	4	32	74	18	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3916	1-01	192	2	98	681	77	NM	NM	NM	NM	NM	NM	Long Valley *
		± 3	1	2	4	2	NM	NM	NM	NM			
35LK3916	2-01	194	2	96	664	81	NM	NM	0	NM	NM	NM	Long Valley
		± 3	1	2	4	2	NM	NM	0	NM			
35LK3916	3-01	98	66	17	95	10	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3916	4-01	117	4	31	76	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3916	6-01	120	4	29	77	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3916	7-01	126	4	34	79	16	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3916	8-01	112	74	20	101	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3916	10-01	111	28	34	191	18	NM	NM	603	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3891	1-01	111	8	52	345	19	NM	NM	821	NM	NM	NM	Silver Lake/Sycan Marsh
		± 2	1	2	3	2	NM	NM	28	NM			
35LK3891	3-01	224	2	90	602	33	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			
35LK3891	4-01	121	3	33	75	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3891	5-01	118	4	32	72	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3891	6-01	126	26	40	184	32	NM	NM	202	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	26	NM			
35LK3891	8-01	112	5	32	76	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	20	NM			
35LK3891	9-01	127	52	25	116	12	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3891	10-01	127	110	19	160	11	NM	NM	NM	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3891	11-01	120	3	34	78	19	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3891	13-01	157	34	26	127	13	NM	NM	255	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3891	14-01	121	172	14	162	8	NM	NM	1042	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3891	15-01	157	36	26	129	13	NM	NM	296	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3891	17-01	119	4	31	75	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	0	NM			
35LK3891	19-01	114	2	73	339	27	NM	NM	57	NM	NM	NM	Parsnip Creek
		± 2	1	2	3	2	NM	NM	27	NM			
35LK3891	20-01	123	68	20	130	14	NM	NM	802	NM	NM	NM	Rainbow Mines *
		± 2	1	1	2	1	NM	NM	34	NM			
35LK3891	21-01	55	402	27	270	10	NM	NM	1285	NM	NM	NM	Dismal Spring FGV
		± 2	3	1	3	2	NM	NM	34	NM			
35LK3891	22-01	115	4	32	75	19	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3891	23-01	117	3	33	74	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3891	24-01	131	70	23	133	11	NM	NM	740	NM	NM	NM	Rainbow Mines
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3891	29-01	101	65	17	91	10	NM	NM	709	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3886	1-01	128	13	32	89	15	NM	NM	NM	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3886	2-01	115	11	30	82	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3886	3-01	126	10	32	87	18	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3886	4-01	122	30	31	87	14	NM	NM	NM	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3886	5-01	113	10	29	87	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3886	6-01	113	19	30	90	13	NM	NM	85	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3886	7-01	119	13	30	84	17	NM	NM	NM	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3886	8-01	126	12	32	86	16	NM	NM	62	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3886	9-01	124	12	31	94	17	NM	NM	68	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3886	10-01	117	12	30	85	15	NM	NM	75	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3889	1-01	107	68	17	99	10	NM	NM	764	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3889	2-01	125	5	32	79	17	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3889	3-01	114	4	31	75	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3889	4-01	134	55	22	121	12	NM	NM	612	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3889	5-01	119	4	33	76	16	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	0	NM			
35LK3889	6-01	131	9	28	84	13	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3889	7-01	120	9	27	80	12	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3889	9-01	101	10	25	74	12	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	23	NM			
35LK3889	11-01	123	9	26	83	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3889	25-01	111	6	30	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3889	25-01-S1	111	74	20	100	10	NM	NM	715	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	32	NM			
35LK4067	1-01	111	6	29	76	16	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4067	2-01	129	52	23	117	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	2	NM	NM	NM	NM			
35LK4067	3-01	123	18	29	94	16	NM	NM	NM	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	2	2	2	NM	NM	NM	NM			
35LK4067	4-01	133	56	25	123	14	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4067	5-01	126	5	30	78	17	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4067	6-01	105	110	18	163	11	NM	NM	NM	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK4067	7-01	85	5	64	497	21	NM	NM	NM	NM	NM	NM	Unknown Obsidian 4 *
		± 2	1	2	4	2	NM	NM	NM	NM			
35LK4067	8-01	122	126	20	173	10	NM	NM	917	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	33	NM			
35LK4067	9-01	113	16	30	90	14	NM	NM	NM	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4067	10-01	120	78	19	141	10	NM	NM	870	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3996	1-01	118	103	19	155	9	NM	NM	NM	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3996	2-01	110	14	27	85	14	NM	NM	153	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3996	3-01	127	53	22	119	11	NM	NM	575	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3996	5-01	123	79	22	141	10	NM	NM	NM	NM	NM	NM	Alturas FGV *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3996	6-01	130	53	22	120	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3996	7-01	121	81	21	147	10	NM	NM	NM	NM	NM	NM	Alturas FGV *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3996	8-01	132	71	22	136	11	NM	NM	748	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3996	9-01	122	5	31	77	16	NM	NM	NM	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3996	10-01	117	105	20	162	11	NM	NM	NM	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3996	11-01	131	55	23	117	15	NM	NM	659	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3986	1-01	125	80	21	139	11	NM	NM	879	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3986	2-01	135	37	26	102	14	NM	NM	394	NM	NM	NM	Unknown Obsidian 6
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3986	3-01	102	70	20	96	10	NM	NM	631	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3986	4-01	135	56	24	122	12	NM	NM	606	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	33	NM			
35LK3986	5-01	132	56	23	119	12	NM	NM	598	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	33	NM			
35LK3986	6-01	128	51	21	117	13	NM	NM	593	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	32	NM			
35LK3986	7-01	124	75	20	137	10	NM	NM	824	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	35	NM			
35LK3986	8-01	120	78	20	138	13	NM	NM	912	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	34	NM			
35LK3986	9-01	122	50	22	115	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3986	10-01	126	82	19	142	11	NM	NM	903	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3986	11-01	128	52	23	116	13	NM	NM	600	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3986	13-01	107	63	19	91	10	NM	NM	562	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3986	15-01	110	27	30	189	18	NM	NM	624	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	29	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3986	16-01	122	117	20	165	9	NM	NM	891	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	2	NM	NM	30	NM			
35LK3986	17-01	122	78	18	140	11	NM	NM	890	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3986	18-01	127	54	24	115	13	NM	NM	622	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3982	1-01	125	31	34	205	18	NM	NM	NM	NM	NM	NM	Blue Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3982	2-01	128	115	21	169	9	NM	NM	NM	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3982	3-01	133	55	23	122	11	NM	NM	668	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3982	5-01	128	32	34	209	19	NM	NM	NM	NM	NM	NM	Blue Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3982	6-01	142	59	25	126	12	NM	NM	633	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	35	NM			
35LK3982	7-01	106	66	17	90	12	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	2	2	2	NM	NM	NM	NM			
35LK3982	8-01	116	47	21	112	12	NM	NM	570	NM	NM	NM	Sugar Hill
		± 2	2	1	2	1	NM	NM	28	NM			
35LK3982	9-01	126	53	23	115	10	NM	NM	592	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3982	10-01	110	70	19	98	12	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3982	11-01	119	28	33	199	18	NM	NM	NM	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3990	5-01	125	75	19	138	10	NM	NM	808	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	29	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3990	8-01	124	4	32	78	16	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3990	9-01	126	111	20	161	9	NM	NM	870	NM	NM	NM	Unknown FGV B
		± 3	2	2	3	2	NM	NM	37	NM			
35LK3990	10-01	67	625	17	174	9	NM	NM	1305	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	1	NM	NM	36	NM			
35LK3990	13-01	121	80	20	141	10	NM	NM	827	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3990	14-01	119	28	33	206	18	NM	NM	619	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3990	15-01	67	624	16	174	9	NM	NM	1209	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	36	NM			
35LK3990	52-01	139	11	30	86	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3990	55-01	108	67	18	98	10	NM	NM	674	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3990	55-02	113	108	19	157	9	NM	NM	861	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	33	NM			
35LK3989	1-01	138	10	28	85	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3989	2-01	134	53	22	119	11	NM	NM	564	NM	NM	NM	Sugar Hill
		± 2	2	1	2	1	NM	NM	34	NM			
35LK3989	3-01	125	10	27	82	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3989	4-01	123	10	25	78	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3989	6-01	129	55	23	121	13	NM	NM	659	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3989	7-01	106	68	17	98	10	NM	NM	686	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	28	NM			
35LK3989	8-01	132	10	29	82	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3989	10-01	128	80	20	141	10	NM	NM	879	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	33	NM			
35LK3989	13-01	106	48	25	70	10	NM	NM	252	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3989	14-01	134	10	27	83	10	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3989	16-01	129	9	29	82	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	20	NM			
35LK3989	17-01	79	251	55	158	6	NM	NM	1672	NM	NM	NM	Unknown FGV
		± 2	3	2	3	2	NM	NM	40	NM			
35LK3989	18-01	123	9	28	81	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	19	NM			
35LK3989	21-01	132	58	22	123	11	NM	NM	598	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3989	22-01	126	30	32	208	18	NM	NM	588	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3989	24-01	129	9	28	81	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	20	NM			
35LK3989	25-01	146	32	24	124	10	NM	NM	238	NM	NM	NM	Surveyor Spring
		± 2	1	2	2	1	NM	NM	24	NM			
35LK3989	29-01	71	634	14	175	8	NM	NM	1293	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	1	NM	NM	33	NM			
35LK3989	37-01	99	46	23	67	10	NM	NM	257	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3989	43-01	117	28	33	194	17	NM	NM	572	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3896	1-01	119	51	21	111	14	NM	NM	554	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3896	2-01	128	9	29	81	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3896	3-01	128	52	24	115	13	NM	NM	555	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	33	NM			
35LK3896	4-01	133	25	40	200	33	NM	NM	197	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	27	NM			
35LK3896	5-01	126	53	22	115	13	NM	NM	565	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3896	6-01	127	9	27	87	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3896	8-01	115	49	22	108	11	NM	NM	548	NM	NM	NM	Sugar Hill
		± 2	1	1	2	2	NM	NM	29	NM			
35LK3896	9-01	118	70	21	132	11	NM	NM	766	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3896	10-01	108	3	31	72	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK3896	11-01	108	64	19	89	12	NM	NM	528	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3896	12-01	66	588	15	165	8	NM	NM	1251	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK3896	14-01	130	53	23	118	12	NM	NM	587	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3896	15-01	94	64	25	98	8	NM	NM	1176	NM	NM	NM	Glass Buttes 3
		± 2	1	1	2	1	NM	NM	30	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3896	17-01	128	53	22	117	13	NM	NM	582	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3896	18-01	116	118	19	162	8	NM	NM	845	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3896	19-01	118	10	27	77	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3896	20-01	125	2	75	235	29	NM	NM	0	NM	NM	NM	Unknown Obsidian 10
		± 2	1	2	2	2	NM	NM	0	NM			
35LK3896	22-01	67	589	16	161	8	NM	NM	1176	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK3896	23-01	200	4	39	71	23	NM	NM	0	NM	NM	NM	Unknown Obsidian 11
		± 3	1	2	2	2	NM	NM	21	NM			
35LK3896	26-01	115	76	21	136	10	NM	NM	801	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	27	NM			
35LK3896	33-01	88	40	24	115	14	NM	NM	762	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3896	34-01	118	10	27	76	15	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3896	35-01	121	9	25	78	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3896	36-01	116	103	19	158	9	NM	NM	929	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	28	NM			
35LK3896	38-01	97	62	17	89	11	NM	NM	677	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3896	56-01-1	128	81	26	292	15	NM	NM	586	NM	NM	NM	Del Prat Spring
		± 2	2	1	2	1	NM	NM	26	NM			
35LK3896	62-01	115	11	53	344	19	NM	NM	739	NM	NM	NM	Silver Lake/Sycan Marsh
		± 2	1	2	3	2	NM	NM	30	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3896	65-01	105	61	16	87	10	NM	NM	548	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3896	66-01-1	117	71	20	128	12	NM	NM	821	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3896	69-01	121	11	26	75	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3896	70-01	83	63	19	57	10	NM	NM	299	NM	NM	NM	McComb Butte
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3896	71-02	123	10	26	77	11	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3896	74-01	106	25	29	180	17	NM	NM	588	NM	NM	NM	Blue Spring
		± 2	1	1	2	2	NM	NM	27	NM			
35LK3896	78-01	98	67	17	91	10	NM	NM	682	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3896	80-02	119	10	25	76	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3896	82-01	125	52	23	114	12	NM	NM	600	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3896	90-01	128	51	23	116	12	NM	NM	625	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3898	1-01	92	74	18	97	13	NM	NM	665	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	33	NM			
35LK3898	2-01	110	74	18	108	9	NM	NM	688	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	28	NM			
35LK3898	3-01	139	89	20	155	9	NM	NM	811	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	43	NM			
35LK3898	6-01	127	9	27	80	12	NM	NM	NM	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3898	9-01	109	189	22	200	8	NM	NM	NM	NM	NM	NM	Unknown FGV *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3898	10-01	70	629	17	177	8	NM	NM	1319	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	1	NM	NM	35	NM			
35LK3898	11-01	63	0	75	405	19	NM	NM	1117	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	34	NM			
35LK3898	13-01	126	11	28	81	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3898	15-01	114	20	19	81	11	NM	NM	65	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3898	19-01	117	51	21	114	11	NM	NM	608	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3898	27-01	120	78	20	141	10	NM	NM	988	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	26	NM			
35LK3898	30-01	138	79	22	147	13	NM	NM	NM	NM	NM	NM	Rainbow Mines *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3903	1-01	116	29	32	195	15	NM	NM	558	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3903	2-01	106	66	17	92	11	NM	NM	641	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	28	NM			
35LK3903	4-01	110	66	18	96	10	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3903	5-01	130	10	26	82	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3903	6-01	89	150	23	152	11	NM	NM	745	NM	NM	NM	Unknown Obsidian 3
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3903	7-01	74	627	17	172	7	NM	NM	1354	NM	NM	NM	Unknown FGV A
		± 2	5	1	3	2	NM	NM	33	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3903	8-01	126	69	22	132	11	NM	NM	746	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3903	9-01	99	89	20	101	11	NM	NM	666	NM	NM	NM	Buck Mountain?
		± 2	2	1	2	1	NM	NM	27	NM			
35LK3903	10-01	131	56	23	121	11	NM	NM	602	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3903	11-01	109	71	17	97	11	NM	NM	615	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	37	NM			
35LK3903	12-01	120	106	21	161	10	NM	NM	923	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	33	NM			
35LK3903	13-01	113	29	33	189	16	NM	NM	606	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4175	1-01	117	105	20	156	9	NM	NM	880	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4176	1-01	122	126	20	170	9	NM	NM	1048	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	39	NM			
35LK4176	2-01	125	29	34	206	18	NM	NM	625	NM	NM	NM	Blue Spring *
		± 2	1	1	2	1	NM	NM	34	NM			
35LK4176	3-01	103	102	21	122	12	NM	NM	732	NM	NM	NM	Harris Flat? *
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4176	4-01	132	54	23	122	12	NM	NM	694	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	32	NM			
35LK4176	5-01	152	11	27	84	13	NM	NM	NM	NM	NM	NM	Cowhead Lake? *
		± 3	1	2	2	2	NM	NM	NM	NM			
35LK4176	6-01	134	11	59	365	19	NM	NM	NM	NM	NM	NM	Silver Lake/Sycan Marsh *
		± 3	1	2	4	2	NM	NM	NM	NM			
35LK4173	1-01	120	48	23	114	12	NM	NM	NM	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	NM	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4173	2-01	112	76	20	132	9	NM	NM	731	NM	NM	NM	Alturas FGV
		± 2	2	1	2	2	NM	NM	31	NM			
35LK4173	3-01	68	589	17	167	8	NM	NM	1240	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4173	4-01	117	104	20	158	10	NM	NM	881	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4173	7-01	91	60	23	86	14	NM	NM	665	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4173	6-01	113	118	19	165	11	NM	NM	905	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	29	NM			
35LK4173	10-01	120	49	22	112	11	NM	NM	583	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4173	11-01	121	70	20	132	10	NM	NM	778	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4173	13-01	101	75	18	95	10	NM	NM	654	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	26	NM			
35LK4173	14-01	90	44	24	63	11	NM	NM	268	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4173	17-01	166	47	88	599	45	NM	NM	1127	NM	NM	NM	Unknown Obsidian 9
		± 2	1	2	3	2	NM	NM	31	NM			
35LK4173	19-01	105	24	23	85	12	NM	NM	72	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4173	20-01	110	70	18	96	9	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4173	22-01	108	28	32	192	17	NM	NM	601	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4173	23-01	211	4	109	1071	102	NM	NM	0	NM	NM	NM	Witham Creek
		± 3	1	2	5	2	NM	NM	23	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4173	24-01	115	68	21	128	9	NM	NM	788	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4173	25-01	122	80	18	138	10	NM	NM	870	NM	NM	NM	Badger Creek
		± 2	2	1	2	1	NM	NM	31	NM			
35LK4173	26-01	0	23	0	109	13	NM	NM	0	NM	NM	NM	Not FGV
		± 1	1	1	2	1	NM	NM	23	NM			
35LK4173	27-01	120	10	28	79	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4173	28-01	122	49	22	113	13	NM	NM	607	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4173	29-01	69	205	31	266	13	NM	NM	919	NM	NM	NM	Unknown FGV
		± 2	3	2	3	2	NM	NM	31	NM			
35LK4173	30-01	102	67	16	92	11	NM	NM	649	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4173	31-01	120	78	20	138	9	NM	NM	904	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4173	32-01	97	41	23	114	13	NM	NM	762	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4173	34-01	102	66	19	90	11	NM	NM	649	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4173	35-01	95	41	23	117	14	NM	NM	739	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4173	36-01	122	11	27	78	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4173	37-01	93	68	22	56	10	NM	NM	315	NM	NM	NM	McComb Butte
		± 2	1	1	1	1	NM	NM	24	NM			
35LK4173	38-01	57	2	73	382	22	NM	NM	1122	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4173	39-01	111	63	18	91	11	NM	NM	570	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4173	40-01	29	501	34	175	6	NM	NM	798	NM	NM	NM	Unknown FGV
		± 2	4	2	3	2	NM	NM	38	NM			
35LK4173	42-01	66	584	17	163	9	NM	NM	1229	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4173	44-01	20	331	50	279	16	NM	NM	798	NM	NM	NM	Unknown FGV
		± 1	3	2	3	2	NM	NM	31	NM			
35LK4173	50-01	120	126	19	168	9	NM	NM	914	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	32	NM			
35LK4173	54-01	61	565	15	163	8	NM	NM	1242	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4173	55-01	126	71	20	135	11	NM	NM	861	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4173	56-01	139	3	62	414	53	NM	NM	0	NM	NM	NM	Unknown Obsidian 1
		± 2	1	2	3	2	NM	NM	23	NM			
35LK4173	57-01	67	595	15	170	7	NM	NM	1213	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4173	58-01	108	8	24	75	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	2	2	2	NM	NM	25	NM			
35LK4173	59-01	128	52	20	114	12	NM	NM	591	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	34	NM			
35LK4173	60-01	122	9	27	78	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4173	63-01	99	179	21	187	12	NM	NM	989	NM	NM	NM	Unknown FGV C
		± 2	2	1	2	1	NM	NM	33	NM			
35LK4173	65-01	132	10	28	81	16	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	28	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4173	66-01	112	19	20	80	11	NM	NM	58	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4173	67-01	135	55	24	121	11	NM	NM	613	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4173	71-01	95	43	24	113	14	NM	NM	757	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4173	78-01	123	51	22	113	12	NM	NM	581	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4173	82-01	120	8	27	77	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4173	84-01	111	71	19	130	11	NM	NM	788	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	30	NM			
35LK4172	2-01	105	80	17	103	13	NM	NM	630	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	27	NM			
35LK4172	3-01	125	9	27	78	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4172	4-01	138	11	27	84	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4172	5-01	131	10	28	83	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4172	6-01	139	10	27	82	11	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4134	1-01	109	66	20	93	12	NM	NM	557	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4134	2-01	128	52	22	114	14	NM	NM	585	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4134	3-01	104	67	18	92	12	NM	NM	657	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			

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

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4134	4-01	103	64	17	89	10	NM	NM	677	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	25	NM			
35LK4134	5-01	104	61	18	90	10	NM	NM	586	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4134	6-01	120	48	22	110	12	NM	NM	584	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4134	7-01	108	65	17	87	11	NM	NM	517	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4134	8-01	122	9	28	77	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK4134	9-01	122	10	27	78	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4134	10-01	125	75	19	137	11	NM	NM	829	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4134	11-01	104	65	17	90	9	NM	NM	578	NM	NM	NM	Buck Mountain
		± 2	2	1	2	2	NM	NM	29	NM			
35LK4134	13-01	98	61	15	86	10	NM	NM	620	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4134	14-01	66	571	14	162	9	NM	NM	1207	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4134	15-01	127	54	22	115	12	NM	NM	567	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4134	16-01	101	66	17	89	11	NM	NM	636	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4134	17-01	65	584	16	164	10	NM	NM	1206	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4134	18-01	118	9	25	77	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4134	19-01	113	49	22	110	12	NM	NM	616	NM	NM	NM	Sugar Hill
		± 2	1	1	2	2	NM	NM	28	NM			
35LK4134	20-01	125	56	22	117	12	NM	NM	604	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	37	NM			
35LK4134	21-01	95	41	24	125	14	NM	NM	751	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4134	22-01	90	35	53	126	12	NM	NM	1154	NM	NM	NM	Cougar Mountain
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4134	24-01	122	10	27	78	12	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4134	25-01	117	8	27	79	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4134	27-01	108	70	19	93	10	NM	NM	617	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4134	33-01	129	57	24	122	12	NM	NM	642	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4134	34-01	117	46	20	109	11	NM	NM	578	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4134	35-01	119	78	20	136	10	NM	NM	851	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4134	36-01	95	46	24	65	12	NM	NM	246	NM	NM	NM	Tucker Hill
		± 2	1	1	1	1	NM	NM	23	NM			
35LK4134	37-01	127	24	40	180	29	NM	NM	196	NM	NM	NM	Mosquito Lake
		± 2	1	1	2	2	NM	NM	23	NM			
35LK4134	38-01	102	66	17	92	10	NM	NM	670	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4134	39-01	105	67	18	92	11	NM	NM	575	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4134	40-01	135	70	27	181	10	NM	NM	726	NM	NM	NM	GF/LIW/RS
		± 2	2	1	2	1	NM	NM	29	NM			
35LK4134	41-01	99	62	17	88	10	NM	NM	610	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4134	42-01	113	73	19	134	11	NM	NM	857	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4134	43-01	102	174	21	186	8	NM	NM	949	NM	NM	NM	Unknown FGV C
		± 2	2	1	2	1	NM	NM	30	NM			
35LK4134	44-01	118	9	27	74	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4134	45-01	115	8	25	73	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4134	47-01	130	54	24	117	13	NM	NM	575	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4134	49-01	116	70	24	269	14	NM	NM	591	NM	NM	NM	Del Prat Spring
		± 2	2	1	3	2	NM	NM	28	NM			
35LK4134	61-01	120	76	20	136	10	NM	NM	814	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4134	62-01	41	469	12	50	6	NM	NM	873	NM	NM	NM	Unknown FGV
		± 2	4	1	2	2	NM	NM	33	NM			
35LK4134	63-01	107	64	17	89	11	NM	NM	578	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4134	64-01	117	9	26	79	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4134	65-01	107	10	51	336	17	NM	NM	795	NM	NM	NM	Silver Lake/Sycan Marsh
		± 2	1	2	3	2	NM	NM	29	NM			
35LK4134	66-01	108	100	16	147	8	NM	NM	856	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	30	NM			

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

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4134	74-01	63	579	17	163	9	NM	NM	1266	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4134	75-01	108	62	18	90	11	NM	NM	561	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4134	77-01	88	43	23	62	10	NM	NM	231	NM	NM	NM	Tucker Hill *
		± 2	1	1	1	1	NM	NM	26	NM			
35LK4134	81-01	58	2	73	370	17	NM	NM	1044	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	41	NM			
35LK4134	82-01	131	10	27	82	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4134	83-01	66	578	17	165	9	NM	NM	1211	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4134	88-01	62	560	16	160	8	NM	NM	1123	NM	NM	NM	Unknown FGV A
		± 2	4	2	3	2	NM	NM	37	NM			
35LK4134	92-01	68	593	18	168	7	NM	NM	1244	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4134	97-01	67	558	15	154	7	NM	NM	1135	NM	NM	NM	Unknown FGV A
		± 1	3	1	2	1	NM	NM	35	NM			
35LK4134	114-01-1	140	77	31	206	10	NM	NM	659	NM	NM	NM	East Medicine Lake
		± 2	2	1	2	1	NM	NM	35	NM			
35LK4135	1-01	132	58	23	122	13	NM	NM	676	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	25	NM			
35LK4135	4-01	131	135	20	179	10	NM	NM	973	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	38	NM			
35LK4135	5-01	103	61	19	91	10	NM	NM	562	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	27	NM			
35LK4135	6-01	103	69	18	95	11	NM	NM	718	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	25	NM			

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

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4135	7-01	112	70	20	130	8	NM	NM	783	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	30	NM			
35LK4135	8-01	134	55	23	118	11	NM	NM	624	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4135	9-01	121	10	29	82	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4135	10-01	136	56	24	123	12	NM	NM	595	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4135	12-01	105	66	17	96	9	NM	NM	651	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4135	13-01	113	69	19	130	9	NM	NM	802	NM	NM	NM	Rainbow Mines *
		± 2	2	1	2	1	NM	NM	34	NM			
35LK4135	17-01	65	598	17	170	7	NM	NM	1232	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4135	18-01	122	117	19	168	10	NM	NM	887	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	29	NM			
35LK4135	21-01	124	30	35	205	18	NM	NM	595	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4135	22-01	72	631	15	176	7	NM	NM	1209	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4135	26-01	110	70	18	98	10	NM	NM	645	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	27	NM			
35LK4135	28-01	137	11	29	84	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4135	29-01	73	636	20	175	8	NM	NM	1251	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4135	34-01	132	9	29	82	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4130	2-01	116	75	19	132	11	NM	NM	833	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	30	NM			
35LK4130	4-01	97	62	18	88	11	NM	NM	651	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4130	6-01	59	2	74	381	20	NM	NM	1072	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	37	NM			
35LK4130	8-01	56	0	73	373	19	NM	NM	1050	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			
35LK4130	9-01	132	76	27	203	9	NM	NM	NM	NM	NM	NM	Grasshopper Group *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK4130	13-01	120	50	22	108	13	NM	NM	619	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4130	16-01	100	185	22	188	11	NM	NM	949	NM	NM	NM	Unknown FGV C
		± 2	2	1	2	1	NM	NM	30	NM			
35LK4130	18-01	108	62	18	89	11	NM	NM	558	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4130	19-01	65	584	16	165	9	NM	NM	1173	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	36	NM			
35LK4130	20-01	100	44	23	114	15	NM	NM	811	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4130	30-01	106	65	17	93	11	NM	NM	604	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4130	33-01	96	41	24	112	16	NM	NM	832	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4130	35-01	122	52	23	115	14	NM	NM	597	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4130	36-01	103	68	17	90	9	NM	NM	620	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4130	37-01	118	77	20	136	11	NM	NM	830	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	29	NM			
35LK4130	40-01	97	64	17	90	12	NM	NM	665	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4130	42-01	94	48	24	68	13	NM	NM	295	NM	NM	NM	Tucker Hill
		± 2	1	1	1	1	NM	NM	25	NM			
35LK4130	46-01	124	52	24	114	12	NM	NM	563	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4130	47-01	112	118	19	156	9	NM	NM	854	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	39	NM			
35LK4130	49-01	106	113	18	156	8	NM	NM	947	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	30	NM			
35LK4130	51-01	97	112	18	124	12	NM	NM	641	NM	NM	NM	Harris Flat?
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4130	52-01	69	608	19	172	8	NM	NM	1317	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4130	55-01	54	0	72	368	18	NM	NM	1087	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35LK4130	56-01	106	87	20	109	10	NM	NM	639	NM	NM	NM	Sugar Hill
		± 2	2	1	2	1	NM	NM	27	NM			
35LK4130	58-01	63	573	15	166	7	NM	NM	1176	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	36	NM			
35LK4130	59-01	108	27	34	188	17	NM	NM	639	NM	NM	NM	Blue Spring
		± 2	1	1	2	2	NM	NM	29	NM			
35LK4130	60-01	105	65	17	89	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK4130	61-01	110	11	29	81	15	NM	NM	95	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4130	65-01	58	2	74	384	18	NM	NM	1103	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35LK4130	66-01	94	43	24	114	15	NM	NM	971	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4130	68-01	110	64	17	89	13	NM	NM	535	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4130	69-01	94	181	20	188	9	NM	NM	1151	NM	NM	NM	Unknown FGV C
		± 2	2	1	2	1	NM	NM	32	NM			
35LK4130	71-01	114	28	33	187	19	NM	NM	617	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4130	74-01	99	47	24	78	11	NM	NM	274	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4130	75-01	133	69	29	183	10	NM	NM	718	NM	NM	NM	GF/LIW/RS
		± 2	2	1	2	1	NM	NM	29	NM			
35LK4130	76-01	113	79	19	100	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK4130	86-01	123	9	26	76	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK4130	89-01	129	54	24	115	10	NM	NM	601	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4130	116-02	104	28	31	189	18	NM	NM	680	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4130	124-01-1	99	63	15	89	11	NM	NM	627	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4130	153-02	98	47	24	67	10	NM	NM	261	NM	NM	NM	Tucker Hill
		± 2	1	1	1	1	NM	NM	24	NM			
35LK4130	167-01-2	100	69	16	93	11	NM	NM	597	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	35	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4130	175-02	106	66	19	92	11	NM	NM	635	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4130	197-01-1	104	77	17	100	12	NM	NM	562	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	27	NM			
35LK4130	214-01	88	65	21	55	10	NM	NM	299	NM	NM	NM	McComb Butte
		± 2	1	1	1	1	NM	NM	27	NM			
35LK4130	215-01	56	2	73	377	19	NM	NM	1222	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	35	NM			
35LK4130	216-01	125	48	23	113	14	NM	NM	590	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	32	NM			
35LK4130	217-01	100	63	17	88	11	NM	NM	682	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4130	220-01	64	588	16	163	5	NM	NM	1121	NM	NM	NM	Unknown FGV A
		± 2	5	2	3	2	NM	NM	37	NM			
35LK4130	221-01	68	586	17	165	7	NM	NM	1251	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4130	222-01	67	588	16	165	10	NM	NM	1200	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4130	224-01	69	595	14	165	8	NM	NM	1225	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	36	NM			
35LK4130	232-02-1-1	111	64	20	126	12	NM	NM	773	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	2	NM	NM	33	NM			
35LK4130	237-01-1	125	10	27	77	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4130	309-03	124	9	28	83	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4130	309-04	67	604	17	166	8	NM	NM	1283	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4130	320-03	99	70	17	93	10	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4130	326-02-1	112	28	31	191	17	NM	NM	602	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4130	326-04-1	104	63	18	88	10	NM	NM	527	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4130	333-02-1	121	50	21	110	13	NM	NM	591	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4130	359-04	114	47	22	106	11	NM	NM	593	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4130	360-02	137	76	28	198	9	NM	NM	649	NM	NM	NM	Grasshopper Group *
		± 2	2	1	2	1	NM	NM	36	NM			
35LK4130	368-03	123	64	20	126	11	NM	NM	NM	NM	NM	NM	Rainbow Mines *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4130	393-03	104	66	18	95	10	NM	NM	620	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	35	NM			
35LK4130	406-02-1	103	67	18	93	11	NM	NM	665	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4130	412-02-1	122	52	24	113	11	NM	NM	607	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4130	421-03	120	51	23	112	14	NM	NM	613	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4130	421-04	114	10	26	74	10	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4130	423-04	99	68	17	93	13	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 1	1	1	1	1	NM	NM	NM	NM			
35LK4130	424-02-1	98	69	17	96	10	NM	NM	765	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	32	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4130	427-02-1	127	54	23	116	14	NM	NM	577	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4130	427-03	134	73	28	198	9	NM	NM	681	NM	NM	NM	Grasshopper Group
		± 2	2	1	2	1	NM	NM	36	NM			
35LK4130	452-02-1	121	50	23	111	12	NM	NM	550	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4130	452-03	136	74	29	197	9	NM	NM	696	NM	NM	NM	Grasshopper Group
		± 2	2	1	2	1	NM	NM	32	NM			
35LK4130	479-02	97	43	21	113	14	NM	NM	777	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	35	NM			
35LK4130	490-02-1	121	9	26	86	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4130	516-02	121	3	75	234	27	NM	NM	0	NM	NM	NM	Unknown Obsidian 10
		± 2	1	2	2	2	NM	NM	22	NM			
35LK4130	518-02	126	84	29	291	13	NM	NM	585	NM	NM	NM	Unknown FGV
		± 2	2	1	3	2	NM	NM	27	NM			
35LK4130	520-02-1	117	120	20	165	6	NM	NM	909	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4130	522-02	97	46	24	65	9	NM	NM	218	NM	NM	NM	Tucker Hill
		± 2	1	1	1	1	NM	NM	24	NM			
35LK4130	539-02	105	26	32	184	16	NM	NM	655	NM	NM	NM	Blue Spring *
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4130	548-01	89	17	24	106	16	NM	NM	112	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4131	2-01	148	61	26	129	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 3	2	2	2	2	NM	NM	NM	NM			
35LK4131	3-01	131	54	22	122	13	NM	NM	671	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4068	1-01	60	0	78	394	19	NM	NM	1092	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			
35LK4068	2-01	122	52	21	111	14	NM	NM	639	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4068	3-01	121	53	22	115	12	NM	NM	604	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4068	4-01	126	52	21	115	10	NM	NM	561	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4068	5-01	130	12	29	81	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4068	6-01	112	48	21	106	11	NM	NM	637	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4068	7-01	110	27	31	183	18	NM	NM	640	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4068	9-01	126	52	24	115	12	NM	NM	567	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4068	10-01	112	29	30	192	20	NM	NM	637	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4068	11-01	135	35	24	102	14	NM	NM	385	NM	NM	NM	Unknown Obsidian 6
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4068	12-01	132	55	24	117	15	NM	NM	605	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4068	13-01	122	9	26	78	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4068	14-01	124	53	23	115	11	NM	NM	621	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4068	18-01	68	596	17	170	11	NM	NM	1285	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4068	22-01	59	0	75	389	18	NM	NM	1100	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	35	NM			
35LK4068	32-01	123	9	28	80	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK4068	33-01	64	590	17	171	9	NM	NM	1399	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	37	NM			
35LK4068	34-01	126	51	22	116	13	NM	NM	605	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4068	39-01	118	50	22	110	12	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4068	44-01	124	10	26	78	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4068	49-01	66	586	16	165	8	NM	NM	1239	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4068	54-01	66	599	16	167	8	NM	NM	1251	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4068	55-01	67	605	18	170	10	NM	NM	1275	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4068	59-01	60	580	16	168	8	NM	NM	1250	NM	NM	NM	Unknown FGV A
		± 2	4	2	3	2	NM	NM	36	NM			
35LK4068	63-01	112	73	18	99	11	NM	NM	666	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4068	66-01	125	9	28	77	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4068	68-01	68	608	16	168	9	NM	NM	1256	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	36	NM			
35LK4068	70-01	111	14	23	90	12	NM	NM	68	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4068	72-01	68	607	15	172	10	NM	NM	1247	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	36	NM			
35LK4068	73-01	70	621	17	180	9	NM	NM	1214	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4068	74-01	70	627	17	171	7	NM	NM	1286	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK4068	78-01	130	9	28	82	13	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4068	118-01	138	76	28	205	8	NM	NM	723	NM	NM	NM	East Medicine Lake
		± 2	2	1	2	1	NM	NM	30	NM			
35LK4068	125-01	124	9	28	80	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4068	126-03-1	127	53	24	118	14	NM	NM	645	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4068	127-01-1	67	596	14	168	8	NM	NM	1220	NM	NM	NM	Unknown FGV A
		± 2	4	2	3	2	NM	NM	36	NM			
35LK4068	136-01	108	15	23	90	12	NM	NM	64	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4068	168-01	118	50	23	109	11	NM	NM	613	NM	NM	NM	Sugar Hill
		± 2	1	1	2	2	NM	NM	30	NM			
35LK4129	1-01	140	60	24	126	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4129	2-01	126	9	28	82	11	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4129	3-01	126	53	22	116	11	NM	NM	596	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4129	4-01	145	11	30	87	14	NM	NM	NM	NM	NM	NM	Cowhead Lake? *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4129	5-01	129	10	26	84	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4129	6-01	123	21	18	91	13	NM	NM	0	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4129	8-01	127	112	19	168	9	NM	NM	917	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3920	3-01	104	65	18	93	12	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3920	7-01	59	0	73	377	20	NM	NM	1155	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	37	NM			
35LK3920	8-01	120	52	22	114	14	NM	NM	639	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	33	NM			
35LK3920	11-01	118	9	26	74	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3920	14-01	140	2	61	431	48	NM	NM	0	NM	NM	NM	Unknown Obsidian 1 *
		± 2	1	2	3	2	NM	NM	25	NM			
35LK3920	15-01	105	97	18	146	10	NM	NM	NM	NM	NM	NM	Unknown FGV B *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3920	18-01	92	61	17	88	10	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	21-01	118	50	23	112	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	22-01	56	2	72	375	18	NM	NM	1042	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35LK3920	23-01	122	165	15	159	10	NM	NM	902	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	33	NM			
35LK3920	24-01	129	68	26	181	10	NM	NM	715	NM	NM	NM	GF/LIW/RS
		± 2	2	1	2	1	NM	NM	29	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	25-01	67	582	18	171	10	NM	NM	1278	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK3920	27-01	118	9	28	76	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3920	29-01	108	20	24	84	9	NM	NM	0	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	2	NM	NM	23	NM			
35LK3920	30-01	120	50	22	112	14	NM	NM	565	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3920	33-01	65	560	16	159	8	NM	NM	1191	NM	NM	NM	Unknown FGV A
		± 2	4	2	3	2	NM	NM	37	NM			
35LK3920	34-01	126	52	21	114	12	NM	NM	584	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3920	35-01	121	52	23	112	12	NM	NM	597	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	36-01	122	9	27	79	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3920	37-01	126	51	22	115	14	NM	NM	578	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3920	38-01	109	61	17	87	11	NM	NM	510	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3920	39-01	122	50	22	112	10	NM	NM	576	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3920	40-01	114	9	26	78	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	20	NM			
35LK3920	41-01	121	9	27	77	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3920	42-01	59	2	74	377	20	NM	NM	1042	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	34	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	46-01	62	547	15	163	8	NM	NM	1305	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK3920	47-01	130	35	23	99	13	NM	NM	342	NM	NM	NM	Unknown Obsidian 6
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3920	48-01	99	63	16	86	9	NM	NM	578	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3920	49-01	116	11	25	77	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3920	50-01	112	8	26	75	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3920	57-01	126	53	22	113	12	NM	NM	584	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	32	NM			
35LK3920	59-01	96	44	24	65	11	NM	NM	210	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3920	61-01	118	81	19	137	11	NM	NM	834	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	27	NM			
35LK3920	62-01	88	39	21	106	15	NM	NM	851	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3920	63-01	91	45	23	63	10	NM	NM	229	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3920	64-01	207	2	86	565	31	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	24	NM			
35LK3920	65-01	97	41	23	127	15	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	67-01	99	22	23	84	11	NM	NM	0	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3920	69-01	113	72	18	132	11	NM	NM	979	NM	NM	NM	Rainbow Mines *
		± 2	2	1	2	1	NM	NM	32	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	70-01	110	114	20	159	10	NM	NM	947	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3920	71-01	55	0	75	372	19	NM	NM	1045	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35LK3920	72-01	120	9	26	78	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3920	73-01	121	49	21	114	12	NM	NM	643	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	89-01	104	156	20	178	10	NM	NM	958	NM	NM	NM	Unknown FGV E
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3920	90-01	114	76	20	134	11	NM	NM	851	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3920	91-01	117	48	22	108	12	NM	NM	570	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	95-01	2	13	0	10	0	NM	NM	1490	NM	NM	NM	Not FGV
		± 1	1	1	1	1	NM	NM	35	NM			
35LK3920	97-01	94	56	22	76	10	NM	NM	488	NM	NM	NM	Buck Mountain?
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3920	98-01	118	10	28	78	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3920	99-01	93	45	23	63	9	NM	NM	262	NM	NM	NM	Tucker Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3920	100-01	117	70	19	129	9	NM	NM	787	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3920	101-01	0	13	23	16	0	NM	NM	359	NM	NM	NM	Not FGV
		± 0	1	1	1	1	NM	NM	28	NM			
35LK3920	105-01	105	15	28	84	15	NM	NM	170	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	110-01	126	52	23	115	11	NM	NM	586	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	114-01	156	65	19	90	11	NM	NM	368	NM	NM	NM	South Warners
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	115-01	121	10	27	77	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3920	118-01	111	102	20	150	9	NM	NM	1010	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	33	NM			
35LK3920	120-01	98	64	16	90	12	NM	NM	726	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3920	124-01	119	10	26	81	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	0	NM			
35LK3920	128-01	118	66	27	185	9	NM	NM	NM	NM	NM	NM	GF/LIW/RS *
		± 2	2	2	3	2	NM	NM	NM	NM			
35LK3920	129-01	61	0	75	383	18	NM	NM	1038	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	38	NM			
35LK3920	130-01	203	3	85	562	29	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	4	2	NM	NM	23	NM			
35LK3920	131-01	99	63	17	91	11	NM	NM	659	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	132-01	95	65	17	90	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	134-01	130	35	26	98	12	NM	NM	328	NM	NM	NM	Unknown Obsidian 6
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3920	135-01	113	74	18	135	10	NM	NM	986	NM	NM	NM	Rainbow Mines *
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3920	145-01	94	41	24	118	16	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	146-01	101	65	18	91	10	NM	NM	610	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3920	153-01	65	580	17	166	8	NM	NM	1226	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	34	NM			
35LK3920	156-01	109	4	30	67	17	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3920	158-01	101	67	18	91	10	NM	NM	674	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	160-01	109	147	32	178	5	NM	NM	1674	NM	NM	NM	Unknown FGV
		± 3	3	2	3	2	NM	NM	45	NM			
35LK3920	165-01	100	69	18	97	11	NM	NM	667	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	36	NM			
35LK3920	171-01	120	76	20	136	11	NM	NM	859	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3920	174-01	119	9	27	76	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3920	177-01	118	9	26	76	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3920	181-01	108	29	30	184	18	NM	NM	587	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3920	182-01	118	9	26	79	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3920	184-01	102	27	23	85	12	NM	NM	55	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3920	189-01	63	571	15	163	8	NM	NM	1107	NM	NM	NM	Unknown FGV A
		± 2	4	2	3	2	NM	NM	38	NM			
35LK3920	190-01	117	121	21	166	11	NM	NM	871	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	29	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	191-01	96	65	17	90	10	NM	NM	664	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	192-01	101	72	16	99	11	NM	NM	733	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	27	NM			
35LK3920	193-01	103	68	19	92	12	NM	NM	616	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3920	196-01	121	10	27	76	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3920	198-01	121	9	28	89	11	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	203-01	116	9	26	76	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK3920	204-01	109	73	18	130	9	NM	NM	843	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	28	NM			
35LK3920	206-01	120	9	27	76	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3920	207-01	99	42	23	116	15	NM	NM	801	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3920	209-01	113	69	18	94	12	NM	NM	529	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3920	217-01-1	122	51	22	111	11	NM	NM	582	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3920	217-02	102	61	19	88	10	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	217-02-2	120	50	22	114	12	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	2	2	2	2	NM	NM	NM	NM			
35LK3920	230-01	121	163	15	156	11	NM	NM	818	NM	NM	NM	Beatys Butte
		± 2	2	1	2	1	NM	NM	34	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	234-04-2	115	70	20	129	11	NM	NM	791	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3920	234-04-3	126	51	21	111	14	NM	NM	595	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3920	234-04-4	116	9	27	79	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	235-01	34	633	24	177	7	NM	NM	571	NM	NM	NM	Unknown FGV
		± 2	4	1	3	2	NM	NM	32	NM			
35LK3920	235-02-1	118	10	27	75	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	20	NM			
35LK3920	238-01-1	126	9	28	78	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	240-01	146	113	24	227	10	NM	NM	773	NM	NM	NM	Glass Mountain
		± 2	2	1	2	1	NM	NM	27	NM			
35LK3920	240-02	127	10	28	78	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	23	NM			
35LK3920	240-03	98	64	18	87	11	NM	NM	659	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3920	241-01-1	119	9	27	77	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3920	249-02-1	112	28	31	185	17	NM	NM	589	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3920	301-01	114	69	20	128	11	NM	NM	797	NM	NM	NM	Rainbow Mines *
		± 2	2	1	2	1	NM	NM	36	NM			
35LK3920	302-01	59	383	25	298	9	NM	NM	591	NM	NM	NM	Unknown FGV
		± 2	3	2	3	2	NM	NM	30	NM			
35LK3920	304-01	111	30	33	187	18	NM	NM	604	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	33	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	305-01	96	79	19	102	11	NM	NM	617	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3920	306-01	111	97	19	151	8	NM	NM	918	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3920	307-01	127	52	22	116	13	NM	NM	599	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			
35LK3920	308-01	52	2	70	359	18	NM	NM	1083	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35LK3920	310-04-2	107	66	18	93	12	NM	NM	671	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	311-05-1	117	9	26	80	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3920	313-01-1	115	10	27	77	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			
35LK3920	313-01-4	117	8	25	77	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3920	313-01-5	116	7	27	75	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3920	314-01-1	0	3	5	2	0	NM	NM	80	NM	NM	NM	Not FGV
		± 0	1	1	1	0	NM	NM	21	NM			
35LK3920	317-02	141	4	65	426	51	NM	NM	0	NM	NM	NM	Unknown Obsidian 1 *
		± 2	1	2	3	2	NM	NM	27	NM			
35LK3920	317-03	129	55	24	118	14	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	317-04-1	43	491	28	194	17	NM	NM	616	NM	NM	NM	Unknown FGV
		± 2	4	2	3	2	NM	NM	33	NM			
35LK3920	317-04-7	124	8	27	81	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	317-04-9	57	525	16	152	8	NM	NM	1174	NM	NM	NM	Unknown FGV
		± 2	4	1	3	2	NM	NM	36	NM			
35LK3920	318-03-3	101	60	18	84	11	NM	NM	477	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	2	NM	NM	38	NM			
35LK3920	318-03-4	126	52	22	114	12	NM	NM	640	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3920	318-03-5	126	10	27	78	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35LK3920	319-06	127	54	23	115	14	NM	NM	609	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	36	NM			
35LK3920	319-07	124	10	28	78	13	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	336-02-1	125	51	22	114	10	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	339-02-1	102	65	17	91	11	NM	NM	698	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	339-03	121	80	20	141	11	NM	NM	856	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	28	NM			
35LK3920	346-02-1	67	589	15	167	7	NM	NM	1237	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK3920	346-02-2	33	454	34	179	9	NM	NM	802	NM	NM	NM	Unknown FGV D
		± 1	4	2	3	2	NM	NM	33	NM			
35LK3920	348-03	61	575	18	162	8	NM	NM	1231	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK3920	350-03	105	45	23	118	14	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	2	2	2	2	NM	NM	NM	NM			
35LK3920	355-02	132	71	28	192	8	NM	NM	687	NM	NM	NM	GF/LIW/RS *
		± 2	2	1	2	1	NM	NM	39	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	355-03-2	109	6	29	74	16	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	24	NM			
35LK3920	355-04	119	9	27	81	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3920	356-02-1	113	8	26	72	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35LK3920	360-02	106	26	31	184	16	NM	NM	609	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	361-09-1	119	9	25	78	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3920	365-01	107	8	24	70	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3920	365-02-1	100	65	16	89	10	NM	NM	633	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3920	367-02	95	42	25	111	14	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	372-02-1	99	62	17	88	10	NM	NM	656	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	30	NM			
35LK3920	375-02-1	126	10	26	77	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	25	NM			
35LK3920	375-02-2	121	8	27	75	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35LK3920	379-02-1	101	63	17	91	13	NM	NM	575	NM	NM	NM	Buck Mountain
		± 2	2	1	2	2	NM	NM	28	NM			
35LK3920	380-04	132	71	29	197	8	NM	NM	723	NM	NM	NM	Grasshopper Group
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3920	380-05-2	106	59	17	87	10	NM	NM	538	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	384-03	113	10	27	74	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	385-03	119	50	21	110	11	NM	NM	651	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3920	386-02	123	9	27	80	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3920	386-03	111	8	27	72	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35LK3920	386-05-1	124	10	29	77	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK3920	386-05-3	112	8	24	74	10	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	2	NM	NM	25	NM			
35LK3920	388-04-1	121	77	20	136	12	NM	NM	888	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3920	388-04-2	123	9	27	75	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3920	389-02-1	93	60	16	87	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	390-03	128	53	22	115	13	NM	NM	638	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3920	390-03-1	127	50	24	114	12	NM	NM	623	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3920	392-03-3	65	563	15	157	8	NM	NM	1193	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	36	NM			
35LK3920	393-01-1	126	9	26	82	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3920	394-02	123	51	23	114	12	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	394-03-1	92	61	17	86	10	NM	NM	614	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	28	NM			
35LK3920	394-03-2	96	47	24	65	12	NM	NM	246	NM	NM	NM	Tucker Hill
		± 2	1	1	1	1	NM	NM	25	NM			
35LK3920	394-03-3	118	50	21	109	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	394-03-4	104	44	20	100	11	NM	NM	583	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3920	395-03-3	116	9	26	77	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35LK3920	395-03-4	98	174	21	183	12	NM	NM	943	NM	NM	NM	Unknown FGV C
		± 2	2	1	2	1	NM	NM	32	NM			
35LK3920	395-04	129	52	21	115	12	NM	NM	604	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	395-05	106	62	20	88	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	397-02	122	50	21	111	14	NM	NM	600	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	397-03-1	98	60	17	89	9	NM	NM	631	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	397-03-3	130	52	24	113	14	NM	NM	572	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3920	397-04	106	68	18	95	12	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3920	401-03-3	131	53	24	118	13	NM	NM	583	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	34	NM			
35LK3920	401-03-5	114	47	20	107	12	NM	NM	591	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	401-03-6	120	51	22	110	14	NM	NM	571	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	402-02	102	66	19	93	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	402-04-3	123	50	22	112	13	NM	NM	566	NM	NM	NM	Sugar Hill
		± 2	1	1	2	2	NM	NM	31	NM			
35LK3920	404-03-1	114	28	33	193	19	NM	NM	543	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	404-03-2	115	49	22	109	12	NM	NM	572	NM	NM	NM	Sugar Hill
		± 2	1	1	2	2	NM	NM	29	NM			
35LK3920	405-02	119	8	26	76	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK3920	406-03-2	131	72	27	197	7	NM	NM	794	NM	NM	NM	Grasshopper Group *
		± 2	2	1	2	1	NM	NM	30	NM			
35LK3920	407-08	97	43	23	111	14	NM	NM	795	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3920	409-02	111	4	32	73	19	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35LK3920	410-04	126	11	27	81	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3920	410-07	134	36	25	101	15	NM	NM	402	NM	NM	NM	Unknown Obsidian 6 *
		± 2	1	1	2	1	NM	NM	35	NM			
35LK3920	413-02	124	52	22	113	12	NM	NM	612	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	417-04	117	9	25	77	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK3920	426-02-2	110	63	19	90	12	NM	NM	558	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	25	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	427-04	141	77	29	208	7	NM	NM	706	NM	NM	NM	East Medicine Lake
		± 2	2	1	2	1	NM	NM	31	NM			
35LK3920	431-03	132	71	26	199	9	NM	NM	NM	NM	NM	NM	Grasshopper Group *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3920	432-06	94	175	22	183	11	NM	NM	NM	NM	NM	NM	Unknown FGV C *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK3920	433-02-3	103	58	17	86	9	NM	NM	548	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	438-05	134	37	25	100	14	NM	NM	370	NM	NM	NM	Unknown Obsidian 6
		± 2	1	1	2	1	NM	NM	31	NM			
35LK3920	438-08-3	125	51	22	110	13	NM	NM	574	NM	NM	NM	Sugar Hill
		± 2	1	1	2	2	NM	NM	31	NM			
35LK3920	438-08-4	99	66	18	89	9	NM	NM	584	NM	NM	NM	Buck Mountain
		± 2	2	1	2	2	NM	NM	29	NM			
35LK3920	439-02-1	96	59	17	84	9	NM	NM	534	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK3920	439-02-3	104	65	17	91	11	NM	NM	648	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35LK3920	439-03	101	67	18	89	10	NM	NM	593	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	33	NM			
35LK3920	442-03	58	3	73	376	20	NM	NM	1049	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35LK3920	444-02	117	75	18	134	8	NM	NM	871	NM	NM	NM	Alturas FGV
		± 2	2	1	2	1	NM	NM	29	NM			
35LK3920	444-04-1	104	66	17	93	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	444-05	126	34	25	95	12	NM	NM	337	NM	NM	NM	Unknown Obsidian 6
		± 2	1	1	2	1	NM	NM	26	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK3920	445-03-5	117	9	24	74	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK3920	445-03-6	107	67	17	95	11	NM	NM	676	NM	NM	NM	Buck Mountain
		± 2	2	1	2	2	NM	NM	30	NM			
35LK3920	447-03-1	58	0	75	386	19	NM	NM	1092	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	42	NM			
35LK3920	447-03-2	119	50	23	112	12	NM	NM	620	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	28	NM			
35LK3920	450-02-2	113	8	25	75	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4279	1-01	55	2	72	370	18	NM	NM	1096	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	35	NM			
35LK4279	2-01	102	63	18	89	10	NM	NM	646	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4279	3-01	62	250	92	287	12	NM	NM	1056	NM	NM	NM	Unknown Vitrophyre 1
		± 2	3	2	3	2	NM	NM	32	NM			
35LK4279	4-01	112	71	18	92	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	2	NM	NM	NM	NM			
35LK4279	6-01	127	10	30	81	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4279	8-01	61	718	53	196	8	NM	NM	1428	NM	NM	NM	Unknown FGV
		± 2	4	2	3	2	NM	NM	38	NM			
35LK4279	9-01	105	56	28	226	15	NM	NM	1246	NM	NM	NM	Unknown Obsidian 7
		± 2	1	1	2	1	NM	NM	29	NM			
35LK4279	11-01	92	58	16	87	10	NM	NM	663	NM	NM	NM	Buck Mountain
		± 2	2	1	2	2	NM	NM	30	NM			
35LK4279	12-01	50	187	44	291	14	NM	NM	1054	NM	NM	NM	Unknown FGV
		± 2	2	2	3	2	NM	NM	30	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4279	16-01	57	292	31	341	15	NM	NM	993	NM	NM	NM	Unknown Vitrophyre 2
		± 2	3	1	3	2	NM	NM	31	NM			
35LK4279	17-01	130	53	22	114	12	NM	NM	619	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4279	18-01	120	72	19	135	12	NM	NM	841	NM	NM	NM	Rainbow Mines
		± 2	2	1	2	1	NM	NM	29	NM			
35LK4279	20-01	125	8	26	79	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4279	31-01	102	82	28	190	18	NM	NM	1114	NM	NM	NM	Unknown FGV
		± 2	2	1	2	1	NM	NM	32	NM			
35LK4279	32-01	56	2	74	374	20	NM	NM	1007	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			
35LK4279	33-01	74	266	46	290	14	4014	1407	1200	4.69	NM	NM	Unknown Obsidian 8
		± 2	3	2	3	2	52	17	32	0.01			
35LK4279	34-01	47	161	38	298	15	5401	372	894	7.40	NM	NM	Unknown FGV
		± 2	2	2	3	2	66	14	31	0.01			
35LK4220	10-01-S1	60	0	75	389	18	NM	NM	1023	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	39	NM			
10/1819-AZW-4	1-01	91	67	21	56	10	NM	NM	294	NM	NM	NM	McComb Butte
		± 2	1	1	1	1	NM	NM	24	NM			
35LK4132	2-01	140	56	23	122	11	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4132	3-01	31	754	28	223	10	NM	NM	858	NM	NM	NM	Unknown FGV
		± 2	5	2	3	2	NM	NM	36	NM			
35LK4132	5-01	114	67	19	96	10	NM	NM	622	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4132	6-01	57	2	74	389	19	NM	NM	1168	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	35	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4132	7-01	127	10	27	82	13	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4132	10-01	129	56	23	123	12	NM	NM	591	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	32	NM			
35LK4132	11-01	128	5	34	81	17	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4132	12-01	63	2	75	405	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35LK4132	13-01	65	2	76	403	19	NM	NM	1128	NM	NM	NM	Blue Mountain
		± 2	1	2	3	1	NM	NM	33	NM			
35LK4132	14-01	64	2	78	408	17	NM	NM	1113	NM	NM	NM	Blue Mountain
		± 2	1	2	3	1	NM	NM	32	NM			
35LK4132	15-01	129	58	22	124	11	NM	NM	628	NM	NM	NM	Sugar Hill
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4132	16-01	113	69	19	94	11	NM	NM	574	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	29	NM			
35LK4132	17-01	114	74	17	101	10	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35LK4132	18-01	115	106	19	159	10	NM	NM	1011	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4221	1-01	153	63	25	124	14	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	2	NM	NM	NM	NM			
35LK4221	2-01	127	34	24	99	14	NM	NM	335	NM	NM	NM	Unknown Obsidian 6
		± 2	1	1	2	2	NM	NM	26	NM			
35LK4221	3-01	133	71	31	181	10	NM	NM	710	NM	NM	NM	GF/LIW/RS
		± 2	2	1	2	1	NM	NM	28	NM			
35LK4221	5-01	131	10	30	81	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	31	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4221	6-01	152	34	27	127	13	NM	NM	287	NM	NM	NM	Surveyor Spring
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4221	7-01	130	10	28	80	13	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4221	8-01	105	67	17	93	11	NM	NM	557	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4221	9-01	57	0	74	376	18	NM	NM	1121	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			
35LK4221	10-01	58	2	75	376	19	NM	NM	1015	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	34	NM			
35LK4221	11-01	106	71	17	95	12	NM	NM	624	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	26	NM			
35LK4221	12-01	103	68	19	98	12	NM	NM	655	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4221	13-01	67	620	16	171	9	NM	NM	1259	NM	NM	NM	Unknown FGV A
		± 2	4	1	3	2	NM	NM	35	NM			
35LK4221	14-01	57	2	71	372	18	NM	NM	1065	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35LK4221	15-01	97	64	17	88	10	NM	NM	596	NM	NM	NM	Buck Mountain
		± 2	2	1	2	2	NM	NM	28	NM			
35LK4221	16-01	105	69	18	96	11	NM	NM	677	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	31	NM			
35LK4221	17-01	104	66	18	93	9	NM	NM	681	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	32	NM			
35LK4221	18-01	58	1	76	388	20	NM	NM	1090	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	35	NM			
35LK4221	19-01	125	79	20	140	13	NM	NM	860	NM	NM	NM	Badger Creek
		± 2	2	1	2	1	NM	NM	30	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4221	20-01	117	4	31	74	18	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	21	NM			
35LK4221	21-01	131	10	29	85	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35LK4221	22-01	109	4	30	76	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	2	NM	NM	24	NM			
35LK4221	23-01	120	10	27	78	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4221	24-01	63	2	77	398	19	NM	NM	1071	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35LK4221	25-01	122	9	27	80	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	20	NM			
35LK4221	26-01	108	114	17	158	10	NM	NM	923	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	33	NM			
35LK4221	27-01	98	45	22	117	14	NM	NM	790	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35LK4221	28-01	105	66	18	92	12	NM	NM	642	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	31	NM			
35LK4221	29-01	121	9	28	80	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4221	30-01	115	29	33	191	20	NM	NM	596	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	27	NM			
35LK4221	31-01	120	9	29	77	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4221	32-01	122	9	28	79	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35LK4221	33-01	58	2	72	376	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4221	34-01	57	0	75	381	18	NM	NM	1147	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			
35LK4221	35-01	56	2	74	378	20	NM	NM	1152	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35LK4221	36-01	128	53	22	115	13	NM	NM	571	NM	NM	NM	Sugar Hill
		± 2	1	1	2	2	NM	NM	27	NM			
35LK4221	37-01	117	9	27	74	11	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35LK4221	38-01	121	10	26	77	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35LK4221	39-01	0	39	0	22	0	NM	NM	471	NM	NM	NM	Not Obsidian
		± 7	10	8	10	10	NM	NM	37	NM			
35LK4221	56-01	60	2	75	388	20	NM	NM	1152	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35LK4221	62-01-S2	121	51	21	108	11	NM	NM	618	NM	NM	NM	Sugar Hill
		± 2	1	1	2	1	NM	NM	30	NM			
35LK4221	63-01-1	222	3	93	600	34	NM	NM	0	NM	NM	NM	Massacre Lake/Guano Valley
		± 3	1	2	3	2	NM	NM	0	NM			
35LK4221	65-01	111	71	18	97	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4221	81-01	111	32	30	199	16	NM	NM	NM	NM	NM	NM	Blue Spring *
		± 2	1	1	2	1	NM	NM	NM	NM			
35LK4221	85-01-1	55	2	74	371	19	NM	NM	1093	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35LK4221	91-01-S1	114	72	18	99	12	NM	NM	678	NM	NM	NM	Buck Mountain
		± 2	2	1	2	1	NM	NM	40	NM			
35LK4221	100-01	27	459	24	180	6	NM	NM	778	NM	NM	NM	Unknown FGV D
		± 2	4	2	3	2	NM	NM	35	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35LK4221	103-01	98	157	34	191	7	NM	NM	1506	NM	NM	NM	Unknown FGV
		± 2	3	2	3	2	NM	NM	40	NM			
35LK4221	111-01	85	18	25	127	18	NM	NM	176	NM	NM	NM	Unknown Obsidian 2
		± 2	1	1	2	1	NM	NM	23	NM			
35LK4221	112-01	59	2	75	387	21	NM	NM	1091	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	30	NM			
35LK4221	113-01	60	2	74	380	19	NM	NM	1100	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			
35LK4221	114-01	132	38	23	101	14	NM	NM	NM	NM	NM	NM	Unknown Obsidian 6 *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL1947	3-01	54	0	69	370	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	4	2	NM	NM	NM	NM			
35KL1947	4-01	113	33	30	204	16	NM	NM	767	NM	NM	NM	Blue Spring
		± 2	1	1	2	1	NM	NM	31	NM			
35KL1947	5-01	62	3	75	405	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	1-01	104	9	49	328	14	NM	NM	753	NM	NM	NM	Silver Lake/Sycan Marsh
		± 2	1	2	3	2	NM	NM	29	NM			
35KL3262	2-01	93	42	24	109	15	NM	NM	806	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35KL3262	3-01	111	10	52	338	18	NM	NM	770	NM	NM	NM	Silver Lake/Sycan Marsh
		± 2	1	2	3	2	NM	NM	31	NM			
35KL3262	4-01	55	2	73	373	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	5-01	56	0	69	362	20	NM	NM	1070	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	35	NM			
35KL3262	7-01	60	0	75	386	19	NM	NM	1023	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	36	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	8-01	120	9	27	78	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35KL3262	9-01	123	8	26	78	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35KL3262	13-01	118	2	73	241	28	NM	NM	0	NM	NM	NM	Unknown Obsidian 10 *
		± 2	1	2	2	2	NM	NM	0	NM			
35KL3262	14-01	94	19	79	744	76	NM	NM	220	NM	NM	NM	Unknown FGV
		± 2	1	2	4	2	NM	NM	26	NM			
35KL3262	15-01	95	65	18	90	11	NM	NM	660	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	33	NM			
35KL3262	16-01	118	66	19	95	10	NM	NM	576	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	34	NM			
35KL3262	17-01	140	77	28	202	8	NM	NM	704	NM	NM	NM	Grasshopper Group
		± 2	2	1	2	1	NM	NM	29	NM			
35KL3262	18-01	54	2	73	371	19	NM	NM	1047	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35KL3262	19-01	58	0	76	390	18	NM	NM	1029	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	41	NM			
35KL3262	22-01	59	3	76	381	18	NM	NM	1018	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	41	NM			
35KL3262	23-01	102	64	16	88	10	NM	NM	688	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	30	NM			
35KL3262	24-01	59	0	75	380	19	NM	NM	1116	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35KL3262	25-01	138	76	27	201	10	NM	NM	679	NM	NM	NM	Grasshopper Group
		± 2	2	1	2	1	NM	NM	28	NM			
35KL3262	27-01	117	8	25	75	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	2	NM	NM	27	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	28-01	59	3	76	388	20	NM	NM	1070	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			
35KL3262	29-01	99	44	24	115	14	NM	NM	765	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	32	NM			
35KL3262	30-01	142	79	29	209	10	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3262	31-01	60	2	75	381	17	NM	NM	1043	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	36	NM			
35KL3262	32-01	58	2	76	380	18	NM	NM	1082	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	40	NM			
35KL3262	33-01	125	61	28	175	10	NM	NM	NM	NM	NM	NM	GF/LIW/RS *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3262	34-01	117	9	26	76	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	35-01	113	9	24	75	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	37-01	113	8	27	75	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	38-01	55	2	72	378	19	NM	NM	1070	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35KL3262	39-01	96	41	22	116	15	NM	NM	NM	NM	NM	NM	Spodue Mountain? *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	41-01	116	8	25	76	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	2	2	2	NM	NM	23	NM			
35KL3262	42-01	117	9	27	77	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	43-01	62	2	76	395	19	NM	NM	1069	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	45-01	117	9	27	75	11	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	46-01	96	43	24	118	16	NM	NM	904	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	29	NM			
35KL3262	47-01	59	2	77	383	19	NM	NM	1073	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	35	NM			
35KL3262	48-01	109	9	25	74	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35KL3262	55-02	56	2	70	363	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	59-01-S1	154	3	69	148	20	NM	NM	NM	NM	NM	NM	Cougar Butte *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	60-01-S1	56	2	74	373	17	NM	NM	1223	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	38	NM			
35KL3262	61-01-S1	62	3	80	400	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	61-01-S2	60	2	78	396	22	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	61-01-S3	66	2	77	393	22	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	61-01-S4	56	2	73	379	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	65-01-S1	135	10	30	82	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	65-01-S2	115	10	28	77	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35KL3262	65-01-S3	121	9	27	79	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	66-01-S1	55	2	76	376	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	66-01-S2	59	2	76	380	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	67-01-S1	52	2	72	367	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	67-01-S2	59	2	76	382	17	NM	NM	1220	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	36	NM			
35KL3262	67-01-S3	61	2	79	393	20	NM	NM	1127	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	54	NM			
35KL3262	71-01	125	9	26	74	11	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	0	NM			
35KL3262	71-02-S1	59	2	73	376	19	NM	NM	1109	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	53	NM			
35KL3262	72-01-S1	61	2	76	385	20	NM	NM	1078	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	39	NM			
35KL3262	73-01-S1	57	2	77	398	18	NM	NM	1168	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	58	NM			
35KL3262	73-01-S2	56	3	75	382	18	NM	NM	1195	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	43	NM			
35KL3262	78-01-S1	58	0	73	369	20	NM	NM	1009	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35KL3262	78-01-S2	55	2	75	376	20	NM	NM	1199	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	34	NM			
35KL3262	78-01-S3	56	2	74	376	21	NM	NM	1168	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	42	NM			
35KL3262	79-01-S1	122	10	29	78	15	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	35	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	80-01-S1	57	2	74	381	18	NM	NM	1149	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35KL3262	80-01-S2	123	10	27	75	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	80-01-S3	59	0	78	382	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	81-01-S1	67	2	81	402	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	82-01-S1	51	2	70	369	18	NM	NM	1221	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35KL3262	82-01-S2	57	1	76	380	20	NM	NM	1225	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	38	NM			
35KL3262	84-01-S1	54	0	72	370	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	84-01-S2	152	4	66	151	20	NM	NM	NM	NM	NM	NM	Cougar Butte *
		± 2	1	2	2	1	NM	NM	NM	NM			
35KL3262	85-01-S1	58	0	74	383	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	90-01-S1	102	45	23	115	14	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	90-01-S2	117	10	27	83	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3262	90-01-S3	115	9	27	75	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35KL3262	92-01-S1	57	2	74	373	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	95-10	123	10	27	77	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	97-01-S1	55	2	76	379	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	98-01	56	2	72	375	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	100-01	135	12	28	87	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	102-01-S1	97	46	25	121	14	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3262	102-01-S2	95	42	22	115	15	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	104-01	59	2	73	379	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	107-01-S1	55	0	74	370	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	107-01-S2	132	10	27	80	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	108-01-S1	53	2	70	371	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	108-01-S2	57	2	75	386	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	109-01-S1	62	2	78	399	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	110-01-1	96	44	24	115	14	NM	NM	760	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	31	NM			
35KL3262	110-01-S1	54	2	70	369	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	111-01-S1	125	10	27	78	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	111-01-S2	58	2	74	378	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	4	2	NM	NM	NM	NM			
35KL3262	114-01-S1	59	0	73	383	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	114-01-S2	118	10	27	76	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	26	NM			
35KL3262	115-01-S1	126	9	28	80	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35KL3262	117-01	59	2	74	380	21	NM	NM	1104	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	35	NM			
35KL3262	139-02-S1	55	2	71	372	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	142-02-S1	140	10	29	82	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3262	143-02-1	144	80	30	209	9	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3262	144-02-S1	58	1	76	391	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	144-02-S2	60	1	75	388	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	145-02-S1	58	0	75	375	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	0	2	3	2	NM	NM	NM	NM			
35KL3262	148-02-S1	60	0	77	387	20	NM	NM	1215	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	40	NM			
35KL3262	148-02-S2	60	2	74	394	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	149-02-2	58	3	77	378	18	NM	NM	1113	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	35	NM			

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

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	149-02-S1	150	11	29	85	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	2	2	2	NM	NM	33	NM			
35KL3262	149-02-S3	60	0	77	392	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	150-02-S1	61	2	78	390	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	151-02	67	2	76	403	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	4	2	NM	NM	NM	NM			
35KL3262	152-02-4	59	2	74	382	20	NM	NM	1089	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35KL3262	152-02-5	117	9	27	76	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35KL3262	153-02-S1	56	2	75	378	19	NM	NM	1165	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	43	NM			
35KL3262	153-02-S2	55	2	74	382	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	154-02-S1	117	9	25	76	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	154-02-S2	152	3	67	151	19	NM	NM	NM	NM	NM	NM	Cougar Butte *
		± 2	1	2	2	1	NM	NM	NM	NM			
35KL3262	155-02-S1	144	10	28	84	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	155-02-S2	58	0	76	379	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	155-02-S3	67	2	80	402	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	158-02-S1	133	9	28	83	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	158-02-S2	63	3	77	393	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	159-02-3	157	4	72	154	22	NM	NM	0	NM	NM	NM	Cougar Butte *
		± 2	1	2	2	1	NM	NM	26	NM			
35KL3262	159-02-S1	58	2	77	377	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	160-02-S1	54	0	73	372	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	160-02-S2	122	78	18	96	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	2	2	2	NM	NM	NM	NM			
35KL3262	164-02-S1	117	9	27	78	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	164-02-S2	59	0	76	388	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	165-02-S1	103	46	25	119	15	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	166-02-S1	57	2	73	375	19	NM	NM	1258	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	35	NM			
35KL3262	166-02-S2	56	2	74	383	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	166-02-S3	133	36	24	101	16	NM	NM	NM	NM	NM	NM	Unknown Obsidian 6 *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	167-02	60	2	74	389	20	NM	NM	1097	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	35	NM			
35KL3262	167-03-S1	55	1	75	378	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	167-03-S2	61	2	78	391	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	167-03-S3	59	2	77	386	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	169-02	59	2	77	381	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	3	4	2	NM	NM	NM	NM			
35KL3262	170-01-S1	57	2	73	376	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	172-02-S1	59	3	76	387	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	172-02-S2	60	0	77	388	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	172-02-S3	118	9	27	79	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	172-02-S4	121	9	26	78	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	173-02-S1	61	3	76	388	20	NM	NM	1159	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	42	NM			
35KL3262	173-02-S2	56	2	75	379	20	NM	NM	1253	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	34	NM			
35KL3262	173-02-S3	107	22	24	88	14	NM	NM	NM	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	174-02-3	54	3	69	366	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	174-02-S1	116	9	26	78	14	NM	NM	NM	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	174-02-S2	64	2	78	393	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	174-02-S4	54	0	70	363	18	NM	NM	1268	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	175-02-S1	55	2	73	371	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	176-02	56	0	72	377	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	178-02-S1	125	9	27	80	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3262	179-02-2	54	2	73	366	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	179-02-S1	57	0	74	378	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	180-02-S1	65	2	82	405	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	180-02-S2	129	10	28	96	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	181-02-S1	153	10	31	89	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	184-02-S1	134	10	28	85	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	185-02-1	58	2	75	387	19	NM	NM	1267	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	32	NM			
35KL3262	185-02-S2	58	2	76	388	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	186-02-S1	128	9	28	79	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3262	186-02-S2	62	0	78	394	22	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	187-03-S1	146	10	30	89	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	187-03-S2	62	0	81	400	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	188-02-S1	55	2	75	378	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	188-02-S2	63	0	77	396	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	191-02-S1	117	9	26	78	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	191-02-S2	128	10	28	81	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3262	192-02-S1	62	2	78	399	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	193-02	117	9	28	77	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	196-02-S1	58	0	73	385	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	196-02-S2	127	82	21	144	11	NM	NM	NM	NM	NM	NM	Alturas FGV *
		± 2	2	1	2	2	NM	NM	NM	NM			
35KL3262	196-02-S3	137	11	31	87	16	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	197-02-S1	61	0	82	405	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	198-02-S1	114	8	26	77	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	24	NM			
35KL3262	198-02-S2	58	2	72	385	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	199-01-S1	125	10	29	81	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	200-02-S1	129	10	26	79	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	200-02-S2	59	2	77	392	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	201-02-S1	59	2	78	394	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	201-02-S2	127	70	27	196	8	NM	NM	NM	NM	NM	NM	Grasshopper Group *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3262	201-02-S3	122	9	27	79	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35KL3262	202-03	58	2	75	383	18	NM	NM	1053	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35KL3262	204-01-S1	59	2	76	393	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	204-01-S2	120	9	27	75	11	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	205-01-1	154	3	68	150	21	NM	NM	0	NM	NM	NM	Cougar Butte
		± 2	1	2	2	2	NM	NM	23	NM			
35KL3262	205-02-S1	56	3	72	373	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	206-05-S1	124	9	27	79	12	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	24	NM			
35KL3262	206-05-S2	49	0	69	360	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	206-05-S3	59	2	75	389	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	207-02-S1	61	2	77	398	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	207-02-S2	135	11	28	82	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3262	209-01-S1	59	2	73	380	20	NM	NM	1001	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35KL3262	210-02-5	62	1	75	384	18	NM	NM	1090	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	33	NM			
35KL3262	210-02-S1	55	2	73	373	20	NM	NM	1246	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	31	NM			
35KL3262	211-02-S1	129	54	23	116	13	NM	NM	607	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	39	NM			
35KL3262	211-02-S2	57	2	73	376	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	212-02-S1	60	2	76	392	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	212-02-S2	156	85	32	216	7	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	2	2	1	NM	NM	NM	NM			
35KL3262	213-02	55	2	72	369	17	NM	NM	1086	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	36	NM			
35KL3262	215-02	57	2	74	376	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	215-03-S1	57	3	72	376	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	215-03-S2	115	10	25	75	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	216-02-2	53	2	73	370	20	NM	NM	1226	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	38	NM			
35KL3262	216-02-S2	54	0	75	378	19	NM	NM	1086	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	217-03-2	122	10	28	80	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	22	NM			
35KL3262	218-03-1	56	0	70	363	19	NM	NM	1069	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	37	NM			
35KL3262	218-03-S2	56	0	73	367	18	NM	NM	1200	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	33	NM			
35KL3262	219-02-S1	56	1	73	379	18	NM	NM	1228	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	35	NM			
35KL3262	221-02-S1	57	2	71	370	19	NM	NM	1263	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	34	NM			
35KL3262	222-02-S1	137	12	28	82	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	222-02-S2	57	2	73	369	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	222-02-S3	58	2	77	384	20	NM	NM	1064	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	40	NM			
35KL3262	223-02-S1	119	10	26	77	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	223-02-S2	58	3	77	383	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	223-03	100	21	22	85	11	NM	NM	56	NM	NM	NM	Drews Creek/Butcher Flat *
		± 2	2	1	2	1	NM	NM	26	NM			
35KL3262	226-01-1	138	74	28	204	9	NM	NM	788	NM	NM	NM	Grasshopper Group
		± 2	2	1	2	1	NM	NM	33	NM			
35KL3262	227-02-2	96	76	19	101	12	NM	NM	689	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	33	NM			
35KL3262	228-02-5	127	10	28	80	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	228-02-S1	58	1	76	379	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	229-02-1	123	51	21	114	14	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	229-02-S1	58	2	77	392	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	229-03	52	2	68	355	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	232-01-S1	57	0	73	383	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	233-02-2	62	0	75	388	21	NM	NM	1004	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	40	NM			
35KL3262	233-02-S1	57	2	75	385	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	233-02-S2	56	1	73	378	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3262	233-02-S3	134	55	25	118	14	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3262	234-02-S1	113	8	25	79	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	237-02-2	62	0	78	392	18	NM	NM	1073	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	41	NM			
35KL3262	237-02-S1	57	2	73	383	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	237-02-S2	114	10	28	76	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	238-02-S1	116	10	28	76	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	238-02-S2	58	0	76	389	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	239-02-S1	58	2	79	389	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	2	2	2	1	NM	NM	NM	NM			
35KL3262	239-02-S2	57	2	73	377	21	NM	NM	1185	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	41	NM			
35KL3262	240-02	112	8	26	82	12	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	24	NM			
35KL3262	241-02-2	58	2	74	382	18	NM	NM	1112	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	30	NM			
35KL3262	241-02-S1	54	2	74	383	18	NM	NM	1245	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	36	NM			
35KL3262	241-02-S2	122	9	27	79	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	242-02-5	62	2	78	395	18	NM	NM	1161	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	42	NM			
35KL3262	242-02-6	59	0	75	395	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	1	1	NM	NM	NM	NM			
35KL3262	242-02-S3	131	10	28	82	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	243-02-S1	60	0	76	393	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	243-02-S2	56	0	75	373	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	244-02-S1	61	3	78	397	22	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	246-02	103	8	25	73	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	2	1	2	1	NM	NM	22	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	247-02-1	117	10	26	75	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	24	NM			
35KL3262	247-02-S1	60	3	75	385	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	248-02-4	56	0	75	383	23	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	249-02-S1	139	10	29	82	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	249-02-S2	61	2	76	392	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	249-02-S3	60	1	77	392	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	250-02-S1	59	3	76	385	20	NM	NM	1143	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	38	NM			
35KL3262	253-03-2	110	8	25	76	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	253-03-S1	56	2	75	383	22	NM	NM	1129	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	37	NM			
35KL3262	254-02-2	103	46	25	122	15	NM	NM	908	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	41	NM			
35KL3262	254-02-9	59	0	75	383	19	NM	NM	1149	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	31	NM			
35KL3262	254-02-S1	59	2	74	382	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	255-03-1	58	3	74	380	19	NM	NM	1106	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	33	NM			
35KL3262	255-03-2	122	9	27	78	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	24	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	255-03-S1	123	8	28	80	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	255-04	145	78	31	211	9	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	255-05	136	75	30	209	10	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	256-02-1	142	75	30	210	11	NM	NM	839	NM	NM	NM	East Medicine Lake
		± 2	2	1	2	1	NM	NM	34	NM			
35KL3262	256-03	121	9	27	79	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	259-02-S1	58	2	74	373	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	259-02-S2	56	0	72	381	24	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	260-02-S1	59	2	77	383	17	NM	NM	1099	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	37	NM			
35KL3262	264-01-1	59	2	76	389	19	NM	NM	1224	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	40	NM			
35KL3262	264-01-S1	54	0	73	369	20	NM	NM	1162	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	35	NM			
35KL3262	265-02	122	53	23	115	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	265-03-1	123	10	29	80	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	1	1	NM	NM	27	NM			
35KL3262	265-03-S1	117	10	27	78	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	266-02-3	112	9	25	75	12	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	29	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	266-02-5	59	2	77	391	19	NM	NM	1178	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	38	NM			
35KL3262	267-02-4	62	1	77	398	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	267-02-S2	56	2	71	375	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	271-02-S1	122	9	27	82	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	271-02-S2	61	0	76	392	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	272-02-2	101	77	19	97	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	272-02-S2	59	2	74	390	22	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	273-02-S1	59	2	75	387	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	274-01-S1	122	9	26	78	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	25	NM			
35KL3262	274-02	138	75	28	205	10	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	275-01-S1	56	2	72	376	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	276-02-2	113	9	25	79	12	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	33	NM			
35KL3262	276-02-4	59	0	77	384	18	NM	NM	1188	NM	NM	NM	Blue Mountain
		± 2	1	1	2	1	NM	NM	32	NM			
35KL3262	276-02-S2	136	11	29	83	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	39	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	276-03	138	73	28	210	9	NM	NM	771	NM	NM	NM	East Medicine Lake
		± 2	1	2	3	2	NM	NM	31	NM			
35KL3262	277-03-S1	95	42	23	124	14	NM	NM	767	NM	NM	NM	Spodue Mountain *
		± 2	1	2	3	2	NM	NM	30	NM			
35KL3262	277-03-S2	60	3	77	392	21	NM	NM	NM	NM	NM	NM	Blue Mountain
		± 3	1	2	2	2	NM	NM	NM	NM			
35KL3262	278-02-S1	58	0	75	386	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	280-01-S1	58	2	75	383	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	NM	NM			
35KL3262	280-01-S2	122	9	27	78	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3262	281-02-3	126	9	28	88	13	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	28	NM			
35KL3262	281-02-S1	62	1	78	393	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	281-02-S2	135	10	28	85	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	282-02-S1	134	10	28	82	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	282-02-S2	59	2	78	397	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	283-02-1	55	0	74	375	19	NM	NM	1103	NM	NM	NM	Blue Mountain
		± 2	2	2	2	2	NM	NM	38	NM			
35KL3262	284-03-S1	58	2	76	378	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	284-03-S2	57	2	73	380	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	286-01	56	0	72	373	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	287-02-2	129	11	28	82	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	28	NM			
35KL3262	287-02-3	177	6	63	147	20	NM	NM	0	NM	NM	NM	Cougar Butte
		± 2	1	2	3	2	NM	NM	25	NM			
35KL3262	287-02-S1	123	10	29	76	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3262	287-02-S2	57	0	75	383	20	NM	NM	1275	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	38	NM			
35KL3262	288-02	134	72	29	199	8	NM	NM	NM	NM	NM	NM	Grasshopper Group *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	288-03-S1	58	2	76	387	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	288-03-S2	60	0	79	383	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	288-03-S3	130	10	28	83	16	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	289-02-S1	57	0	74	377	18	NM	NM	1045	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	42	NM			
35KL3262	289-02-S2	58	2	74	376	19	NM	NM	1033	NM	NM	NM	Blue Mountain
		± 2	1	1	2	2	NM	NM	38	NM			
35KL3262	290-02-1	58	0	76	393	21	NM	NM	1284	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	35	NM			
35KL3262	290-02-S1	116	8	26	77	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	26	NM			
35KL3262	290-02-S2	58	2	73	376	20	NM	NM	1096	NM	NM	NM	Blue Mountain
		± 2	2	1	2	1	NM	NM	34	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	291-02-S1	141	11	30	82	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3262	291-02-S2	55	0	72	371	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	295-02-S1	55	0	75	370	19	NM	NM	1179	NM	NM	NM	Blue Mountain *
		± 2	2	1	2	1	NM	NM	36	NM			
35KL3262	295-02-S2	138	77	29	204	11	NM	NM	NM	NM	NM	NM	Grasshopper Group *
		± 2	1	1	1	1	NM	NM	NM	NM			
35KL3262	295-03	52	0	72	365	19	NM	NM	1249	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	34	NM			
35KL3262	297-02-S1	58	2	74	386	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	299-02-S1	131	9	27	85	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	299-02-S2	55	0	76	377	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	300-02-S1	60	2	74	381	20	NM	NM	1146	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	36	NM			
35KL3262	300-02-S2	58	2	73	385	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	301-02-S1	146	12	31	85	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3262	301-02-S2	59	2	75	387	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3262	302-02-S1	60	3	80	396	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3262	303-02-S1	147	11	30	83	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	3	2	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3262	303-02-S2	119	9	23	74	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 3	1	2	2	2	NM	NM	NM	NM			
35KL3262	303-02-S3	139	58	23	121	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3493	1-01	173	36	29	135	12	NM	NM	NM	NM	NM	NM	Surveyor Spring *
		± 3	1	2	2	2	NM	NM	NM	NM			
35KL3300	1-01	62	0	76	407	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	4	2	NM	NM	NM	NM			
35KL3300	2-01	104	47	24	124	15	NM	NM	802	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	29	NM			
35KL3300	3-01	103	43	23	124	15	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3300	4-01	105	46	23	122	13	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3300	5-01	61	0	74	396	19	NM	NM	1113	NM	NM	NM	Blue Mountain
		± 2	1	2	3	1	NM	NM	33	NM			
35KL3300	6-01	60	1	76	398	18	NM	NM	NM	NM	NM	NM	Blue Mountain
		± 2	1	2	3	1	NM	NM	NM	NM			
35KL3300	7-01	113	8	27	79	12	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	23	NM			
35KL3300	9-01	140	70	30	188	9	NM	NM	NM	NM	NM	NM	GF/LIW/RS *
		± 2	2	2	2	2	NM	NM	NM	NM			
35KL3300	10-01	125	9	27	81	11	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3300	11-01	54	2	72	379	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3300	12-01	115	9	51	359	18	NM	NM	NM	NM	NM	NM	Silver Lake/Sycan Marsh *
		± 2	1	2	3	1	NM	NM	NM	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3300	15-01-S1	57	1	73	391	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3446	2-01	57	0	72	388	18	NM	NM	1203	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	36	NM			
35KL3446	3-01	59	0	75	390	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	4	2	NM	NM	NM	NM			
35KL3446	4-01-1	58	2	73	387	16	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3446	4-01-S1	62	2	77	414	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	NM	NM			
35KL3446	4-01-S2	160	124	25	240	8	NM	NM	NM	NM	NM	NM	Glass Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3446	5-01-S1	62	1	79	409	18	NM	NM	1196	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	36	NM			
35KL3446	6-01-1	150	63	22	128	13	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3446	6-01-S1	61	3	76	404	19	NM	NM	1208	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	36	NM			
35KL3446	9-01-1	64	2	76	408	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	NM	NM			
35KL3495	1-01	169	4	69	163	20	NM	NM	NM	NM	NM	NM	Cougar Butte *
		± 2	1	2	2	1	NM	NM	NM	NM			
35KL3495	2-01	123	9	27	82	11	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3495	3-01	0	3	0	0	0	NM	NM	NM	NM	NM	NM	Not Obsidian
		± 0	1	0	1	1	NM	NM	NM	NM			
35KL3495	4-01	131	10	29	82	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3495	6-01	100	47	26	70	11	NM	NM	NM	NM	NM	NM	Tucker HIll *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3495	8-01	116	74	19	97	12	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	2	NM	NM	NM	NM			
35KL3495	9-01	157	85	30	226	9	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3495	10-01	119	10	25	81	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	2	2	2	NM	NM	24	NM			
35KL3495	11-01	172	5	73	166	20	NM	NM	NM	NM	NM	NM	Cougar Butte *
		± 2	1	2	2	1	NM	NM	NM	NM			
35KL3495	12-01	127	11	27	82	14	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	27	NM			
35KL3495	13-01	120	109	20	161	11	NM	NM	962	NM	NM	NM	Unknown FGV B
		± 2	2	1	2	1	NM	NM	28	NM			
35KL3495	14-01	56	0	71	374	20	NM	NM	1024	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	36	NM			
35KL3447	3-01	81	220	21	239	11	NM	NM	1151	NM	NM	NM	Unknown FGV
		± 2	3	1	3	1	NM	NM	29	NM			
35KL3447	4-01	152	84	30	224	9	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3447	5-01	56	2	74	391	17	NM	NM	1229	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	38	NM			
35KL3447	6-01	65	2	78	409	19	NM	NM	1159	NM	NM	NM	Blue Mountain
		± 2	1	2	3	1	NM	NM	31	NM			
35KL3447	7-01	64	2	76	408	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3447	8-01	60	1	75	407	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3447	9-01	146	79	28	221	9	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3447	10-01	142	77	27	211	9	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3447	11-01	158	86	29	223	9	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3447	12-01	133	75	28	204	8	NM	NM	NM	NM	NM	NM	Grasshopper Group *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3447	14-01	149	84	28	216	8	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3447	17-01	115	11	50	356	19	NM	NM	903	NM	NM	NM	Silver Lake/Sycan Marsh
		± 2	1	2	3	1	NM	NM	28	NM			
35KL3447	17-02	158	88	32	229	10	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3447	18-01	158	123	27	243	9	NM	NM	NM	NM	NM	NM	Glass Mountain *
		± 3	2	2	3	1	NM	NM	NM	NM			
35KL3447	18-01-1	141	79	29	220	9	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3447	24-01	102	44	23	127	13	NM	NM	935	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	27	NM			
35KL3447	34-01	57	3	75	388	18	NM	NM	1266	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	33	NM			
35KL3449	1-01	27	670	23	169	10	NM	NM	795	NM	NM	NM	Unknown FGV
		± 1	4	1	3	2	NM	NM	33	NM			
35KL3449	3-01	59	0	78	384	17	NM	NM	1104	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35KL3449	4-01	126	8	27	77	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			

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

Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3449	5-01	148	82	30	214	10	NM	NM	720	NM	NM	NM	East Medicine Lake
		± 2	2	1	2	1	NM	NM	30	NM			
35KL3449	6-01	96	51	22	63	11	NM	NM	233	NM	NM	NM	Tucker Hill
		± 2	1	1	1	1	NM	NM	25	NM			
35KL3449	8-01	138	11	28	84	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35KL3449	11-01	106	4	31	70	16	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	1	1	NM	NM	NM	NM			
35KL3449	17-01	126	10	24	82	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35KL3449	20-01	122	9	27	77	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	21	NM			
35KL3449	21-01	109	90	35	345	14	NM	NM	NM	NM	NM	NM	Unknown FGV *
		± 2	2	2	3	2	NM	NM	NM	NM			
35KL3449	22-01	153	118	27	230	11	NM	NM	NM	NM	NM	NM	Glass Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3449	24-01	138	74	28	200	10	NM	NM	721	NM	NM	NM	Grasshopper Group
		± 2	2	1	2	1	NM	NM	28	NM			
35KL3449	25-01	102	16	21	83	11	NM	NM	0	NM	NM	NM	Drews Creek/Butcher Flat
		± 2	1	1	2	1	NM	NM	27	NM			
35KL3449	26-01	53	0	73	366	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3449	27-01	139	77	31	200	8	NM	NM	695	NM	NM	NM	Grasshopper Group
		± 2	2	1	2	1	NM	NM	37	NM			
35KL3449	28-01	135	11	29	82	13	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3449	29-01	128	68	27	191	7	NM	NM	699	NM	NM	NM	GF/LIW/RS
		± 2	2	2	2	2	NM	NM	30	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3449	30-01	52	2	65	360	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3449	34-01	40	541	36	152	6	NM	NM	642	NM	NM	NM	Unknown FGV
		± 2	4	2	3	2	NM	NM	36	NM			
35KL3449	35-01	56	2	74	379	17	NM	NM	1103	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	34	NM			
35KL3449	36-01	119	9	26	78	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	25	NM			
35KL3449	37-01-S1	136	56	23	123	14	NM	NM	NM	NM	NM	NM	Sugar Hill *
		± 2	2	1	2	2	NM	NM	NM	NM			
35KL3449	41-01	93	44	24	63	12	NM	NM	269	NM	NM	NM	Tucker Hill *
		± 2	1	1	2	1	NM	NM	31	NM			
35KL3449	44-01	56	0	75	376	19	NM	NM	1194	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	34	NM			
35KL3449	45-01	96	63	16	90	10	NM	NM	669	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	35	NM			
35KL3449	48-01-S1	128	10	61	374	19	NM	NM	NM	NM	NM	NM	Silver Lake/Sycan Marsh *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3449	49-01-S1	132	71	30	197	9	NM	NM	NM	NM	NM	NM	Grasshopper Group *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3449	50-01	29	506	23	139	5	NM	NM	711	NM	NM	NM	Unknown FGV
		± 1	4	1	3	2	NM	NM	33	NM			
35KL3449	52-01	148	79	29	211	9	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	2	2	1	NM	NM	NM	NM			
35KL3449	56-01	148	117	28	229	10	NM	NM	942	NM	NM	NM	Glass Mountain *
		± 2	2	1	2	1	NM	NM	41	NM			
35KL3449	57-03-2	107	3	29	69	15	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3449	57-03-4	125	9	26	77	12	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	26	NM			
35KL3449	58-02-1	108	7	26	75	15	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3449	59-02-1	96	73	18	91	10	NM	NM	685	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	28	NM			
35KL3449	59-02-S1	59	2	72	368	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3449	59-03	93	42	24	113	15	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3449	63-01-S1	102	70	19	96	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	2	2	2	NM	NM	NM	NM			
35KL3449	64-04-11	99	44	23	133	16	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	2	NM	NM	NM	NM			
35KL3449	65-02-1	126	9	27	80	14	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35KL3449	65-02-2	57	0	74	374	19	NM	NM	1010	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	32	NM			
35KL3449	65-02-S1	56	3	70	367	18	NM	NM	996	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	41	NM			
35KL3449	66-02-1	58	1	74	377	18	NM	NM	1056	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	34	NM			
35KL3449	74-03-1	121	8	27	79	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3449	75-04-S1	122	10	27	75	12	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3449	79-03-S1	102	63	17	88	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	2	2	2	NM	NM	NM	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3449	89-02-1	129	71	27	201	10	NM	NM	NM	NM	NM	NM	Grasshopper Group *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3449	90-02	96	43	22	116	13	NM	NM	760	NM	NM	NM	Spodue Mountain
		± 2	1	1	2	1	NM	NM	32	NM			
35KL3449	90-03-S1	148	81	30	211	10	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3448	2-01	66	3	77	373	21	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 3	1	3	5	3	NM	NM	NM	NM			
35KL3448	3 01-S1	62	2	77	412	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3448	4 01-S1	63	3	76	392	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	4	2	NM	NM	NM	NM			
35KL3448	5-01	66	0	78	396	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 3	1	3	5	2	NM	NM	NM	NM			
35KL3472	3-01	63	1	76	401	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	NM	NM			
35KL3472	5-01	69	1	82	428	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	NM	NM			
35KL3472	7-01	64	2	79	413	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3472	13-01	160	120	27	235	9	NM	NM	NM	NM	NM	NM	Glass Mountain *
		± 3	2	2	3	2	NM	NM	NM	NM			
35KL3307	4-01	149	119	26	235	9	NM	NM	889	NM	NM	NM	Glass Mountain *
		± 2	2	1	2	1	NM	NM	28	NM			
35KL3307	5-01	100	49	24	68	10	NM	NM	243	NM	NM	NM	Tucker HIll *
		± 2	1	1	2	1	NM	NM	22	NM			
35KL3307	11-01	122	11	28	79	14	NM	NM	NM	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	NM	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3307	12-01	152	3	66	148	20	NM	NM	NM	NM	NM	NM	Cougar Butte *
		± 2	1	2	2	2	NM	NM	NM	NM			
35KL3307	15-01	111	8	24	77	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	22	NM			
35KL3307	16-01	59	0	75	396	16	NM	NM	1097	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	39	NM			
35KL3307	17-01	116	73	18	99	12	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	NM	NM			
35KL3307	18-01	116	69	19	98	11	NM	NM	672	NM	NM	NM	Buck Mountain *
		± 2	2	1	2	1	NM	NM	36	NM			
35KL3307	19-01	108	71	18	98	10	NM	NM	636	NM	NM	NM	Buck Mountain
		± 2	1	1	2	1	NM	NM	30	NM			
35KL3307	20-01	159	88	30	225	8	NM	NM	NM	NM	NM	NM	East Medicine Lake *
		± 3	2	2	3	1	NM	NM	NM	NM			
35KL3451	1-01	128	10	26	81	13	NM	NM	0	NM	NM	NM	Cowhead Lake
		± 2	1	1	2	1	NM	NM	23	NM			
35KL3451	2-01	110	72	19	100	11	NM	NM	NM	NM	NM	NM	Buck Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3451	3-01	110	49	24	124	15	NM	NM	NM	NM	NM	NM	Spodue Mountain *
		± 2	1	1	2	1	NM	NM	NM	NM			
35KL3451	4-01	124	10	27	79	12	NM	NM	0	NM	NM	NM	Cowhead Lake *
		± 2	1	1	2	1	NM	NM	23	NM			
35KL3451	5-01	150	8	64	182	17	NM	NM	0	NM	NM	NM	Cougar Butte *
		± 2	1	2	2	1	NM	NM	25	NM			
35KL3443	4-01	64	2	74	370	21	NM	NM	1028	NM	NM	NM	Blue Mountain
		± 2	1	2	3	2	NM	NM	34	NM			
35KL3277	1-01	55	0	68	374	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			

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Northwest Research Obsidian Studies Laboratory

Table A-1. Results of XRF Studies: Sites Associated with the Ruby Pipeline Project, Lake and Klamath Counties, Oregon

		Trace Element Concentrations									Ratios		
Site	Catalog No.	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe^2O^{3T}	Fe:Mn	Fe:Ti	Geochemical Source
35KL3277	2-01	41	15	45	91	8	NM	NM	NM	NM	NM	NM	Not Obsidian
		± 1	1	1	2	1	NM	NM	NM	NM			
35KL3277	3-01	63	2	74	401	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	NM	NM			
35KL3277	4-01	59	2	73	401	18	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	1	NM	NM	NM	NM			
35KL3277	5-01	62	2	76	396	19	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			
35KL3277	7-01	163	4	67	159	23	NM	NM	NM	NM	NM	NM	Cougar Butte *
		± 2	1	2	2	1	NM	NM	NM	NM			
35KL3277	8-01	67	3	82	416	17	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	4	2	NM	NM	NM	NM			
35KL3277	9-01	73	2	83	428	16	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	4	2	NM	NM	NM	NM			
35KL3277	10-01	63	2	76	405	20	NM	NM	1107	NM	NM	NM	Blue Mountain
		± 2	1	2	3	1	NM	NM	36	NM			
35KL3277	12-01	65	3	79	417	20	NM	NM	NM	NM	NM	NM	Blue Mountain *
		± 2	1	2	3	2	NM	NM	NM	NM			

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

Appendix B

Results of Obsidian Hydration Analysis of Obsidian Artifacts from Ruby Pipeline Project Sites

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	3-01	SC 3	Surface	BLA	Surveyor Spring	6.3 ± 0.1	NM ± NM	--
35LK1231	4-01	SC 4	Surface	PPT	Buck Mountain	2.8 ± 0.1	NM ± NM	--
35LK1231	11-01	SC 11	Surface	BLA	Surveyor Spring	10.7 ± 0.1	1.6 ± 0.1	Rim 1 = cut A; Rims 2 & 3 (10.7 mic.) = cut B
35LK1231	20-01	SC 20	Surface	PRE	Surveyor Spring	4.7 ± 0.1	NM ± NM	--
35LK1231	27-01	SC 27	Surface	BLA	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	28-01	SC 28	Surface	PPT	Surveyor Spring	8.2 ± 0.1	NM ± NM	--
35LK1231	36-01	SC 36	Surface	BLA	Surveyor Spring	10.8 ± 0.1	NM ± NM	DFV
35LK1231	39-01	SC 39	Surface	BLA	Surveyor Spring	2.2 ± 0.1	6.3 ± 0.1	Smaller rim on ventral margin
35LK1231	48-01	SC 48	Surface	BLA	Variety 5	1.6 ± 0.1	6.2 ± 0.0	Smaller rim on BRE
35LK1231	51-01	SC 51	Surface	BLA	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	56-01	SC 56	Surface	KNI	Cowhead Lake	2.2 ± 0.1	NM ± NM	--
35LK1231	57-01	SC 57	Surface	BLA	Surveyor Spring	3.0 ± 0.1	NM ± NM	--
35LK1231	58-01	SC 58	Surface	BLA	Surveyor Spring	7.4 ± 0.1	NM ± NM	--
35LK1231	64-01	SC 64	Surface	BLA	Surveyor Spring	7.3 ± 0.1	10.0 ± 0.1	Smaller rim on dorsal margin
35LK1231	66-01	SC 66	Surface	BLA	Sugar Hill	4.1 ± 0.1	NM ± NM	Dorsal surface is DFV, UNR, approx 10.5 mic.
35LK1231	71-01	SC 71	Surface	BLA	Surveyor Spring	10.0 ± 0.1	NM ± NM	--
35LK1231	74-01	SC 74	Surface	BLA	Surveyor Spring	8.1 ± 0.1	2.0 ± 0.1	Rims 1 & 2 = cut A; Rim 3 = cut B (8.0 mic.)
35LK1231	75-01	SC 75	Surface	BLA	Surveyor Spring	1.7 ± 0.1	7.0 ± 0.1	Smaller rim on BRE scar; dorsal is BEV
35LK1231	79-01	SC 79	Surface	PPT	Sugar Hill	1.8 ± 0.1	7.2 ± 0.1	Smaller rim on BRE flake scar
35LK1231	83-01	SC 83	Surface	BUR	Blue Spring	NA ± NA	NM ± NM	REC; UNR, DFV (possibly burnt)
35LK1231	84-01	SC 84	Surface	BLA	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK1231	85-01	SC 85	Surface	PPT	Surveyor Spring	8.3 ± 0.1	NM ± NM	--
35LK1231	86-01	SC 86	Surface	PPT	Surveyor Spring	6.1 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	88-01	SC 88	Surface	BLA	Parsnip Creek	9.1 ± 0.1	NM ± NM	DFV
35LK1231	94-01	SC 94	Surface	BLA	Surveyor Spring	9.2 ± 0.1	7.5 ± 0.1	9.2 on dorsal and BRE, 7.5 on lateral margin
35LK1231	96-01	SC 96	Surface	COR	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	102-01	SC 102	Surface	BLA	Surveyor Spring	8.7 ± 0.1	10.6 ± 0.1	Smaller rim on dorsal surface
35LK1231	103-01	SC 103	Surface	KNI	Unknown Obsidian 1	NA ± NA	NM ± NM	REC; UNR, OPA
35LK1231	104-01	SC 104	Surface	PRE	Cowhead Lake	5.6 ± 0.1	6.9 ± 0.1	Smaller rim on BRE
35LK1231	111-01	SC 111	Surface	PPT	Unknown Obsidian 1	6.1 ± 0.1	NM ± NM	--
35LK1231	112-01	SC 112	Surface	PPT	Mosquito Lake	NA ± NA	NM ± NM	REC; UNR, DFV (possibly burnt)
35LK1231	113-01	SC 113	Surface	KNI	Massacre Lake/Guano Valley	8.2 ± 0.1	8.3 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	119-01	SC 119	Surface	BLA	Surveyor Spring	1.8 ± 0.1	4.7 ± 0.0	Smaller rim on ventral margin
35LK1231	125-01	SC 125	Surface	COR	Surveyor Spring	4.8 ± 0.1	15.8 ± 0.1	Smaller rim on ventral surface
35LK1231	134-01	SC 134	Surface	BLA	Cowhead Lake	6.1 ± 0.1	6.1 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	135-01	SC 135	Surface	PPT	Unknown Obsidian 1	5.7 ± 0.1	NM ± NM	--
35LK1231	136-01	SC 136	Surface	BLA/BUR	Surveyor Spring	5.7 ± 0.1	11.2 ± 0.1	Smaller rim on BRE
35LK1231	138-01	SC 138	Surface	BLA	Surveyor Spring	3.9 ± 0.1	10.9 ± 0.1	Smaller rim on dorsal margin
35LK1231	139-01	SC 139	Surface	BUR	Surveyor Spring	10.0 ± 0.1	10.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	140-01	SC 140	Surface	BLA	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	141-01	SC 141	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	142-01	SC 142	Surface	BLA	Surveyor Spring	10.9 ± 0.1	NM ± NM	--
35LK1231	151-01	SC 151	Surface	PPT	Long Valley	1.2 ± 0.0	5.7 ± 0.1	Smaller rim on dorsal margin
35LK1231	182-01	SC 182	Surface	BLA	Surveyor Spring	9.2 ± 0.1	10.3 ± 0.1	Smaller rim on BRE
35LK1231	197-01	SC 197	Surface	COR	Surveyor Spring	6.3 ± 0.1	NM ± NM	--
35LK1231	203-01	SC 203	Surface	BLA	Surveyor Spring	4.3 ± 0.1	NM ± NM	DFV

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	204-01	SC 204	Surface	COR	Surveyor Spring	4.3 ± 0.1	NM ± NM	--
35LK1231	209-01	SC 209	Surface	COR	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	227-01	SC 227	Surface	BLA	Surveyor Spring	4.9 ± 0.1	NM ± NM	--
35LK1231	238-01	SC 238	Surface	BLA	Surveyor Spring	2.8 ± 0.1	5.6 ± 0.1	Smaller rim on ventral margin scar
35LK1231	241-01	SC 241	Surface	BLA	Surveyor Spring	5.9 ± 0.0	11.3 ± 0.0	Large rim on v., small on d/margin
35LK1231	248-01	SC 248	Surface	FLT	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK1231	250-01	SC 250	Surface	BLA	Surveyor Spring	1.9 ± 0.1	6.8 ± 0.1	Smaller rim on dorsal margin
35LK1231	257-01	SC 257	Surface	BLA	Surveyor Spring	9.0 ± 0.1	9.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	263-01	SC 263	Surface	BLA/BUR	Unknown Obsidian 1	4.3 ± 0.1	NM ± NM	--
35LK1231	264-01	SC 264	Surface	BLA	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	265-01	SC 265	Surface	PRE	Surveyor Spring	5.7 ± 0.1	NM ± NM	--
35LK1231	268-01	SC 268	Surface	PPT	Buck Mountain	10.6 ± 0.1	NM ± NM	--
35LK1231	269-01	SC 269	Surface	PPT	Mosquito Lake	1.3 ± 0.0	3.4 ± 0.1	Rims 1 & 2 = cut A; Rim 3 = cut B (3.3 mic.)
35LK1231	271-01	SC 271	Surface	PPT	Surveyor Spring	6.9 ± 0.1	NM ± NM	--
35LK1231	270-01	SC 270	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	279-01	SC 279	Surface	BLA	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK1231	290-01	SC 290	Surface	PPT	Cowhead Lake	7.7 ± 0.1	NM ± NM	--
35LK1231	296-01	SC 296	Surface	COR	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	299-01	SC 299	Surface	PPT	Spodue Mountain	6.6 ± 0.1	NM ± NM	DFV
35LK1231	301-01	SC 301	Surface	PPT	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	304-01	SC 304	Surface	PPT	Silver Lake/Sycan Marsh	1.4 ± 0.1	5.1 ± 0.1	Rims 1 & 2 = cut A; Rim 3 = cut B (5.0 mic.)
35LK1231	312-01	SC 312	Surface	COR	Surveyor Spring	8.2 ± 0.1	NM ± NM	REC
35LK1231	325-01	SC 325	Surface	BLA	Surveyor Spring	9.4 ± 0.1	9.4 ± 0.1	Rim 1 = cut A; Rim 2 = cut B

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	326-01	SC 326	Surface	BLA	Surveyor Spring	2.9 ± 0.1	7.9 ± 0.1	Smaller rim on dorsal BRE scar
35LK1231	332-01	SC 332	Surface	BLA	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	333-01	SC 333	Surface	KNI	Surveyor Spring	9.3 ± 0.1	NM ± NM	--
35LK1231	338-01	SC 338	Surface	BLA	Surveyor Spring	8.2 ± 0.1	NM ± NM	--
35LK1231	339-01	SC 339	Surface	BLA	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK1231	342-01	SC 342	Surface	PPT	Cowhead Lake	3.2 ± 0.1	NM ± NM	--
35LK1231	345-01	SC 345	Surface	BLA	Surveyor Spring	9.2 ± 0.1	NM ± NM	--
35LK1231	347-01	SC 347	Surface	BLA	Surveyor Spring	5.0 ± 0.1	4.3 ± 0.1	Small rim on d/surface cut B; Rim 3 = 5.0 mic.
35LK1231	348-01	SC 348	Surface	BLA	Surveyor Spring	10.0 ± 0.1	NM ± NM	--
35LK1231	350-01	SC 350	Surface	BLA	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK1231	355-01	SC 355	Surface	BLA	Surveyor Spring	1.8 ± 0.1	NM ± NM	--
35LK1231	356-01	SC 356	Surface	BLA	Surveyor Spring	2.4 ± 0.0	NM ± NM	--
35LK1231	358-01	SC 358	Surface	BLA	Surveyor Spring	8.6 ± 0.1	NM ± NM	--
35LK1231	359-01	SC 359	Surface	BLA	Surveyor Spring	8.4 ± 0.1	NM ± NM	--
35LK1231	365-01	SC 365	Surface	PPT	Cowhead Lake	1.7 ± 0.1	NM ± NM	--
35LK1231	367-01	SC 367	Surface	BLA/BUR	Cowhead Lake	6.1 ± 0.1	1.7 ± 0.1	Small rim on v/margin cut B; Rim 3 = 6.1 mic.
35LK1231	369-01	SC 369	Surface	BLA	Surveyor Spring	5.1 ± 0.1	NM ± NM	--
35LK1231	370-01	SC 370	Surface	BLA	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	371-01	SC 371	Surface	BLA	Surveyor Spring	9.2 ± 0.1	NM ± NM	--
35LK1231	375-01	SC 375	Surface	PPT	Surveyor Spring	4.6 ± 0.0	4.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	376-01	SC 376	Surface	BLA	Surveyor Spring	8.6 ± 0.1	NM ± NM	--
35LK1231	379-01	SC 379	Surface	BLA	Surveyor Spring	8.1 ± 0.1	10.1 ± 0.1	REC; smaller rim on BRE, ventral is BEV
35LK1231	380-01	SC 380	Surface	BLA	Surveyor Spring	5.1 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	382-01	SC 382	Surface	BLA	Surveyor Spring	6.9 ± 0.1	10.5 ± 0.1	Four rims; Rim 3 = 7.0 mic.; Rim 4 = 10.3 mic.
35LK1231	384-01	SC 384	Surface	BLA	Surveyor Spring	1.7 ± 0.0	7.4 ± 0.1	Smaller rim on ventral margin scar
35LK1231	385-01	SC 385	Surface	BLA	Surveyor Spring	5.2 ± 0.1	NM ± NM	--
35LK1231	386-01	SC 386	Surface	BLA	Surveyor Spring	7.3 ± 0.1	7.3 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	389-01	SC 389	Surface	BLA	Surveyor Spring	1.3 ± 0.1	NM ± NM	NVH on BRE
35LK1231	390-01	SC 390	Surface	BLA	Surveyor Spring	9.1 ± 0.1	NM ± NM	--
35LK1231	393-01	SC 393	Surface	BLA	Surveyor Spring	6.3 ± 0.1	6.3 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	396-01	SC 396	Surface	BLA	Mosquito Lake	5.6 ± 0.1	NM ± NM	Rim on ventral surface of cut A; cut B is UNR
35LK1231	399-01	SC 399	Surface	PPT	Cowhead Lake	4.8 ± 0.1	NM ± NM	--
35LK1231	400-01	SC 400	Surface	BLA	Surveyor Spring	8.7 ± 0.1	NM ± NM	--
35LK1231	401-01	SC 401	Surface	BLA	Surveyor Spring	8.2 ± 0.1	NM ± NM	--
35LK1231	402-01	SC 402	Surface	PPT	Surveyor Spring	3.4 ± 0.1	NM ± NM	REC
35LK1231	406-01	SC 406	Surface	BLA	Surveyor Spring	8.0 ± 0.1	NM ± NM	--
35LK1231	410-01	SC 410	Surface	BLA	Surveyor Spring	10.1 ± 0.1	NM ± NM	--
35LK1231	412-01	SC 412	Surface	BLA	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	414-01	SC 414	Surface	BLA	Surveyor Spring	2.0 ± 0.1	NM ± NM	DFV, possibly burnt
35LK1231	416-01	SC 416	Surface	BLA	Surveyor Spring	7.2 ± 0.1	10.9 ± 0.1	Smaller rim on dorsal margin
35LK1231	417-01	SC 417	Surface	SCR	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	420-01	SC 420	Surface	CHO	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	424-01	SC 424	Surface	BLA	Surveyor Spring	6.9 ± 0.1	NM ± NM	--
35LK1231	429-01	SC 429	Surface	BLA	Surveyor Spring	9.8 ± 0.1	7.5 ± 0.0	Small rim on d/margin cut B; Rim 3 = 9.7 mic.
35LK1231	430-01	SC 430	Surface	CHO	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	431-01	SC 431	Surface	PPT	Blue Spring	3.5 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	433-01	SC 433	Surface	CHO	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK1231	435-01	SC 435	Surface	COR	Surveyor Spring	7.9 ± 0.1	NM ± NM	--
35LK1231	436-01	SC 436	Surface	COR	Surveyor Spring	10.1 ± 0.1	NM ± NM	--
35LK1231	438-01	SC 438	Surface	BLA	Surveyor Spring	6.7 ± 0.1	8.4 ± 0.1	REC; smaller rim on dorsal margin
35LK1231	440-01	SC 440	Surface	FLT	Surveyor Spring	10.0 ± 0.1	NM ± NM	--
35LK1231	443-01	SC 443	Surface	BLA	Surveyor Spring	5.3 ± 0.1	NM ± NM	--
35LK1231	453-01	SC 453	Surface	BLA	Surveyor Spring	7.4 ± 0.1	NM ± NM	--
35LK1231	458-01	SC 458	Surface	PPT	Blue Spring	4.5 ± 0.1	7.0 ± 0.1	REC; smaller rim on ventral margin
35LK1231	459-01	SC 459	Surface	BLA	Surveyor Spring	9.8 ± 0.0	NM ± NM	DFV, IRR
35LK1231	460-01	SC 460	Surface	PPT	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK1231	462-01	SC 462	Surface	PPT	Cowhead Lake	5.2 ± 0.1	NM ± NM	--
35LK1231	467-01	SC 467	Surface	COR	Surveyor Spring	4.7 ± 0.0	NM ± NM	--
35LK1231	473-01	SC 473	Surface	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	474-01	SC 474	Surface	COR	Surveyor Spring	1.2 ± 0.1	NM ± NM	--
35LK1231	476-01	SC 476	Surface	COR	Surveyor Spring	1.2 ± 0.1	4.2 ± 0.1	Smaller rim on dorsal surface
35LK1231	478-01	SC 478	Surface	COR	Surveyor Spring	5.0 ± 0.1	7.7 ± 0.1	Smaller rim on ventral surface
35LK1231	481-01	SC 481	Surface	PRE	Quartz Mountain	NA ± NA	NM ± NM	UNR, WEA, DFV (both cuts)
35LK1231	482-01	SC 482	Surface	COR	Surveyor Spring	10.0 ± 0.1	NM ± NM	--
35LK1231	484-01	SC 484	Surface	COR	Surveyor Spring	4.3 ± 0.1	NM ± NM	--
35LK1231	486-01	SC 486	Surface	COR	Surveyor Spring	5.0 ± 0.1	NM ± NM	--
35LK1231	487-01	SC 487	Surface	COR	Surveyor Spring	1.3 ± 0.1	4.6 ± 0.0	Smaller rim on dorsal surface
35LK1231	488-01	SC 488	Surface	PPT	Cowhead Lake	NA ± NA	NM ± NM	UNR, DFV, possibly burnt (both cuts)
35LK1231	489-01	SC 489	Surface	COR	Surveyor Spring	1.2 ± 0.1	10.4 ± 0.1	Smaller rim on dorsal surface

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	491-01	SC 491	Surface	COR	Surveyor Spring	5.3 ± 0.1	7.2 ± 0.1	Smaller rim on modified margin
35LK1231	492-01	SC 492	Surface	COR	Surveyor Spring	5.2 ± 0.1	NM ± NM	--
35LK1231	493-01	SC 493	Surface	COR	Surveyor Spring	5.1 ± 0.1	NM ± NM	--
35LK1231	495-01	SC 495	Surface	COR	Surveyor Spring	5.1 ± 0.1	NM ± NM	--
35LK1231	496-01	SC 496	Surface	COR	Surveyor Spring	1.8 ± 0.1	NM ± NM	--
35LK1231	497-01	SC 497	Surface	COR	Surveyor Spring	3.7 ± 0.1	NM ± NM	--
35LK1231	498-01	SC 498	Surface	COR	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK1231	499-01	SC 499	Surface	COR	Surveyor Spring	4.9 ± 0.0	4.9 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	505-01	SC 505	Surface	COR	Surveyor Spring	3.8 ± 0.1	NM ± NM	--
35LK1231	509-01	SC 509	Surface	COR	Surveyor Spring	3.8 ± 0.1	NM ± NM	--
35LK1231	512-01	SC 512	Surface	BLA	Surveyor Spring	9.9 ± 0.1	NM ± NM	--
35LK1231	519-01	SC 519	Surface	COR	Surveyor Spring	1.8 ± 0.1	7.2 ± 0.1	Smaller rim on dorsal surface
35LK1231	524-01	SC 524	Surface	COR	Surveyor Spring	4.6 ± 0.1	NM ± NM	DFV
35LK1231	525-01	SC 525	Surface	COR	Surveyor Spring	4.6 ± 0.1	NM ± NM	--
35LK1231	526-01	SC 526	Surface	BLA	Surveyor Spring	6.9 ± 0.1	11.4 ± 0.1	Smaller rim on ventral surface
35LK1231	527-01	SC 527	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	531-01	SC 531	Surface	COR	Surveyor Spring	2.1 ± 0.0	5.2 ± 0.1	Smaller rim on dorsal surface
35LK1231	532-01	SC 532	Surface	COR	Surveyor Spring	5.2 ± 0.1	NM ± NM	--
35LK1231	536-01	SC 536	Surface	COR	Surveyor Spring	7.1 ± 0.0	NM ± NM	--
35LK1231	539-01	SC 539	Surface	BLA	Surveyor Spring	1.2 ± 0.1	8.1 ± 0.1	Large rim on v/surface; Rim 3 = 10.8 mic.
35LK1231	541-01	SC 541	Surface	COR	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK1231	546-01	SC 546	Surface	COR	Surveyor Spring	4.7 ± 0.0	NM ± NM	Dorsal surface is UNR, WEA, approx. 9 mic.
35LK1231	547-01	SC 547	Surface	COR	Surveyor Spring	7.2 ± 0.1	7.2 ± 0.1	Rim 1 = cut A; Rim 2 = cut B

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	548-01	SC 548	Surface	PPT	Surveyor Spring	6.1 ± 0.1	NM ± NM	DFV
35LK1231	551-01	SC 551	Surface	COR	Surveyor Spring	4.9 ± 0.0	10.7 ± 0.1	Larger rim on dorsal(?) surface
35LK1231	553-01	SC 553	Surface	COR	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	558-01	SC 558	Surface	COR	Surveyor Spring	6.5 ± 0.1	6.5 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	557-01	SC 557	Surface	COR	Surveyor Spring	5.1 ± 0.1	6.1 ± 0.1	Smaller rim on margin
35LK1231	559-01	SC 559	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	560-01	SC 560	Surface	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	561-01	SC 561	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	562-01	SC 562	Surface	COR	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK1231	565-01	SC 565	Surface	COR	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	566-01	SC 566	Surface	COR	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	567-01	SC 567	Surface	COR	Surveyor Spring	6.7 ± 0.1	NM ± NM	--
35LK1231	571-01	SC 571	Surface	COR	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	575-01	SC 575	Surface	COR	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR
35LK1231	577-01	SC 577	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	579-01	SC 579	Surface	COR	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK1231	583-01	SC 583	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	585-01	SC 585	Surface	COR	Surveyor Spring	3.2 ± 0.1	6.7 ± 0.1	Smaller rim on ventral margin
35LK1231	592-01	SC 592	Surface	COR	Surveyor Spring	8.0 ± 0.1	NM ± NM	--
35LK1231	593-01	SC 593	Surface	COR	Surveyor Spring	6.0 ± 0.1	5.9 ± 0.0	Rim 1 = cut A; Rim 2 = cut B
35LK1231	594-01	SC 594	Surface	COR	Surveyor Spring	3.5 ± 0.0	4.3 ± 0.0	Smaller rim on dorsal surface
35LK1231	595-01	SC 595	Surface	COR	Surveyor Spring	4.9 ± 0.1	NM ± NM	--
35LK1231	598-01	SC 598	Surface	COR	Surveyor Spring	7.0 ± 0.1	7.4 ± 0.1	REC; Rim 1 = cut A; Rim 2 = cut B

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	599-01	SC 599	Surface	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	600-01	SC 600	Surface	COR	Surveyor Spring	3.4 ± 0.1	NM ± NM	NVH on dorsal scar
35LK1231	605-01	SC 605	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	606-01	SC 606	Surface	BLA	Surveyor Spring	4.1 ± 0.1	8.3 ± 0.1	Smaller rim on ventral surface
35LK1231	608-01	SC 608	Surface	COR	Surveyor Spring	4.3 ± 0.1	NM ± NM	--
35LK1231	611-01	SC 611	Surface	COR	Surveyor Spring	6.5 ± 0.1	NM ± NM	--
35LK1231	613-01	SC 613	Surface	COR	Surveyor Spring	4.4 ± 0.0	NM ± NM	--
35LK1231	615-01	SC 615	Surface	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	617-01	SC 617	Surface	COR	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	618-01	SC 618	Surface	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	619-01	SC 619	Surface	COR	Surveyor Spring	7.1 ± 0.1	7.1 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	620-01	SC 620	Surface	COR	Surveyor Spring	6.9 ± 0.1	6.8 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	621-01	SC 621	Surface	BLA	Surveyor Spring	5.2 ± 0.1	5.3 ± 0.1	--
35LK1231	623-01	SC 623	Surface	COR	Surveyor Spring	1.5 ± 0.1	NM ± NM	--
35LK1231	625-01	SC 625	Surface	BLA	Surveyor Spring	10.3 ± 0.1	NM ± NM	--
35LK1231	626-01	SC 626	Surface	COR	Surveyor Spring	6.6 ± 0.1	NM ± NM	--
35LK1231	627-01	SC 627	Surface	COR	Surveyor Spring	1.7 ± 0.0	6.9 ± 0.1	Smaller rim on ventral margin
35LK1231	629-01	SC 629	Surface	COR	Surveyor Spring	3.8 ± 0.1	NM ± NM	--
35LK1231	633-01	SC 633	Surface	COR	Surveyor Spring	7.3 ± 0.1	NM ± NM	--
35LK1231	634-01	SC 634	Surface	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	635-01	SC 635	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	636-01	SC 636	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	REC
35LK1231	638-01	SC 638	Surface	COR	Surveyor Spring	6.4 ± 0.1	3.8 ± 0.1	Small rim on d/margin cut B; Rim 3 = 6.4 mic.

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	639-01	SC 639	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	640-01	SC 640	Surface	COR	Surveyor Spring	4.2 ± 0.0	NM ± NM	--
35LK1231	641-01	SC 641	Surface	COR	Surveyor Spring	2.1 ± 0.0	6.9 ± 0.1	Smaller rim on ventral surface
35LK1231	642-01	SC 642	Surface	COR	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	644-01	SC 644	Surface	COR	Surveyor Spring	6.7 ± 0.1	NM ± NM	--
35LK1231	645-01	SC 645	Surface	COR	Surveyor Spring	4.3 ± 0.1	NM ± NM	--
35LK1231	646-01	SC 646	Surface	COR	Surveyor Spring	10.7 ± 0.1	NM ± NM	--
35LK1231	648-01	SC 648	Surface	COR	Surveyor Spring	3.9 ± 0.1	NM ± NM	--
35LK1231	649-01	SC 649	Surface	COR	Surveyor Spring	4.2 ± 0.1	4.2 ± 0.0	Rim 1 = cut A; Rim 2 = cut B
35LK1231	652-01	SC 652	Surface	COR	Surveyor Spring	5.1 ± 0.1	NM ± NM	--
35LK1231	654-01	SC 654	Surface	COR	Surveyor Spring	3.9 ± 0.1	NM ± NM	--
35LK1231	661-01	SC 661	Surface	COR	Surveyor Spring	8.7 ± 0.1	NM ± NM	--
35LK1231	662-01	SC 662	Surface	COR	Surveyor Spring	5.1 ± 0.1	6.8 ± 0.0	Smaller rim on dorsal surface
35LK1231	665-01	SC 665	Surface	COR	Surveyor Spring	4.2 ± 0.0	NM ± NM	--
35LK1231	668-01	SC 668	Surface	COR	Surveyor Spring	10.2 ± 0.1	NM ± NM	--
35LK1231	669-01	SC 669	Surface	PPT	Mosquito Lake	5.9 ± 0.1	NM ± NM	--
35LK1231	670-01	SC 670	Surface	PPT	Cowhead Lake	5.4 ± 0.1	NM ± NM	--
35LK1231	671-01	SC 671	Surface	PPT	Cowhead Lake	5.5 ± 0.1	NM ± NM	--
35LK1231	673-01	SC 673	Surface	PPT	Cowhead Lake	4.9 ± 0.1	NM ± NM	NVH on BRE
35LK1231	675-01	SC 675	Surface	PPT	Unknown Obsidian 1	5.3 ± 0.1	5.3 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	677-01	SC 677	Surface	BLA	Surveyor Spring	7.3 ± 0.1	10.5 ± 0.1	Smaller rim on dorsal margin
35LK1231	682-01	SC 682	Surface	COR	Surveyor Spring	9.8 ± 0.1	NM ± NM	--
35LK1231	684-01	SC 684	Surface	PRE	Surveyor Spring	1.5 ± 0.1	7.1 ± 0.1	Smaller rim on BRE of cut A

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	687-01	SC 687	Surface	PPT	Beatys Butte	3.6 ± 0.1	NM ± NM	DFV
35LK1231	688-01	SC 688	Surface	BLA	Surveyor Spring	9.7 ± 0.1	NM ± NM	REC
35LK1231	689-01	SC 689	Surface	PPT	Beatys Butte	3.6 ± 0.1	NM ± NM	--
35LK1231	691-01	SC 691	Surface	PPT/BUR	Cowhead Lake	3.8 ± 0.1	3.9 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	692-01	SC 692	Surface	PPT	Cowhead Lake	6.0 ± 0.1	NM ± NM	Dorsal is BEV, appears same
35LK1231	693-01	SC 693	Surface	BLA	Surveyor Spring	4.0 ± 0.1	9.3 ± 0.0	Rims 1 & 2 = cut A; Rim 3 = cut B (9.2 mic.)
35LK1231	696-01	SC 696	Surface	BLA	Surveyor Spring	9.0 ± 0.1	NM ± NM	--
35LK1231	698-01	SC 698	Surface	COR	Surveyor Spring	9.4 ± 0.1	NM ± NM	--
35LK1231	707-01	SC 707	Surface	BLA	Surveyor Spring	10.2 ± 0.1	NM ± NM	--
35LK1231	709-01	SC 709	Surface	COR	Surveyor Spring	11.1 ± 0.1	11.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	710-01	SC 710	Surface	COR	Surveyor Spring	1.4 ± 0.1	5.7 ± 0.1	Smaller rim on ventral margin
35LK1231	711-01	SC 711	Surface	CHO	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK1231	712-01	SC 712	Surface	BLA	Surveyor Spring	9.4 ± 0.0	NM ± NM	NVH on ventral margin
35LK1231	713-01	SC 713	Surface	COR	Surveyor Spring	9.1 ± 0.1	NM ± NM	--
35LK1231	715-01	SC 715	Surface	PPT	Unknown Obsidian 1	3.2 ± 0.1	NM ± NM	--
35LK1231	716-01	SC 716	Surface	BLA	Surveyor Spring	2.2 ± 0.0	8.4 ± 0.0	Smaller rim on dorsal margin
35LK1231	724-01	SC 724	Surface	BLA	Surveyor Spring	7.6 ± 0.1	NM ± NM	--
35LK1231	725-01	SC 725	Surface	BLA	Surveyor Spring	1.5 ± 0.1	7.7 ± 0.1	Smaller rim on BRE
35LK1231	732-01	SC 732	Surface	COR	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK1231	734-01	SC 734	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	735-01	SC 735	Surface	BLA	Surveyor Spring	8.3 ± 0.1	NM ± NM	--
35LK1231	745-01	SC 745	Surface	PPT	Buck Mountain	3.3 ± 0.1	NM ± NM	--
35LK1231	747-01	SC 747	Surface	PPT	Buck Mountain?	3.5 ± 0.1	NM ± NM	REC

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	749-01	SC 749	Surface	COR	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	751-01	SC 751	Surface	PPT	Cowhead Lake	4.5 ± 0.1	NM ± NM	--
35LK1231	754-01	SC 754	Surface	COR	Surveyor Spring	6.5 ± 0.1	8.6 ± 0.1	Smaller rim on dorsal margin
35LK1231	756-01	SC 756	Surface	WFL	Surveyor Spring	6.7 ± 0.1	NM ± NM	DFV
35LK1231	757-01	SC 757	Surface	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	758-01	AC 7/SC 1	Surface	PPT	Buck Mountain?	NA ± NA	NM ± NM	REC; UNR, DFV (possibly burnt)
35LK1231	768-01	AC 7/SC 11	Surface	COR	Surveyor Spring	10.0 ± 0.1	9.9 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	785-01	AC 7/SC 28	Surface	BLA	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	788-01	AC 7/SC 31	Surface	PRE	Massacre Lake/Guano Valley	1.7 ± 0.1	4.6 ± 0.1	Smaller rim on BRE
35LK1231	794-01	AC 7/SC 37	Surface	BLA	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	805-01	AC 8/SC 9	Surface	PPT	Sugar Hill	5.0 ± 0.1	NM ± NM	--
35LK1231	806-01	AC 8/SC 10	Surface	PPT	Surveyor Spring	NA ± NA	NM ± NM	UNR (appears burnt)
35LK1231	814-01	AC 8/SC 18	Surface	PPT	Massacre Lake/Guano Valley	6.7 ± 0.1	6.7 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	821-01	AC 8/SC 25	Surface	PPT	Cowhead Lake	NA ± NA	NM ± NM	UNR (appears burnt - both cuts)
35LK1231	822-01	AC 8/SC 26	Surface	PPT	Cowhead Lake	6.5 ± 0.1	NM ± NM	DFV (possibly burnt)
35LK1231	823-01	AC 8/SC 27	Surface	PPT	Cowhead Lake	5.9 ± 0.1	NM ± NM	--
35LK1231	824-01	AC 8/SC 28	Surface	PPT	Buck Mountain	4.6 ± 0.1	4.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	825-01	AC 8/SC 29	Surface	PPT	Massacre Lake/Guano Valley	5.7 ± 0.1	5.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	826-01	AC 8/SC 30	Surface	PPT	Surveyor Spring	8.7 ± 0.1	5.6 ± 0.1	Rims 1 & 2 = cut A; Rim 3 = cut B (8.7 mic.)
35LK1231	827-01	AC 8/SC 31	Surface	PPT	Beatys Butte	3.2 ± 0.1	3.2 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	829-01	AC 8/SC 33	Surface	BLA	Cowhead Lake	9.5 ± 0.1	NM ± NM	--
35LK1231	835-01	AC 8/SC 39	Surface	BLA	Surveyor Spring	1.8 ± 0.1	8.1 ± 0.1	Smaller rim on dorsal surface
35LK1231	836-01	AC 8/SC 40	Surface	BLA	Surveyor Spring	8.3 ± 0.1	8.4 ± 0.1	Rim 1 = cut A; Rim 2 = cut B

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	837-01	AC 8/SC 41	Surface	PPT	Surveyor Spring	4.7 ± 0.1	5.4 ± 0.1	Small rim on d/surf cut A; Rim 3 = cut B (5.5)
35LK1231	841-01	AC 8/SC 45	Surface	BLA	Surveyor Spring	8.7 ± 0.1	8.8 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	846-01	AC 8/SC 50	Surface	PPT	Buck Mountain	4.9 ± 0.1	NM ± NM	DFV, IRR
35LK1231	847-01	AC 8/SC 51	Surface	BLA	Surveyor Spring	5.4 ± 0.1	NM ± NM	--
35LK1231	854-01	AC 8/SC 58	Surface	BLA	Surveyor Spring	5.6 ± 0.1	8.3 ± 0.1	Small rim on v/margin of cut A; cut B is HV
35LK1231	858-01	AC 8/SC 62	Surface	PPT	Cowhead Lake *	2.4 ± 0.1	NM ± NM	NVH on BRE
35LK1231	862-01	AC 8/SC 66	Surface	PPT	Cowhead Lake	5.3 ± 0.1	NM ± NM	--
35LK1231	863-01	AC 8/SC 67	Surface	PPT	Cowhead Lake	4.6 ± 0.1	NM ± NM	--
35LK1231	868-01	AC 8/SC 72	Surface	BLA	Surveyor Spring	3.6 ± 0.1	NM ± NM	--
35LK1231	876-01	AC 8/SC 80	Surface	BLA	Surveyor Spring	10.2 ± 0.1	11.5 ± 0.1	REC; smaller rim on BRE
35LK1231	880-01	AC 8/SC 84	Surface	BLA	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	885-01	AC 8/SC 89	Surface	BLA	Surveyor Spring	8.9 ± 0.1	NM ± NM	DFV, dorsal surface is BEV
35LK1231	887-01	AC 8/SC 91	Surface	BLA	Surveyor Spring	8.5 ± 0.1	8.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	894-01	EPG / SC 1	Surface	BLA	Unknown FGV F	NM ± NM	NM ± NM	Not cut
35LK1231	896-01	EPG / SC 3	Surface	BLA	Surveyor Spring	7.6 ± 0.1	NM ± NM	Dorsal is BEV, appears same
35LK1231	897-01	EPG/SC 4	Surface	PPT	Unknown Obsidian 1	4.2 ± 0.0	NM ± NM	OPA, DFV
35LK1231	898-01	EPG / SC 5	Surface	BLA	Surveyor Spring	8.7 ± 0.1	NM ± NM	DFV
35LK1231	899-01	EPG / SC 6	Surface	PPT	Massacre Lake/Guano Valley	5.5 ± 0.1	5.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	900-01	EPG / SC 7	Surface	PPT	Buck Mountain	4.5 ± 0.1	NM ± NM	--
35LK1231	901-01	EPG / SC 8	Surface	PPT	Cowhead Lake	4.2 ± 0.1	1.2 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	972-01-1	QTU 13	Surface	FLT	Cowhead Lake	3.2 ± 0.0	9.2 ± 0.1	Smaller rim on dorsal margin
35LK1231	1008-02-1	QTU 21	Surface	COR	Surveyor Spring	7.2 ± 0.1	NM ± NM	--
35LK1231	1050-01-2	AC 7/QTU 2	Level 1	HAM	Surveyor Spring	NA ± NA	NM ± NM	UNR (cortex on both surfaces)

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1063-01-S1	AC 8/QTU 1	Level 3	PRE	Cowhead Lake	5.6 ± 0.1	NM ± NM	--
35LK1231	1064-01	AC-8/QTU 1	Level 4	PPT	Massacre Lake/Guano Valley	9.0 ± 0.1	NM ± NM	REC; HV
35LK1231	1073-01-2	AC 8/QTU 3	Level 4	FLT	Surveyor Spring	7.8 ± 0.1	7.8 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	1074-02	AC 8/QTU 3	Level 5	BLA	Surveyor Spring	5.4 ± 0.1	NM ± NM	--
35LK1231	1138-02	QTU 10	Level 1	BLA	Surveyor Spring	6.2 ± 0.1	NM ± NM	--
35LK1231	1143-02-1	EPG/QTU 10	Level 6	COR	Surveyor Spring	8.7 ± 0.1	NM ± NM	REC
35LK1231	1202-01	SC 1002	Surface	PPT	Cowhead Lake	5.5 ± 0.1	NM ± NM	NVH on BRE
35LK1231	1203-01	SC 1003	Surface	PPT	Cowhead Lake	5.5 ± 0.1	NM ± NM	--
35LK1231	1204-01	SC 1004	Surface	BLA/FLT	Surveyor Spring	7.6 ± 0.1	NM ± NM	--
35LK1231	1207-01	SC 1007	Surface	PPT	Cowhead Lake	5.0 ± 0.1	NM ± NM	NVH on BRE
35LK1231	1208-01	SC 1008	Surface	CHO	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	1220-02-1	TU B01	Level 4	BLA	Surveyor Spring	8.0 ± 0.1	NM ± NM	NVH on ventral surface
35LK1231	1229-02-1	TU B02	Level 5	FLT	Surveyor Spring	8.8 ± 0.0	NM ± NM	--
35LK1231	1235-03-1	TU B03	Level 3	PPT	Massacre Lake/Guano Valley	1.5 ± 0.1	7.6 ± 0.1	Smaller rim on BRE
35LK1231	1237-04	TU B03	Level 5	BLA	Surveyor Spring	8.8 ± 0.1	NM ± NM	--
35LK1231	1242-02	TU B04	Level 2	COR	Surveyor Spring	7.7 ± 0.1	NM ± NM	--
35LK1231	1243-02	TU B04	Level 3	BLA	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	1247-02-1	TU B04	Level 7	FLT	Surveyor Spring	8.0 ± 0.1	NM ± NM	--
35LK1231	1247-02-2	TU B04	Level 7	COR	Surveyor Spring	5.1 ± 0.0	NM ± NM	--
35LK1231	1247-02-3	TU B04	Level 7	COR	Surveyor Spring	6.7 ± 0.1	NM ± NM	--
35LK1231	1247-02-4	TU B04	Level 7	COR	Surveyor Spring	6.6 ± 0.1	7.6 ± 0.1	REC; smaller rim on dorsal (?) surface
35LK1231	1248-02	TU B04	Level 8	BLA	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	1248-03-1	TU B04	Level 8	BLA	Surveyor Spring	7.8 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1248-03-2	TU B04	Level 8	COR	Surveyor Spring	6.3 ± 0.1	NM ± NM	--
35LK1231	1252-02	TU C01	Level 4	FLT	Surveyor Spring	7.7 ± 0.1	NM ± NM	--
35LK1231	1253-02	TU C01	Level 5	SCR	Surveyor Spring	8.0 ± 0.1	NM ± NM	--
35LK1231	1256-03-1	TU C01	Level 8	COR	Surveyor Spring	7.5 ± 0.1	NM ± NM	--
35LK1231	1263-03	TU C02	Level 4	COR	Surveyor Spring	6.9 ± 0.1	NM ± NM	HV
35LK1231	1263-06-1	TU C02	Level 4	COR	Surveyor Spring	8.0 ± 0.1	NM ± NM	--
35LK1231	1263-06	TU C02	Level 4	BLA	Surveyor Spring	7.9 ± 0.1	8.0 ± 0.1	NVH on dorsal margin of cut A
35LK1231	1271-03	TU C03	Level 5	BLA	Surveyor Spring	9.1 ± 0.1	NM ± NM	--
35LK1231	1281-03	TU C04	Level 3	COR	Surveyor Spring	8.0 ± 0.1	NM ± NM	--
35LK1231	1283-02-1	TU C04	Level 4	COR	Surveyor Spring	8.0 ± 0.1	NM ± NM	HV
35LK1231	1283-02-2	TU C04	Level 4	WFL	Surveyor Spring	7.9 ± 0.1	NM ± NM	--
35LK1231	1283-03-2	TU C04	Level 4	COR	Surveyor Spring	9.2 ± 0.1	NM ± NM	--
35LK1231	1283-03-4	TU C04	Level 4	FLT	Surveyor Spring	7.5 ± 0.0	NM ± NM	NVH on dorsal surface
35LK1231	1284-04	TU C04	Level 5	BLA	Surveyor Spring	7.6 ± 0.1	NM ± NM	--
35LK1231	1298-02-1	TU D01	Level 11	FLT	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	1309-04	TU D02	Level 9	FLT	Surveyor Spring	7.9 ± 0.1	7.9 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	1335-02	TU D04	Level 10	FLT	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK1231	1343-03	TU E01	Level 5	PRE	Surveyor Spring	6.9 ± 0.1	NM ± NM	--
35LK1231	1344-04	TU E01	Level 6	PPT	Surveyor Spring	5.2 ± 0.1	NM ± NM	--
35LK1231	1345-02-3	TU E01	Level 7	KNI	Badger Creek	4.6 ± 0.1	NM ± NM	--
35LK1231	1345-03	TU E01	Level 7	BLA	Surveyor Spring	5.3 ± 0.1	NM ± NM	--
35LK1231	1345-04	TU E01	Level 7	BLA	Surveyor Spring	5.4 ± 0.1	NM ± NM	--
35LK1231	1348-02-1	TU E01	Level 10	PPT	Massacre Lake/Guano Valley	5.4 ± 0.1	NM ± NM	REC

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1348-03	TU E01	Level 10	KNI	Cowhead Lake	4.6 ± 0.1	NM ± NM	--
35LK1231	1349-01	TU E1	Level 11	PPT	Surveyor Spring *	4.6 ± 0.1	NM ± NM	--
35LK1231	1353-02-2	TU E02	Level 4	COR	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK1231	1356-01	TU E02	Level 6	KNI	Cowhead Lake	5.3 ± 0.1	NM ± NM	--
35LK1231	1356-02	TU E02	Level 6	WFL	Surveyor Spring	6.2 ± 0.1	NM ± NM	REC; HV, IRR
35LK1231	1356-07	TU E02	Level 6	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	1356-09-1	TU E02	Level 6	BLA	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK1231	1356-10	TU E02	Level 6	BLA	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK1231	1356-11	TU E02	Level 6	BLA/FLT	Surveyor Spring	6.2 ± 0.1	NM ± NM	--
35LK1231	1365-02	TU E03	Level 2	BLA	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR, DFV (possibly burnt)
35LK1231	1365-05	TU E03	Level 2	COR/HA	Surveyor Spring	8.0 ± 0.0	NM ± NM	--
35LK1231	1367-01	TU E03	Level 4	BLA	Surveyor Spring	5.5 ± 0.1	8.9 ± 0.1	Smaller rim on dorsal surface
35LK1231	1370-04	TU E03	Level 7	BLA	Surveyor Spring	5.0 ± 0.1	NM ± NM	--
35LK1231	1372-02	TU E03	Level 9	BLA	Surveyor Spring	5.0 ± 0.1	NM ± NM	--
35LK1231	1372-04	TU E03	Level 9	FLT	Surveyor Spring	7.5 ± 0.1	NM ± NM	--
35LK1231	1375-03	TU E03	Level 11	BLA	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	1381-03-1	TU E04	Level 8	FLT	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	1381-03-2	TU E04	Level 8	COR	Surveyor Spring	5.2 ± 0.1	NM ± NM	--
35LK1231	1381-03-3	TU E04	Level 8	COR	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	1386-04	TU E4	Level 5	PPT	Surveyor Spring	6.5 ± 0.1	NM ± NM	--
35LK1231	1386-05	TU E04	Level 5	BLA	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	1386-06	TU E04	Level 5	COR	Surveyor Spring	5.1 ± 0.1	NM ± NM	--
35LK1231	1386-08	TU E04	Level 5	COR	Surveyor Spring	5.5 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1387-06	TU E04	Level 6	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	1388-03	TU E04	Level 7	PPT	Cowhead Lake *	4.3 ± 0.1	NM ± NM	--
35LK1231	1388-06	TU E4	Level 7	PPT	Sugar Hill	6.8 ± 0.1	NM ± NM	--
35LK1231	1389-02-1	TU E04	Level 8	FLT	Surveyor Spring	7.8 ± 0.1	9.0 ± 0.1	Smaller rim on ventral margin
35LK1231	1389-02-2	TU E04	Level 8	COR	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	1389-02-3	TU E04	Level 8	BLA	Surveyor Spring	4.8 ± 0.0	NM ± NM	--
35LK1231	1389-02-4	TU E04	Level 8	PPT	Cowhead Lake	4.0 ± 0.1	NM ± NM	--
35LK1231	1389-05	TU E04	Level 9	COR	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK1231	1391-02-2	TU B04	Level 9	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	1391-04	TU E4	Level 9	PPT	Beatys Butte	4.9 ± 0.1	NM ± NM	--
35LK1231	1391-05	TU E04	Level 9	COR	Surveyor Spring	10.3 ± 0.1	NM ± NM	DFV
35LK1231	1391-08	TU E04	Level 9	COR	Surveyor Spring	7.6 ± 0.1	NM ± NM	--
35LK1231	1393-02-1	TU E04	Level 11	COR	Surveyor Spring	9.3 ± 0.1	NM ± NM	--
35LK1231	1393-03	TU E04	Level 11	FLT	Surveyor Spring	7.5 ± 0.1	NM ± NM	--
35LK1231	1393-04	TU E04	Level 11	FLT	Surveyor Spring	9.6 ± 0.1	NM ± NM	--
35LK1231	1394-02-1	TU E04	Level 12	PPT	Cowhead Lake	5.0 ± 0.1	NM ± NM	--
35LK1231	1395-02	TU E04	Level 13	BLA	Surveyor Spring	5.1 ± 0.1	5.1 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	1395-05-1	TU E04	Level 13	FLT	Surveyor Spring	9.6 ± 0.1	NM ± NM	--
35LK1231	1397-03	TU I03	Level 4	COR	Surveyor Spring	7.3 ± 0.1	NM ± NM	Ventral surface is HV, UNR (8 - 8.6 microns)
35LK1231	1397-09	TU E4	Level 14	PPT	Mosquito Lake	4.5 ± 0.1	NM ± NM	--
35LK1231	1398-02-1	TU E04	Level 15	BLA	Surveyor Spring	5.4 ± 0.1	NM ± NM	IRR
35LK1231	1408-03	TU G01	Level 1	BLA	Surveyor Spring	8.6 ± 0.1	NM ± NM	--
35LK1231	1411-02	TU G01	Level 4	COR	Surveyor Spring	5.3 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1411-04	TU G01	Level 4	COR	Surveyor Spring	7.6 ± 0.1	NM ± NM	--
35LK1231	1412-02-1	TU G01	Level 5	COR	Surveyor Spring	9.8 ± 0.1	NM ± NM	NVH on modified edge
35LK1231	1413-03	TU G01	Level 6	COR	Surveyor Spring	3.6 ± 0.1	NM ± NM	--
35LK1231	1414-02-1	TU G01	Level 7	FLT	Surveyor Spring	3.0 ± 0.1	NM ± NM	Appears burnt
35LK1231	1415-04	TU G01	Level 8	COR	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	1416-02-1	TU G01	Level 9	COR	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK1231	1417-02	TU G01	Level 10	BLA	Surveyor Spring	8.2 ± 0.1	NM ± NM	--
35LK1231	1422-02-2	TU G02	Level 2	COR	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	1423-02	TU G2	Level 3	PPT	Buck Mountain	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK1231	1424-02-1	TU G02	Level 4	COR	Surveyor Spring	8.5 ± 0.1	NM ± NM	REC
35LK1231	1425-01	TU G02	Level 5	BLA	Surveyor Spring	8.4 ± 0.1	NM ± NM	--
35LK1231	1425-02-2	TU G02	Level 5	COR	Surveyor Spring	3.3 ± 0.1	NM ± NM	--
35LK1231	1426-03	TU G02	Level 6	DRL	Surveyor Spring	5.2 ± 0.1	NM ± NM	--
35LK1231	1429-03	TU G02	Level 9	COR	Surveyor Spring	8.5 ± 0.1	NM ± NM	--
35LK1231	1431-02	TU G02	Level 11	COR	Surveyor Spring	7.7 ± 0.1	NM ± NM	--
35LK1231	1431-03-1	TU G02	Level 11	BLA	Surveyor Spring	9.1 ± 0.0	NM ± NM	--
35LK1231	1431-04	TU G2	Level 11	PPT	Massacre Lake/Guano Valley	5.3 ± 0.1	NM ± NM	--
35LK1231	1432-02	TU G02	Level 12	COR	Surveyor Spring	6.2 ± 0.1	NM ± NM	--
35LK1231	1437-02	TU G03	Level 4	BLA	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	1438-03	TU G03	Level 5	COR	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK1231	1442-03	TU G03	Level 9	WFL	Surveyor Spring	8.9 ± 0.1	NM ± NM	--
35LK1231	1444-03	TU G03	Level 11	COR	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	1450-02-1	TU G04	Level 1	COR	Surveyor Spring	7.4 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1453-03	TU G04	Level 4	BLA	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR, DFV (possibly burnt)
35LK1231	1455-02	TU G04	Level 6	BLA	Surveyor Spring	9.3 ± 0.1	NM ± NM	--
35LK1231	1456-03	TU G04	Level 7	COR	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK1231	1461-02-1	TU G04	Level 11	COR	Surveyor Spring	7.9 ± 0.1	NM ± NM	DFV, HV (fissures/hackles)
35LK1231	1461-02-2	TU G04	Level 11	FLT	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	1462-03	TU G04	Level 12	COR	Surveyor Spring	8.3 ± 0.1	NM ± NM	--
35LK1231	1467-03	TU H02	Level 1	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	1479-03-1	TU I01	Level 2	FLT	Surveyor Spring	7.4 ± 0.1	NM ± NM	--
35LK1231	1481-03	TU I01	Level 4	BLA	Surveyor Spring	9.3 ± 0.1	NM ± NM	--
35LK1231	1483-02	TU I01	Level 6	COR	Surveyor Spring	8.6 ± 0.1	NM ± NM	Ventral surface is beveled
35LK1231	1483-03	TU I01	Level 6	COR	Surveyor Spring	7.4 ± 0.1	NM ± NM	REC; HV
35LK1231	1483-04	TU I01	Level 6	BLA	Surveyor Spring	9.1 ± 0.1	NM ± NM	REC; HV
35LK1231	1483-06-1	TU I01	Level 6	BLA	Surveyor Spring	9.4 ± 0.1	NM ± NM	--
35LK1231	1483-08	TU I01	Level 6	COR	Surveyor Spring	9.6 ± 0.1	NM ± NM	DFV
35LK1231	1483-09	TU I01	Level 6	COR	Surveyor Spring	6.7 ± 0.1	7.6 ± 0.1	Smaller rim on dorsal surface
35LK1231	1484-02	TU I01	Level 7	WFL	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK1231	1484-04-1	TU I01	Level 7	COR	Surveyor Spring	9.0 ± 0.1	NM ± NM	--
35LK1231	1484-06	TU I1	Level 7	PPT	Cowhead Lake	6.1 ± 0.1	NM ± NM	--
35LK1231	1487-02-1	TU I02	Level 2	COR	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	1487-03	TU I02	Level 2	COR	Surveyor Spring	9.9 ± 0.1	NM ± NM	--
35LK1231	1489-03	TU I02	Level 4	FLT	Surveyor Spring	9.4 ± 0.1	NM ± NM	--
35LK1231	1490-05	TU I02	Level 5	BLA	Surveyor Spring	8.7 ± 0.0	9.3 ± 0.1	HV, DFV; smaller rim on ventral surface
35LK1231	1490-13	TU I02	Level 5	BLA	Surveyor Spring	10.1 ± 0.1	NM ± NM	Dorsal surface is BEV

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1490-15	TU I02	Level 5	FLT	Unknown FGV C	NM ± NM	NM ± NM	Not cut
35LK1231	1491-08	TU I02	Level 6	BLA	Surveyor Spring	8.6 ± 0.0	8.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	1491-12	TU I02	Level 6	FLT	Cowhead Lake	6.6 ± 0.1	NM ± NM	REC
35LK1231	1491-14-01	TU I02	Level 6	COR	Surveyor Spring	8.3 ± 0.1	NM ± NM	DFV
35LK1231	1492-03	TU I02	Level 7	WFL	Surveyor Spring	8.5 ± 0.1	NM ± NM	--
35LK1231	1496-02	TU I03	Level 3	COR	Surveyor Spring	8.4 ± 0.1	NM ± NM	--
35LK1231	1497-07-01	TU I03	Level 4	FLT	Surveyor Spring	6.5 ± 0.1	7.6 ± 0.1	REC; smaller rim on ventral surface
35LK1231	1498-05	TU I03	Level 5	BLA	Surveyor Spring	9.4 ± 0.1	NM ± NM	--
35LK1231	1498-06	TU I3	Level 5	FLT	Cowhead Lake	6.2 ± 0.1	NM ± NM	--
35LK1231	1505-06	TU I04	Level 5	COR	Surveyor Spring	9.4 ± 0.1	NM ± NM	REC
35LK1231	1506-02	TU I04	Level 6	BLA	Tank Creek	4.5 ± 0.0	6.1 ± 0.1	NVH on BRE, smaller rim on ventral surface
35LK1231	1509-02-08	TU J01	Level 1	BLA	BS/PP/FM	8.4 ± 0.1	NM ± NM	DFV
35LK1231	1510-03	TU J01	Level 2	BLA	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	1510-04	TU J01	Level 2	BLA	Surveyor Spring	3.5 ± 0.1	NM ± NM	--
35LK1231	1511-02	TU J01	Level 3	PPT	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	1512-02-06	TU J01	Level 4	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	1514-02	TU J01	Level 6	BLA	Surveyor Spring	6.7 ± 0.1	12.5 ± 0.1	Larger rim on ventral surface
35LK1231	1514-03-3	TU J01	Level 6	BLA	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	1515-03	TU J01	Level 7	BLA	Surveyor Spring	4.4 ± 0.1	7.0 ± 0.1	Smaller rim on dorsal margin
35LK1231	1517-02	TU J2	Level 1	PPT	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	1518-02	TU J2	Level 2	PPT	Cowhead Lake	2.7 ± 0.1	NM ± NM	--
35LK1231	1518-05	TU J02	Level 2	BLA	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	1519-02	TU J02	Level 3	BLA	Surveyor Spring	8.1 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1519-04	TU J02	Level 3	BLA/KNI	Unknown Obsidian 1	4.7 ± 0.1	NM ± NM	OPA, DFV
35LK1231	1519-05-08	TU J02	Level 3	COR	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	1519-05-13	TU J02	Level 3	BLA/COR	Surveyor Spring	7.0 ± 0.1	8.3 ± 0.1	REC; larger rim on ventral margin
35LK1231	1522-01-01	TU J02	Level 6	FLT	Surveyor Spring	6.5 ± 0.1	NM ± NM	REC
35LK1231	1524-04	TU J03	Level 1	COR	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK1231	1525-02	TU J03	Level 2	BLA/BUR	Surveyor Spring	7.7 ± 0.1	NM ± NM	--
35LK1231	1525-04-03	TU J03	Level 2	COR	Surveyor Spring	8.6 ± 0.1	NM ± NM	--
35LK1231	1525-07	TU J03	Level 2	BLA	Surveyor Spring	4.7 ± 0.1	8.2 ± 0.1	Smaller rim on ventral scar
35LK1231	1526-02-06	TU J03	Level 3	COR	Surveyor Spring	7.5 ± 0.1	NM ± NM	DFV, HV
35LK1231	1526-02-1	TU J03	Level 3	BLA	Surveyor Spring	4.6 ± 0.1	NM ± NM	--
35LK1231	1526-04	TU J03	Level 3	BLA	Surveyor Spring	6.7 ± 0.1	NM ± NM	--
35LK1231	1526-05	TU J3	Level 3	PPT	Surveyor Spring	3.9 ± 0.1	NM ± NM	--
35LK1231	1526-06	TU J03	Level 3	PRE	Surveyor Spring	2.9 ± 0.1	NM ± NM	--
35LK1231	1529-02-2	TU J04	Level 2	BLA	Surveyor Spring	7.8 ± 0.1	NM ± NM	DFV
35LK1231	1529-03-01	TU J04	Level 2	COR	Surveyor Spring	4.3 ± 0.1	NM ± NM	--
35LK1231	1529-04	TU J4	Level 2	PPT	Unknown Obsidian 1	3.9 ± 0.1	NM ± NM	--
35LK1231	1529-3-7	TU J03	Level 2	BLA	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	1530-03-1	TU J04	Level 3	BLA	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	1531-03-01	TU J04	Level 4	COR	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	1531-03-02	TU J04	Level 4	COR	Surveyor Spring	8.9 ± 0.1	NM ± NM	--
35LK1231	1561-02	TU K01	Level 2	UNI	Surveyor Spring	8.0 ± 0.0	NM ± NM	--
35LK1231	1564-04	TU K01	Level 5	BLA	Surveyor Spring	7.3 ± 0.1	NM ± NM	--
35LK1231	1571-03	TU K02	Level 3	FLT/PPT	Cowhead Lake	3.8 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1574-02	TU K02	Level 6	BLA	Surveyor Spring	8.9 ± 0.1	NM ± NM	--
35LK1231	1582-03	TU K3	Level 5	PPT	Surveyor Spring	7.8 ± 0.1	NM ± NM	HV
35LK1231	1599-02	TU K05	Level 3	COR	Surveyor Spring	4.8 ± 0.1	NM ± NM	--
35LK1231	1612-03	TU K06	Level 2	BLA	Surveyor Spring	9.7 ± 0.1	NM ± NM	--
35LK1231	1621-03	TU K07	Level 3	BLA	Surveyor Spring	8.6 ± 0.1	NM ± NM	--
35LK1231	1638-02-01	TU K09	Level 2	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	1656-04-1	TU L01	Level 3	BLA	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK1231	1662-02	TU L02	Level 3	PRE	Surveyor Spring	5.3 ± 0.1	NM ± NM	--
35LK1231	1675-03	TU M01	Level 5	BLA	Surveyor Spring	8.4 ± 0.1	NM ± NM	--
35LK1231	1676-03	TU M01	Level 6	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	1676-04	TU M01	Level 6	COR	Surveyor Spring	8.4 ± 0.1	NM ± NM	--
35LK1231	1683-03	TU M02	Level 5	BLA	Surveyor Spring	3.6 ± 0.0	9.1 ± 0.1	Smaller rim on ventral surface
35LK1231	1690-02-1	TU M03	Level 3	SCR	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	1690-03	TU M03	Level 3	PPT	Hawks Valley *	4.3 ± 0.1	NM ± NM	--
35LK1231	1690-04	TU M03	Level 3	BLA	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	1692-03	TU M03	Level 5	BLA	Surveyor Spring	4.6 ± 0.1	NM ± NM	--
35LK1231	1692-04	TU M03	Level 5	BLA	Surveyor Spring	5.1 ± 0.1	NM ± NM	REC
35LK1231	1693-03	TU M03	Level 6	BLA/KNI	Surveyor Spring	8.0 ± 0.1	NM ± NM	HV, IRR
35LK1231	1694-03-01	TU M03	Level 7	FLT	Surveyor Spring	8.3 ± 0.1	NM ± NM	--
35LK1231	1694-04	TU M03	Level 7	FLT	Surveyor Spring	8.2 ± 0.1	NM ± NM	--
35LK1231	1697-02-04	TU M04	Level 1	COR	Surveyor Spring	3.7 ± 0.1	NM ± NM	--
35LK1231	1701-03	TU M04	Level 5	BLA	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK1231	1702-03	TU M04	Level 6	BLA	Surveyor Spring	8.2 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1734-03	TU O01	Level 3	PPT	Cowhead Lake	5.5 ± 0.1	NM ± NM	DFV
35LK1231	1745-05	TU P01	Level 2	PPT	Tucker Hill	2.6 ± 0.0	NM ± NM	REC; possibly burnt
35LK1231	1745-08-01	TU P01	Level 2	COR	Surveyor Spring	7.4 ± 0.1	NM ± NM	--
35LK1231	1750-02-3	TU P02	Level 1	PRE	Cowhead Lake *	3.4 ± 0.1	NM ± NM	IRR, DFV
35LK1231	1751-03-3	TU P02	Level 2	BLA	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK1231	1766-03-01	TU P03-F1	Level 3	COR	Unknown Obsidian 1	3.9 ± 0.1	5.7 ± 0.1	REC; larger rim on dorsal surface
35LK1231	1767-01-01	TU P02/P03-F1	Level 3-4	COR	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	1768-01	TU Q01	Surface	BLA	Surveyor Spring	5.3 ± 0.1	NM ± NM	--
35LK1231	1768-02	TU Q01	Surface	FLT	Mosquito Lake	4.2 ± 0.1	NM ± NM	--
35LK1231	1769-05	TU Q01	Level 1	BLA	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	1769-07	TU Q1	Level 1	PPT	Buck Mountain	7.0 ± 0.1	NM ± NM	--
35LK1231	1770-02	TU Q01	Level 2	BLA	Surveyor Spring	5.2 ± 0.1	NM ± NM	REC
35LK1231	1770-03	TU Q1	Level 2	PPT	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	1770-04	TU Q01	Level 2	BLA	Surveyor Spring	8.5 ± 0.1	NM ± NM	--
35LK1231	1770-07	TU Q1	Level 2	PPT	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK1231	1770-11-26	TU Q01	Level 2	COR	Surveyor Spring	4.3 ± 0.1	NM ± NM	--
35LK1231	1771-02	TU Q1	Level 3	PPT	Cowhead Lake	5.2 ± 0.1	NM ± NM	--
35LK1231	1771-03	TU Q01	Level 3	BLA	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	1771-05-8	TU Q01	Level 3	COR	Surveyor Spring	9.0 ± 0.1	10.2 ± 0.0	REC; smaller rim on dorsal surface
35LK1231	1771-05-10	TU Q01	Level 3	COR	Surveyor Spring	8.9 ± 0.1	NM ± NM	--
35LK1231	1771-05-12	TU Q01	Level 3	COR	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	1772-01	TU Q01	Level 4	BLA	Surveyor Spring	6.3 ± 0.1	NM ± NM	--
35LK1231	1773-02-1	TU Q01	Level 5	PPT	Cowhead Lake *	5.2 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1774-02-01	TU Q01	Level 6	COR	Surveyor Spring	4.6 ± 0.1	NM ± NM	--
35LK1231	1780-02	TU Q01	Level 1	BLA	Surveyor Spring	10.5 ± 0.1	NM ± NM	DFV
35LK1231	1780-07	TU Q2	Level 1	DRL	Cowhead Lake *	5.1 ± 0.1	NM ± NM	--
35LK1231	1780-08	TU Q2	Level 1	PPT	Blue Spring	6.5 ± 0.1	NM ± NM	REC
35LK1231	1781-05-09	TU Q02	Level 2	COR/HA	Surveyor Spring	6.3 ± 0.1	NM ± NM	--
35LK1231	1781-05-12	TU Q02	Level 2	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	1781-05-13	TU Q02	Level 2	PPT	Surveyor Spring *	7.2 ± 0.1	NM ± NM	--
35LK1231	1782-02	TU Q02	Level 3	BLA	Surveyor Spring	5.4 ± 0.1	NM ± NM	--
35LK1231	1782-03	TU Q02	Level 3	COR	Surveyor Spring	7.5 ± 0.1	NM ± NM	--
35LK1231	1782-04	TU Q02	Level 3	COR	Surveyor Spring	7.9 ± 0.1	NM ± NM	--
35LK1231	1782-06	TU Q02	Level 3	PRE	Surveyor Spring	6.7 ± 0.1	NM ± NM	--
35LK1231	1783-05	TU Q02	Level 4	BLA	Surveyor Spring	5.1 ± 0.1	NM ± NM	--
35LK1231	1785-01	TU Q02	Level 5	FLT	Surveyor Spring	9.5 ± 0.1	NM ± NM	REC; HV, DFV
35LK1231	1787-03	TU Q02	Level 2	FLT	Surveyor Spring	6.7 ± 0.1	8.5 ± 0.0	Smaller rim on dorsal surface
35LK1231	1801-01	SC 1012	Surface	PPT	Unknown Obsidian 2	2.8 ± 0.1	5.5 ± 0.1	REC; smaller rim on BRE
35LK1231	1802-01	SC 1013	Surface	PPT	Cowhead Lake	4.9 ± 0.1	NM ± NM	REC
35LK1231	1803-01	SC 1014	Surface	PRE	Surveyor Spring	6.2 ± 0.1	NM ± NM	--
35LK1231	1804-01	SC 1015	Surface	PPT	Mosquito Lake	7.0 ± 0.0	NM ± NM	REC; rim is from BRE, d/v are WEA, UNR
35LK1231	1805-01	SC 1016	Surface	PPT	Surveyor Spring	2.6 ± 0.1	NM ± NM	--
35LK1231	1806-01	SC 1017	Surface	PPT	Unknown Obsidian 1	5.0 ± 0.0	NM ± NM	NVH on BRE, OPA
35LK1231	1807-01	SC 1018	Surface	PPT	Massacre Lake/Guano Valley	5.5 ± 0.1	NM ± NM	REC
35LK1231	1808-01	SC 1019	Surface	PPT	Massacre Lake/Guano Valley	5.5 ± 0.1	NM ± NM	--
35LK1231	1809-01	SC 1020	Surface	PPT	Cowhead Lake *	2.4 ± 0.1	3.8 ± 0.1	Small rim on dorsal margin; Rim 3 = 5.8 mic.

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Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1812-02	TU R01	Level 2	FLT	Surveyor Spring	7.2 ± 0.1	NM ± NM	--
35LK1231	1812-04	TU R01	Level 2	PRE	Surveyor Spring	5.4 ± 0.1	NM ± NM	--
35LK1231	1814-03	TU R01	Level 4	COR	Surveyor Spring	8.2 ± 0.1	9.7 ± 0.1	Smaller rim on ventral surface
35LK1231	1814-05	TU R01	Level 4	PRE	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	1817-02-01	TU R01	Level 7	WFL	Surveyor Spring	9.7 ± 0.1	NM ± NM	REC
35LK1231	1818-03	TU R01	Level 8	BLA	Surveyor Spring	9.6 ± 0.1	NM ± NM	--
35LK1231	1822-03	TU R2	Level 1	PPT	East Medicine Lake *	6.3 ± 0.1	7.9 ± 0.1	Larger rim on ventral scar
35LK1231	1822-04	TU R02	Level 1	BLA	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK1231	1825-03	TU R02	Level 4	COR	Surveyor Spring	6.5 ± 0.1	NM ± NM	--
35LK1231	1825-04	TU R02	Level 4	COR	Surveyor Spring	7.2 ± 0.1	NM ± NM	--
35LK1231	1825-05-2	TU R02	Level 4	COR	Surveyor Spring	9.3 ± 0.1	NM ± NM	REC
35LK1231	1827-01	TU R2	Level 6	FLT	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK1231	1827-06-6	TU R02	Level 6	PPT	Surveyor Spring *	6.7 ± 0.1	NM ± NM	--
35LK1231	1848-01	AC 5/SC 2	Surface	PPT	Unknown Obsidian 1	NA ± NA	NM ± NM	UNR, OPA
35LK1231	1850-01	AC 5/SC 4	Surface	PPT	Cowhead Lake	2.1 ± 0.1	NM ± NM	--
35LK1231	1853-01	AC 5/SC 7	Surface	BLA	Surveyor Spring	6.2 ± 0.1	NM ± NM	--
35LK1231	1857-01	AC 5/SC 11	Surface	COR	Surveyor Spring	5.2 ± 0.1	NM ± NM	--
35LK1231	1859-01	AC 5/SC 13	Surface	BLA	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK1231	1862-01	AC 5/SC 16	Surface	FLT	Surveyor Spring	6.8 ± 0.1	NM ± NM	PAT, DFV
35LK1231	1867-01	AC 5/SC 21	Surface	PPT	Cowhead Lake	5.3 ± 0.1	NM ± NM	--
35LK1231	1871-01	AC-5/SC 25	Surface	PPT	Massacre Lake/Guano Valley	4.3 ± 0.1	NM ± NM	--
35LK1231	1876-01	AC 5/SC 30	Surface	BLA	Surveyor Spring	3.8 ± 0.0	6.7 ± 0.1	Smaller rim on BRE, dorsal scars
35LK1231	1879-01	AC 5/SC 33	Surface	BLA	Surveyor Spring	7.4 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1880-01	AC 5/SC 34	Surface	COR/ADZ	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	1881-01	AC 5/SC 35	Surface	BLA	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK1231	1882-01	AC 5/SC 36	Surface	BLA	Surveyor Spring	6.9 ± 0.1	NM ± NM	--
35LK1231	1883-01	AC 5/SC 37	Surface	BLA	Cowhead Lake	1.5 ± 0.0	7.7 ± 0.1	Smaller rim on dorsal margin
35LK1231	1887-01	AC 5/SC 41	Surface	BLA	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	1892-01	AC 5/SC 46	Surface	BLA	Surveyor Spring	6.9 ± 0.1	NM ± NM	--
35LK1231	1895-01	AC 5/SC 49	Surface	PPT	Unknown Obsidian 1	NA ± NA	NM ± NM	UNR, OPA
35LK1231	1896-01	AC-5/SC 50	Surface	PPT	Mosquito Lake	5.5 ± 0.1	NM ± NM	--
35LK1231	1899-01	AC 5/SC 53	Surface	BLA	Surveyor Spring	2.1 ± 0.1	NM ± NM	--
35LK1231	1902-01	AC-5/SC 55	Surface	PPT	Sugar Hill *	3.4 ± 0.1	NM ± NM	--
35LK1231	1903-01	AC 5/SC 56	Surface	COR/ADZ	Surveyor Spring	6.5 ± 0.1	NM ± NM	NVH on ventral margin
35LK1231	1908-01	AC 5/SC 61	Surface	BLA	Surveyor Spring	2.1 ± 0.1	7.1 ± 0.1	Small rim on dorsal margin; Rim 3 = 13.4 mic.
35LK1231	1910-01	AC 5/SC 63	Surface	PPT	Unknown Obsidian 1	1.5 ± 0.1	4.9 ± 0.1	Smaller rim on BRE
35LK1231	1915-01	AC-5/SC 68	Surface	PPT	Unknown Obsidian 1	5.7 ± 0.1	NM ± NM	--
35LK1231	1917-01	AC 5/SC 70	Surface	PPT	Cowhead Lake	2.3 ± 0.1	NM ± NM	--
35LK1231	1921-01	AC-5/SC 74	Surface	PPT	Unknown FGV B *	NM ± NM	NM ± NM	Not cut
35LK1231	1922-01	AC-5/SC 75	Surface	PPT	Buck Mountain	3.2 ± 0.1	NM ± NM	--
35LK1231	1923-01	AC 5/SC 76	Surface	BLA	Surveyor Spring	5.9 ± 0.1	NM ± NM	REC
35LK1231	1924-01	AC 5/SC 77	Surface	COR	Surveyor Spring	1.7 ± 0.0	7.3 ± 0.1	Smaller rim on dorsal margin
35LK1231	1925-01	AC 5/SC 78	Surface	PPT	Beatys Butte	NA ± NA	NM ± NM	NVH, OPA
35LK1231	1926-01	AC-5/SC 79	Surface	SCR	Cowhead Lake	7.6 ± 0.1	NM ± NM	--
35LK1231	1927-01	AC 5/SC 80	Surface	BLA	Surveyor Spring	10.1 ± 0.1	NM ± NM	REC
35LK1231	1928-01	AC 5/SC 81	Surface	COR	Surveyor Spring	3.0 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	1936-01	AC-5/SC 89	Surface	PPT	Unknown Obsidian 1 *	1.4 ± 0.1	2.8 ± 0.1	Smaller rim on BRE
35LK1231	1938-01	AC 5/SC 91	Surface	PPT	Massacre Lake/Guano Valley	5.9 ± 0.1	6.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	1942-01	AC 5/SC 95	Surface	COR	Surveyor Spring	8.5 ± 0.1	NM ± NM	DFV
35LK1231	1943-01	AC 5/SC 96	Surface	COR	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK1231	1944-01	AC 5/SC 97	Surface	BLA	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	1946-01	AC 5/SC 99	Surface	COR	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK1231	1947-01	AC 5/SC 100	Surface	COR	Surveyor Spring	2.1 ± 0.1	5.2 ± 0.1	Smaller rim on dorsal margin
35LK1231	1950-01	AC-5/SC 103	Surface	PPT	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	1951-01	AC 5/SC 104	Surface	BLA	Surveyor Spring	9.9 ± 0.1	NM ± NM	HV, DFV
35LK1231	1953-01	AC 5/SC 106	Surface	BLA	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK1231	1955-01	AC 5/SC 108	Surface	BLA	Surveyor Spring	4.7 ± 0.1	NM ± NM	--
35LK1231	1956-01	AC-5/SC 109	Surface	PPT	Cowhead Lake	6.4 ± 0.1	6.5 ± 0.1	REC on base (cut 2); base is DFV
35LK1231	1965-01	AC 5/SC 118	Surface	BLA	Surveyor Spring	3.9 ± 0.1	NM ± NM	--
35LK1231	1967-01	AC 5/SC 120	Surface	BLA	Surveyor Spring	5.7 ± 0.1	NM ± NM	--
35LK1231	1969-01	AC 5/SC 122	Surface	COR	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK1231	1974-01	AC 5/SC 127	Surface	PPT	Surveyor Spring	8.6 ± 0.1	8.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	1975-01	AC 5/SC 128	Surface	PPT	Cowhead Lake	1.4 ± 0.1	8.2 ± 0.1	DFV, smaller rim on dorsal margin
35LK1231	1984-01	AC-5/SC 137	Surface	PPT	Cowhead Lake	2.2 ± 0.1	NM ± NM	--
35LK1231	1987-01	AC-5/SC 140	Surface	PPT	Unknown Obsidian 1	5.1 ± 0.1	5.0 ± 0.1	Cut 1 on tip; cut 2 on base
35LK1231	1991-01	AC 5/SC 144	Surface	PPT	Cowhead Lake	4.8 ± 0.1	1.4 ± 0.1	Rim 1 = cut A; Rims 2 & 3 = cut B
35LK1231	1993-01	AC 5/SC 146	Surface	BLA	Surveyor Spring	9.3 ± 0.1	10.4 ± 0.1	Rim 1 = cut A; Rims 2 & 3 (4.8 mic.) = cut B
35LK1231	1995-01	AC-5/SC 148	Surface	PPT	Cowhead Lake	5.1 ± 0.1	NM ± NM	--
35LK1231	2002-01	AC-5/SC 155	Surface	PPT	Cowhead Lake	4.0 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	2015-01	AC 5/SC 168	Surface	BLA	Surveyor Spring	9.1 ± 0.1	NM ± NM	--
35LK1231	2033-01	AC 5/SC 186	Surface	BLA	Surveyor Spring	4.8 ± 0.1	4.8 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	2036-01	AC 5/SC 189	Surface	BLA	Surveyor Spring	1.7 ± 0.0	5.7 ± 0.1	Rims 1 & 2 = cut A; Rim 3 = cut B (5.7 mic.)
35LK1231	2037-01	AC 5/SC 190	Surface	BLA	Surveyor Spring	10.6 ± 0.1	2.0 ± 0.1	Rim 1 = cut A; Rims 2 & 3 (10.5 mic.) = cut B
35LK1231	2042-01	AC 5/SC 195	Surface	BLA	Surveyor Spring	7.8 ± 0.1	NM ± NM	DFV, HV
35LK1231	2043-01	AC-5/SC 196	Surface	PPT	Cowhead Lake	2.9 ± 0.0	8.3 ± 0.1	Smaller rim on dorsal (?) surface
35LK1231	2044-01	AC-5/SC 197	Surface	PPT	Cowhead Lake	7.6 ± 0.1	NM ± NM	--
35LK1231	2045-01	AC 5/SC 198	Surface	PPT	Unknown Obsidian 1	5.0 ± 0.1	NM ± NM	OPA, DFV
35LK1231	2055-01	AC 5/SC 208	Surface	PRE	Surveyor Spring	10.1 ± 0.1	NM ± NM	REC; DFV
35LK1231	2057-01	AC 5/SC 210	Surface	BLA	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	2061-01	AC 5/SC 214	Surface	BLA	Surveyor Spring	8.9 ± 0.1	NM ± NM	--
35LK1231	2062-01	AC 5/SC 215	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2066-01	AC 5/SC 219	Surface	BLA	Surveyor Spring	5.7 ± 0.1	NM ± NM	--
35LK1231	2068-01	AC 5/SC 221	Surface	PPT	Buck Mountain	4.4 ± 0.1	NM ± NM	DFV, BEV
35LK1231	2071-01	AC 5/SC 224	Surface	FLT	Surveyor Spring	10.6 ± 0.1	NM ± NM	--
35LK1231	2093-01	AC 6/SC 1	Surface	BLA	Surveyor Spring	9.0 ± 0.1	NM ± NM	REC
35LK1231	2097-01	AC 6/SC 5	Surface	PPT	Massacre Lake/Guano Valley	NA ± NA	NM ± NM	REC; UNR, DFV (possibly burnt)
35LK1231	2098-01	AC 6/SC 6	Surface	BLA	Surveyor Spring	2.0 ± 0.1	NM ± NM	REC; possibly burnt
35LK1231	2102-01	AC 6/SC 10	Surface	BLA	Surveyor Spring	7.4 ± 0.1	NM ± NM	--
35LK1231	2104-01	AC 6/SC 12	Surface	BLA	Surveyor Spring	8.7 ± 0.1	NM ± NM	REC
35LK1231	2107-01	AC-6/SC 15	Surface	PPT	Tucker Hill	4.7 ± 0.1	NM ± NM	--
35LK1231	2111-01	AC 6/SC 19	Surface	PPT	Tucker Hill	4.6 ± 0.1	NM ± NM	--
35LK1231	2113-01	AC-6/SC 21	Surface	PPT	Cowhead Lake	6.2 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	2118-01	AC 6/SC 26	Surface	BLA	Surveyor Spring	7.3 ± 0.1	NM ± NM	--
35LK1231	2122-01	AC 6/SC 30	Surface	BLA	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	2130-01	AC 6/SC 38	Surface	BLA	Surveyor Spring	7.6 ± 0.1	NM ± NM	--
35LK1231	2134-01	AC-6/SC 42	Surface	PPT	Unknown FGV B *	NM ± NM	NM ± NM	Not cut
35LK1231	2138-01	AC-6/SC 46	Surface	PPT	Surveyor Spring	7.9 ± 0.1	NM ± NM	--
35LK1231	2162-01	AC-9/SC 2	Surface	PPT	Unknown Obsidian 1	NA ± NA	NM ± NM	NVH, WEA, OPA
35LK1231	2167-01	AC 9/SC 7	Surface	DRL	Surveyor Spring	9.6 ± 0.1	NM ± NM	--
35LK1231	2173-01	AC 9/SC 13	Surface	COR	Surveyor Spring	7.3 ± 0.1	NM ± NM	DFV
35LK1231	2176-01	AC 9/SC 16	Surface	PPT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2177-01	AC 9/SC 17	Surface	PPT	Blue Spring	3.4 ± 0.1	NM ± NM	BRE is BEV, UNR
35LK1231	2180-01	AC 9/SC 20	Surface	PPT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2181-01	AC 9/SC 21	Surface	PPT	Cowhead Lake	4.5 ± 0.1	NM ± NM	--
35LK1231	2182-01	AC 9/SC 22	Surface	BLA	Surveyor Spring	7.8 ± 0.1	NM ± NM	IRR, DFV
35LK1231	2192-01	AC-9/SC 32	Surface	PPT	Cowhead Lake	7.0 ± 0.1	NM ± NM	--
35LK1231	2195-01	AC 9/SC 35	Surface	PPT	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	2199-01	AC 9/SC 39	Surface	PPT	Unknown Obsidian 1	NA ± NA	NM ± NM	UNR, OPA
35LK1231	2206-01	AC 9/SC 46	Surface	COR	Surveyor Spring	8.9 ± 0.1	NM ± NM	--
35LK1231	2207-01	AC-9/SC 47	Surface	PPT	Surveyor Spring *	6.9 ± 0.1	NM ± NM	--
35LK1231	2217-01	AC 9/SC 57	Surface	BLA	Surveyor Spring	6.1 ± 0.1	NM ± NM	DFV
35LK1231	2218-01	AC 9/SC 58	Surface	BLA	Surveyor Spring	7.5 ± 0.1	NM ± NM	--
35LK1231	2221-01	AC 9/SC 61	Surface	BLA	Surveyor Spring	10.7 ± 0.1	NM ± NM	REC; ventral surface only, dorsal is HV, UNR
35LK1231	2224-01	AC-9/SC 64	Surface	PPT	Buck Mountain	1.1 ± 0.1	5.8 ± 0.1	REC; smaller rim on lateral margin
35LK1231	2225-01	AC 9/SC 65	Surface	PPT	Surveyor Spring	4.3 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	2236-01	AC 9/SC 76	Surface	BLA	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	2243-01	AC 9/SC 83	Surface	PPT	Cowhead Lake	4.0 ± 0.1	NM ± NM	REC; NVH on dorsal margin
35LK1231	2249-01	AC 9/SC 89	Surface	BLA	Surveyor Spring	1.1 ± 0.0	6.7 ± 0.1	Smaller rim on dorsal margin
35LK1231	2253-01	AC 9/SC 93	Surface	COR	Surveyor Spring	6.4 ± 0.1	NM ± NM	BEV, DFV
35LK1231	2256-01	AC 9/SC 96	Surface	BLA	Unknown FGV C	NM ± NM	NM ± NM	Not cut
35LK1231	2262-01	AC 9/SC 102	Surface	PPT	Unknown Obsidian 1 *	2.3 ± 0.1	5.1 ± 0.1	Smaller rim on dorsal surface
35LK1231	2265-01	AC 9/SC 105	Surface	BLA	Surveyor Spring	1.6 ± 0.1	8.4 ± 0.1	Smaller rim on dorsal margin
35LK1231	2274-01	AC 9/SC 114	Surface	COR	Surveyor Spring	5.0 ± 0.1	NM ± NM	NVH on dorsal surface
35LK1231	2276-01	AC-9/SC 116	Surface	PPT	Surveyor Spring	9.2 ± 0.1	NM ± NM	--
35LK1231	2281-01	AC-9/SC 121	Surface	PPT	Coyote Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2289-01	AC 9/SC 129	Surface	BLA	Buck Mountain	6.9 ± 0.1	NM ± NM	--
35LK1231	2290-01	AC-9/SC 130	Surface	PPT	Surveyor Spring *	2.1 ± 0.1	NM ± NM	HV
35LK1231	2294-01	AC 9/SC 134	Surface	BLA	Surveyor Spring	6.7 ± 0.1	NM ± NM	--
35LK1231	2308-01	AC 9/SC 148	Surface	BLA	Surveyor Spring	8.5 ± 0.0	NM ± NM	--
35LK1231	2311-01	AC-9/SC 151	Surface	PPT	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	2314-01	AC 9/SC 154	Surface	BLA	Surveyor Spring	5.1 ± 0.1	9.6 ± 0.1	Larger rim on ventral surface
35LK1231	2315-01	AC 9/SC 155	Surface	FLT	Surveyor Spring	3.0 ± 0.0	NM ± NM	DFV (possibly burnt)
35LK1231	2318-01	AC 9/SC 158	Surface	BLA	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	2322-01	AC-9/SC 162	Surface	PPT	Cowhead Lake	6.5 ± 0.1	NM ± NM	--
35LK1231	2323-01	AC 9/SC 163	Surface	PPT	Surveyor Spring	11.3 ± 0.1	NM ± NM	--
35LK1231	2324-01	AC 9/SC 164	Surface	BLA	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2326-01	AC 9/SC 166	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2332-01	AC 9/SC 172	Surface	BLA	Surveyor Spring	10.0 ± 0.1	10.6 ± 0.1	REC; larger rim on ventral surface

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						Rim 1	Rim 2	
35LK1231	2337-01	AC 9/SC 177	Surface	PPT	Buck Mountain	NA ± NA	NM ± NM	REC; UNR, DFV
35LK1231	2340-01	AC 9/SC 180	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2345-01	AC 9/SC 185	Surface	PPT	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	2348-01	AC 9/SC 188	Surface	PPT	Unknown Obsidian 1	6.0 ± 0.1	NM ± NM	--
35LK1231	2352-01	AC-9/SC 192	Surface	PPT	Cowhead Lake	NA ± NA	NM ± NM	REC; UNR
35LK1231	2356-01	AC 9/SC 196	Surface	BLA	Surveyor Spring	7.9 ± 0.1	NM ± NM	--
35LK1231	2359-01	AC-9/SC 199	Surface	PPT	Cowhead Lake	6.6 ± 0.1	NM ± NM	--
35LK1231	2364-01	AC 9/SC 204	Surface	BLA	Surveyor Spring	1.9 ± 0.1	9.9 ± 0.1	REC; Rims 1 & 2 = cut A, cut B is UNR
35LK1231	2365-01	AC 9/ SC 205	Surface	BLA	Surveyor Spring	10.0 ± 0.1	NM ± NM	NVH on dorsal margin
35LK1231	2366-01	AC-9/SC 206	Surface	PPT	Unknown Obsidian 1	4.6 ± 0.1	NM ± NM	OPA
35LK1231	2368-01	AC-9/SC 208	Surface	DRL	Mosquito Lake	6.2 ± 0.1	NM ± NM	DFV
35LK1231	2373-01	AC 9/SC 213	Surface	PPT	Mosquito Lake	5.4 ± 0.0	7.0 ± 0.1	Smaller rim on BRE
35LK1231	2375-01	AC 9/SC 215	Surface	BLA	Surveyor Spring	9.5 ± 0.1	NM ± NM	BRE is BEV, NVH?
35LK1231	2379-01	AC 9/SC 219	Surface	BLA	Coyote Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2381-01	AC 9/SC 221	Surface	BLA	Surveyor Spring	3.3 ± 0.1	NM ± NM	DFV
35LK1231	2389-01	AC 9/SC 229	Surface	BLA	Surveyor Spring	2.1 ± 0.1	10.2 ± 0.1	Smaller rim on dorsal surface
35LK1231	2393-01	AC 9/SC 233	Surface	BLA	Surveyor Spring	10.1 ± 0.1	NM ± NM	BEV, DFV
35LK1231	2394-01	AC-9/SC 234	Surface	PPT	Mosquito Lake	6.8 ± 0.1	NM ± NM	DFV
35LK1231	2396-01	AC-9/SC 236	Surface	PPT	Cowhead Lake	6.3 ± 0.1	NM ± NM	--
35LK1231	2397-01	AC 9/SC 237	Surface	COR	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2400-01	AC-9/SC 240	Surface	PPT	Buck Mountain	2.2 ± 0.1	NM ± NM	REC; DFV
35LK1231	2402-01	AC-9/SC 242	Surface	PPT	Unknown Obsidian 2 *	4.7 ± 0.1	7.7 ± 0.1	Smaller rim on dorsal & ventral margins
35LK1231	2415-01	AC 9/SC 255	Surface	BLA	Surveyor Spring	8.9 ± 0.1	NM ± NM	--

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						Rim 1	Rim 2	
35LK1231	2425-01	AC 9/SC 265	Surface	BLA	Cowhead Lake	5.1 ± 0.1	9.6 ± 0.1	Rim 1=v; Rim 2=d; Rim 3=3.4; Rim 4=5.1
35LK1231	2430-01	AC 9/SC 270	Surface	PPT	Unknown Obsidian 1	NA ± NA	NM ± NM	NVH, OPA
35LK1231	2434-01	AC 9/SC 274	Surface	BLA	Surveyor Spring	9.3 ± 0.1	9.4 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	2438-01	AC 9/SC 278	Surface	BLA	Surveyor Spring	8.7 ± 0.1	NM ± NM	--
35LK1231	2442-01	AC-9/SC 282	Surface	PPT	Cowhead Lake	6.1 ± 0.1	NM ± NM	--
35LK1231	2450-01	AC 9/SC 290	Surface	BLA	Surveyor Spring	11.8 ± 0.1	NM ± NM	DFV
35LK1231	2451-01	AC 9/SC 291	Surface	COR	Surveyor Spring	9.0 ± 0.1	NM ± NM	HV
35LK1231	2455-01	AC 9/SC 295	Surface	CHO	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2459-01	AC 9/SC 299	Surface	BLA	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2464-01	AC 9/SC 304	Surface	BLA	Surveyor Spring	12.4 ± 0.1	NM ± NM	--
35LK1231	2469-01	AC-9/SC 309	Surface	PPT	Surveyor Spring	9.3 ± 0.1	NM ± NM	--
35LK1231	2471-01	AC-9/SC 311	Surface	PPT	Cowhead Lake	4.2 ± 0.1	9.2 ± 0.1	Smaller rim on dorsal margin
35LK1231	2496-01	AC 9/SC 360	Surface	BLA	Surveyor Spring	8.3 ± 0.1	NM ± NM	--
35LK1231	2497-01	AC-9/SC 362	Surface	PPT	Cowhead Lake	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK1231	2500-01	AC 9/SC 368	Surface	BLA	Surveyor Spring	11.0 ± 0.1	NM ± NM	--
35LK1231	2502-01	AC 9/SC 372	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2503-01	AC 9/SC 374	Surface	CHO	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2504-01	AC-9/SC 376	Surface	PPT	Cowhead Lake	7.5 ± 0.1	NM ± NM	--
35LK1231	2505-01	AC 9/SC 378	Surface	COR	Surveyor Spring	10.3 ± 0.1	NM ± NM	--
35LK1231	2506-01	AC 9/SC 380	Surface	BLA	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK1231	2512-01	AC-9/SC 392	Surface	PPT	Buck Mountain	7.5 ± 0.1	NM ± NM	--
35LK1231	2519-01	AC 9/SC 406	Surface	PPT	Mosquito Lake	NA ± NA	NM ± NM	REC; UNR, DFV
35LK1231	2555-02	QTU 5	Level 2	PPT	Mosquito Lake	4.4 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	2568-02-19	AC 9/QTU 6	Level 3	COR	Surveyor Spring	6.5 ± 0.1	NM ± NM	--
35LK1231	2585-01	AC 10/SC 5	Surface	BLA	Surveyor Spring	8.0 ± 0.1	8.0 ± 0.0	Larger rim on v/surface of cut B; Rim 3 = 8.6
35LK1231	2586-01	AC 10/SC 6	Surface	BLA	Surveyor Spring	8.5 ± 0.1	NM ± NM	--
35LK1231	2587-01	AC 10/SC 7	Surface	BLA	Unknown FGV C	NM ± NM	NM ± NM	Not cut
35LK1231	2589-01	AC 10/SC 9	Surface	BLA	Surveyor Spring	8.1 ± 0.1	8.1 ± 0.0	Rim 1 = cut A; Rim 2 = cut B
35LK1231	2592-01	AC 10/SC 12	Surface	BLA	Drews Creek/Butcher Flat	6.0 ± 0.1	NM ± NM	--
35LK1231	2596-01	AC 10/SC 16	Surface	BLA	Unknown Obsidian 1	5.3 ± 0.0	6.3 ± 0.1	OPA, DFV, smaller rim on dorsal margin
35LK1231	2600-01	AC-10/ SC 20	Surface	PPT	Long Valley	7.5 ± 0.1	NM ± NM	REC
35LK1231	2605-01	AC 10/SC 25	Surface	BLA	Surveyor Spring	9.5 ± 0.1	NM ± NM	REC
35LK1231	2610-01	AC-10/ SC 30	Surface	PPT	Mosquito Lake	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK1231	2613-01	AC 10/SC 33	Surface	BLA	Surveyor Spring	7.0 ± 0.1	7.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	2619-01	AC-10/ SC 39	Surface	PPT	Surveyor Spring	6.0 ± 0.1	NM ± NM	BEV, DFV
35LK1231	2621-01	AC 10/SC 41	Surface	BLA	Surveyor Spring	11.0 ± 0.1	NM ± NM	DFV
35LK1231	2626-01	AC-10/ SC 46	Surface	PPT	Buck Mountain	4.4 ± 0.1	NM ± NM	--
35LK1231	2629-01	AC-10/ SC 49	Surface	PPT	Surveyor Spring	7.5 ± 0.1	NM ± NM	BEV (on ventral surface)
35LK1231	2630-01	AC 10/SC 50	Surface	BLA	Surveyor Spring	8.7 ± 0.1	NM ± NM	--
35LK1231	2632-01	AC 10/SC 52	Surface	BLA	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK1231	2633-01	AC-10/ SC 53	Surface	BUR	Sugar Hill *	3.2 ± 0.1	NM ± NM	--
35LK1231	2637-01	AC 10/SC 57	Surface	BLA	Surveyor Spring	8.6 ± 0.0	8.6 ± 0.1	Rim 1 = cut A (DFV); Rim 2 = cut B
35LK1231	2638-01	AC 10/SC 58	Surface	BLA	Cowhead Lake	7.0 ± 0.1	7.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	2639-01	AC 10/SC 59	Surface	BLA	Surveyor Spring	9.7 ± 0.1	NM ± NM	--
35LK1231	2645-01	AC 10/SC 65	Surface	BLA	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR, DFV
35LK1231	2647-01	AC 10/SC 67	Surface	BLA	Surveyor Spring	6.1 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	2650-01	AC-10/ SC 70	Surface	PPT	Cowhead Lake	1.6 ± 0.1	5.3 ± 0.1	Smaller rim on BRE
35LK1231	2652-01	AC 10/SC 72	Surface	BLA	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	2654-01	AC 10/SC 74	Surface	BLA	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK1231	2657-01	AC 10/SC 77	Surface	BLA	Parsnip Creek	6.0 ± 0.1	NM ± NM	--
35LK1231	2659-01	AC 10/SC 79	Surface	BLA	Surveyor Spring	6.0 ± 0.0	9.8 ± 0.1	Larger rim on dorsal scar
35LK1231	2662-01	AC 10/SC 82	Surface	BLA	Surveyor Spring	2.0 ± 0.1	6.8 ± 0.1	Smaller rim on dorsal surface, DFV, IRR
35LK1231	2668-01	AC 10/SC 88	Surface	BLA	Surveyor Spring	8.4 ± 0.1	NM ± NM	--
35LK1231	2672-01	AC-10/ SC 92	Surface	PPT	Mosquito Lake	1.8 ± 0.1	NM ± NM	REC
35LK1231	2673-01	AC-10/ SC 93	Surface	PPT	Unknown Obsidian 1	6.0 ± 0.1	NM ± NM	OPA, DFV
35LK1231	2674-01	AC-10/ SC 94	Surface	PPT	Unknown Obsidian 1	2.4 ± 0.1	NM ± NM	--
35LK1231	2676-01	AC-10/ SC 96	Surface	PPT	Surveyor Spring	1.4 ± 0.0	4.0 ± 0.1	Smaller rim on BRE
35LK1231	2680-01	AC-10/ SC 100	Surface	PPT	Cowhead Lake	2.4 ± 0.1	NM ± NM	--
35LK1231	2681-01	AC 10/SC 101	Surface	CHO	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2682-01	AC-10/ SC 102	Surface	PPT	Cowhead Lake	2.3 ± 0.1	NM ± NM	REC
35LK1231	2683-01	AC-10/ SC 103	Surface	PPT	Mosquito Lake	NA ± NA	NM ± NM	REC; UNR, DFV
35LK1231	2684-01	AC-10/ SC 104	Surface	PPT	Cowhead Lake	6.8 ± 0.1	NM ± NM	--
35LK1231	2688-01	AC 10/SC 108	Surface	BLA	Surveyor Spring	8.2 ± 0.1	NM ± NM	--
35LK1231	2693-01	AC 1/SC 1	Surface	COR	Surveyor Spring	5.3 ± 0.1	NM ± NM	--
35LK1231	2695-01	AC 1/SC 3	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	2696-01	AC 1/SC 4	Surface	COR	Surveyor Spring	3.9 ± 0.0	NM ± NM	--
35LK1231	2697-01	AC 1/SC 5	Surface	COR	Surveyor Spring	7.6 ± 0.1	NM ± NM	--
35LK1231	2702-01	AC 1/SC 10	Surface	COR	Surveyor Spring	4.6 ± 0.1	NM ± NM	DFV
35LK1231	2709-01	AC 1/SC 17	Surface	COR	Surveyor Spring	8.1 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	2710-01	AC 1/SC 18	Surface	COR	Surveyor Spring	6.7 ± 0.1	10.3 ± 0.1	Larger rim on dorsal surface (HV, cortex-like)
35LK1231	2711-01	AC 1/SC 19	Surface	COR	Surveyor Spring	3.2 ± 0.1	NM ± NM	REC
35LK1231	2713-01	AC 1/SC 21	Surface	COR	Surveyor Spring	5.9 ± 0.1	NM ± NM	Dorsal surface is BEV, HV
35LK1231	2714-01	AC 1/SC 22	Surface	COR	Surveyor Spring	4.3 ± 0.1	6.1 ± 0.1	Smaller rim on dorsal margin
35LK1231	2716-01	AC 1/SC 24	Surface	COR	Surveyor Spring	6.9 ± 0.1	NM ± NM	--
35LK1231	2723-01	AC 1/SC 31	Surface	COR/ADZ	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK1231	2731-01	AC 1/SC 39	Surface	COR	Surveyor Spring	3.2 ± 0.1	NM ± NM	--
35LK1231	2733-01	AC 1/SC 41	Surface	COR/HA	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	2736-01	AC 1/SC 44	Surface	COR	Surveyor Spring	2.6 ± 0.1	NM ± NM	DFV
35LK1231	2744-01	AC 1/SC 52	Surface	COR	Surveyor Spring	8.5 ± 0.1	NM ± NM	--
35LK1231	2747-01	AC 1/SC 55	Surface	COR	Surveyor Spring	3.6 ± 0.0	NM ± NM	--
35LK1231	2748-01	AC 1/SC 56	Surface	COR	Surveyor Spring	3.7 ± 0.1	NM ± NM	--
35LK1231	2749-01	AC 1/SC 57	Surface	COR	Surveyor Spring	6.2 ± 0.1	NM ± NM	--
35LK1231	2753-01	AC 1/SC 61	Surface	COR	Surveyor Spring	6.2 ± 0.1	NM ± NM	--
35LK1231	2756-01	AC 1/SC 64	Surface	COR	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK1231	2757-01	AC 1/SC 65	Surface	COR	Surveyor Spring	7.7 ± 0.1	NM ± NM	--
35LK1231	2758-01	AC 1/SC 66	Surface	COR	Surveyor Spring	6.4 ± 0.0	NM ± NM	--
35LK1231	2778-01	AC 1/SC 86	Surface	COR/HA	Surveyor Spring	3.9 ± 0.1	NM ± NM	--
35LK1231	2786-01	AC 1/SC 94	Surface	COR	Surveyor Spring	6.9 ± 0.1	NM ± NM	--
35LK1231	2791-01	AC 1/SC 99	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	2792-01	AC 1/SC 100	Surface	COR	Surveyor Spring	4.1 ± 0.0	NM ± NM	--
35LK1231	2793-01	AC 1/SC 101	Surface	COR	Surveyor Spring	6.0 ± 0.1	NM ± NM	REC
35LK1231	2796-01	AC 1/SC 104	Surface	COR	Surveyor Spring	6.1 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	2798-01	AC 1/SC 106	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	2800-01	AC 1/SC 108	Surface	COR	Surveyor Spring	6.9 ± 0.1	NM ± NM	--
35LK1231	2802-01	AC 1/SC 110	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	2813-01	AC 1/SC 121	Surface	COR	Surveyor Spring	11.0 ± 0.1	NM ± NM	--
35LK1231	2815-01	AC 1/SC 123	Surface	COR	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	2822-01	AC 1/SC 130	Surface	COR	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK1231	2825-01	AC 1/SC 133	Surface	COR	Surveyor Spring	9.0 ± 0.1	9.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK1231	2826-01	AC 1/SC 134	Surface	COR	Surveyor Spring	6.2 ± 0.1	NM ± NM	--
35LK1231	2834-01	AC 1/SC 142	Surface	COR	Surveyor Spring	3.8 ± 0.1	NM ± NM	--
35LK1231	2835-01	AC 1/SC 143	Surface	COR	Surveyor Spring	7.3 ± 0.1	NM ± NM	--
35LK1231	2839-01	AC 1/SC 147	Surface	COR	Surveyor Spring	4.7 ± 0.1	NM ± NM	--
35LK1231	2846-01	AC 1/SC 155	Surface	COR/ADZ	Surveyor Spring	3.9 ± 0.1	NM ± NM	Cortex on unmodified dorsal surface
35LK1231	2847-01	AC 1/SC 156	Surface	COR	Surveyor Spring	4.5 ± 0.1	6.6 ± 0.1	Smaller rim on dorsal surface, DFV, IRR
35LK1231	2848-01	AC 1/SC 157	Surface	COR	Surveyor Spring	5.3 ± 0.1	NM ± NM	--
35LK1231	2851-01	AC 1/SC 160	Surface	COR	Surveyor Spring	6.5 ± 0.1	NM ± NM	--
35LK1231	2852-01	AC 1/SC 161	Surface	COR	Surveyor Spring	7.8 ± 0.1	NM ± NM	--
35LK1231	2854-01	AC 1/SC 163	Surface	HAM	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK1231	2860-01	AC 1/SC 154	Surface	COR	Surveyor Spring	7.6 ± 0.0	NM ± NM	--
35LK1231	2863-01	AC 1/SC 171	Surface	COR	Surveyor Spring	4.1 ± 0.0	NM ± NM	NVH on dorsal surface
35LK1231	2864-01	AC 1/SC 172	Surface	COR	Surveyor Spring	4.8 ± 0.1	NM ± NM	BEV, DFV
35LK1231	2881-01	AC 1/SC 189	Surface	COR	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	2884-01	AC 1/SC 192	Surface	COR	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	2889-01	AC 1/SC 197	Surface	COR	Surveyor Spring	7.5 ± 0.1	NM ± NM	NVH on dorsal surface

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	2899-01	AC 1/SC 207	Surface	BLA	Surveyor Spring	8.5 ± 0.1	3.6 ± 0.1	Rim 1 = cut A; Rims 2 & 3 (8.5 mic.) = cut B
35LK1231	2901-01	AC 1/SC 209	Surface	COR	Surveyor Spring	4.2 ± 0.1	NM ± NM	DFV
35LK1231	2908-01	AC 1/SC 216	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	2909-01	AC 1/SC 217	Surface	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	BEV, DFV
35LK1231	2913-01	AC 1/SC 221	Surface	COR	Surveyor Spring	7.4 ± 0.1	NM ± NM	--
35LK1231	2916-01	AC 1/SC 224	Surface	COR	Surveyor Spring	10.5 ± 0.1	NM ± NM	DFV
35LK1231	2934-01	AC 1/SC 242	Surface	COR	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	2936-01	AC 1/SC 244	Surface	COR	Surveyor Spring	3.5 ± 0.0	7.8 ± 0.1	Smaller rim on modified margin
35LK1231	2938-01	AC 1/SC 246	Surface	COR	Surveyor Spring	6.8 ± 0.1	NM ± NM	REC; DFV
35LK1231	2939-01	AC 1/SC 247	Surface	COR	Surveyor Spring	1.9 ± 0.1	6.5 ± 0.1	Smaller rim on dorsal surface, DFV, IRR
35LK1231	2942-01	AC 1/SC 250	Surface	COR/HA	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	2958-01	AC 1/SC 266	Surface	BLA	Surveyor Spring	6.2 ± 0.1	NM ± NM	--
35LK1231	2963-01	AC 1/SC 271	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2964-01	AC 1/SC 272	Surface	BLA	Surveyor Spring	5.4 ± 0.1	NM ± NM	--
35LK1231	2967-01	AC 1/SC 275	Surface	BLA	Surveyor Spring	6.6 ± 0.1	NM ± NM	--
35LK1231	2971-01	AC 1/SC 279	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK1231	2983-01	AC 1/SC 291	Surface	BLA	Glass Buttes 1	3.0 ± 0.1	4.9 ± 0.1	Smaller rim on dorsal surface
35LK1231	2984-01	AC 1/SC 292	Surface	COR	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	2985-01	AC 1/SC 293	Surface	COR	Surveyor Spring	6.7 ± 0.1	NM ± NM	--
35LK1231	2992-01	AC 1/SC 300	Surface	COR	Surveyor Spring	3.2 ± 0.0	NM ± NM	--
35LK1231	2994-01	AC 1/SC 302	Surface	COR	Surveyor Spring	6.1 ± 0.0	NM ± NM	--
35LK1231	2995-01	AC 1/SC 303	Surface	COR	Surveyor Spring	10.0 ± 0.1	NM ± NM	DFV
35LK1231	3001-01	AC 1/SC 309	Surface	BLA	Surveyor Spring	1.1 ± 0.1	9.3 ± 0.1	Smaller rim on ventral surface

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						Rim 1	Rim 2	
35LK1231	3006-01	AC 1/SC 314	Surface	COR	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK1231	3015-01	AC 1/SC 323	Surface	COR	Surveyor Spring	5.0 ± 0.1	NM ± NM	REC
35LK1231	3016-01	AC 1/SC 324	Surface	COR	Surveyor Spring	9.0 ± 0.1	NM ± NM	--
35LK1231	3020-01	AC 1/SC 328	Surface	COR	Surveyor Spring	4.6 ± 0.1	NM ± NM	--
35LK1231	3022-01	AC 1/SC 330	Surface	BLA	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	3023-01	AC 1/SC 331	Surface	BLA	Surveyor Spring	7.7 ± 0.1	NM ± NM	--
35LK1231	3025-01	AC 1/SC 333	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--
35LK1231	3028-01	AC 1/SC 336	Surface	COR	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	3030-01	AC 1/SC 338	Surface	COR	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	3033-01	AC 1/SC 341	Surface	COR	Surveyor Spring	6.6 ± 0.1	NM ± NM	--
35LK1231	3036-01	AC 1/SC 344	Surface	BLA	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	3040-01	AC 1/SC 348	Surface	COR	Surveyor Spring	14.9 ± 0.1	NM ± NM	--
35LK1231	3055-01	AC 1/SC 364	Surface	COR	Surveyor Spring	7.0 ± 0.1	NM ± NM	NVH on dorsal surface
35LK1231	3056-01	AC 1/SC 365	Surface	COR	Surveyor Spring	6.6 ± 0.1	NM ± NM	--
35LK1231	3080-01	AC 1/SC 388	Surface	COR	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK1231	3082-01	AC 1/SC 390	Surface	COR	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK1231	3084-01	AC 1/SC 392	Surface	COR	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	3099-01	AC 1/SC 407	Surface	COR	Surveyor Spring	4.5 ± 0.0	NM ± NM	--
35LK1231	3100-01	AC 1/SC 408	Surface	BLA	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK1231	3110-01	AC 1/SC 418	Surface	COR/HA	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	3120-01	AC 1/SC 428	Surface	COR	Surveyor Spring	7.2 ± 0.1	NM ± NM	--
35LK1231	3123-01	AC 1/SC 431	Surface	COR	Surveyor Spring	4.6 ± 0.1	NM ± NM	--
35LK1231	3127-01	AC-1/SC 435	Surface	PPT	Cowhead Lake	4.7 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	3145-01	AC-1/SC 453	Surface	PPT	Surveyor Spring	2.3 ± 0.1	8.1 ± 0.1	Smaller rim on BRE
35LK1231	3147-01	AC 1/SC 455	Surface	COR	Surveyor Spring	1.6 ± 0.1	6.5 ± 0.1	Smaller rim on dorsal surface
35LK1231	3148-01	AC 1/SC 456	Surface	COR	Surveyor Spring	4.0 ± 0.1	7.6 ± 0.1	Smaller rim on ventral margin
35LK1231	3154-01	AC 1/SC 462	Surface	SCR	Surveyor Spring	7.3 ± 0.1	NM ± NM	HV
35LK1231	3158-01	AC 1/SC 466	Surface	BLA	Surveyor Spring	7.2 ± 0.1	NM ± NM	--
35LK1231	3161-01	AC 1/SC 469	Surface	BLA	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	3162-01	AC 1/SC 470	Surface	BLA	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	3174-01	AC-1/SC 482	Surface	PPT	Buck Mountain	5.5 ± 0.1	NM ± NM	--
35LK1231	3181-01	AC 1/SC 489	Surface	COR	Surveyor Spring	7.0 ± 0.0	NM ± NM	--
35LK1231	3188-01	AC-1/SC 496	Surface	PPT	Surveyor Spring	5.6 ± 0.1	NM ± NM	REC
35LK1231	3191-01	AC 1/SC 499	Surface	COR	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK1231	3193-01	AC 1/SC 501	Surface	BLA	Surveyor Spring	6.6 ± 0.1	NM ± NM	--
35LK1231	3194-01	AC 1/SC 502	Surface	COR	Surveyor Spring	4.3 ± 0.1	NM ± NM	--
35LK1231	3197-01	AC 1/SC 505	Surface	BLA	Cowhead Lake	3.5 ± 0.1	NM ± NM	--
35LK1231	3198-01	AC 1/SC 506	Surface	COR	Surveyor Spring	4.3 ± 0.1	NM ± NM	--
35LK1231	3212-01	AC 1/SC 520	Surface	COR	Surveyor Spring	5.8 ± 0.1	8.7 ± 0.1	Larger rim and NVH on dorsal surface
35LK1231	3218-01	AC 1/SC 526	Surface	BLA	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK1231	3222-01	AC 1/SC 530	Surface	BLA	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK1231	3223-01	AC 1/SC 531	Surface	BLA	Surveyor Spring	5.1 ± 0.1	NM ± NM	--
35LK1231	3231-01	AC 1/SC 539	Surface	COR	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK1231	3238-01	AC 1/SC 546	Surface	PRE	Surveyor Spring	5.1 ± 0.1	NM ± NM	--
35LK1231	3251-01	AC-1/SC 559	Surface	PPT	Surveyor Spring	5.7 ± 0.1	NM ± NM	--
35LK1231	3252-01	AC 1/SC 560	Surface	BLA	Surveyor Spring	4.6 ± 0.1	NM ± NM	REC; DFV

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	3254-01	AC 1/SC 562	Surface	BLA	Surveyor Spring	5.8 ± 0.1	NM ± NM	--
35LK1231	3257-01	AC 1/SC 565	Surface	BLA	Surveyor Spring	7.7 ± 0.1	NM ± NM	--
35LK1231	3266-01	AC 1/SC 574	Surface	COR	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	3267-01	AC-1/SC 575	Surface	PPT	Unknown Obsidian 2?	5.1 ± 0.1	NM ± NM	--
35LK1231	3272-01	AC 1/SC 580	Surface	COR	Surveyor Spring	6.5 ± 0.1	NM ± NM	HV
35LK1231	3284-01	AC 1/SC 592	Surface	COR	Surveyor Spring	3.2 ± 0.0	NM ± NM	--
35LK1231	3290-01	AC 1/SC 598	Surface	COR	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK1231	3300-01	AC 1/SC 608	Surface	COR/ADZ	Surveyor Spring	8.6 ± 0.1	NM ± NM	--
35LK1231	3306-01	AC 1/SC 614	Surface	BLA	Surveyor Spring	5.6 ± 0.1	7.7 ± 0.1	Smaller rim on BRE
35LK1231	3312-01	AC 1/SC 620	Surface	SCR	Surveyor Spring	5.3 ± 0.1	NM ± NM	--
35LK1231	3313-01	AC 1/SC 621	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	3326-01	AC 1/SC 634	Surface	BLA	Surveyor Spring	3.0 ± 0.1	NM ± NM	--
35LK1231	3331-01	AC 1/SC 639	Surface	BLA	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR, DFV
35LK1231	3332-01	AC 1/SC 640	Surface	COR	Surveyor Spring	6.2 ± 0.0	NM ± NM	--
35LK1231	3337-01	AC 1/SC 645	Surface	COR	Surveyor Spring	7.2 ± 0.1	NM ± NM	HV, DFV
35LK1231	3340-01	AC 1/SC 648	Surface	BLA	Surveyor Spring	2.2 ± 0.1	4.9 ± 0.1	Smaller rim on ventral margin
35LK1231	3341-01	AC 1/SC 649	Surface	COR/ADZ	Surveyor Spring	5.0 ± 0.1	6.2 ± 0.1	Smaller rim on ventral margin
35LK1231	3342-01	AC 1/SC 650	Surface	COR/ADZ	Surveyor Spring	8.2 ± 0.1	NM ± NM	--
35LK1231	3350-01	AC-1/SC 658	Surface	PPT	Cowhead Lake	3.3 ± 0.1	NM ± NM	--
35LK1231	3352-01	AC-1/SC 660	Surface	PPT	Cowhead Lake	5.4 ± 0.1	NM ± NM	NVH on ventral margin
35LK1231	3353-01	AC 1/SC 661	Surface	COR	Surveyor Spring	3.9 ± 0.0	NM ± NM	IRR
35LK1231	3354-03	AC 1/QTU 1	Surface	COR	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	3354-05	AC 1/QTU 1	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	3355-02	AC 1/QTU 1	Level 1	COR	Surveyor Spring	3.9 ± 0.1	NM ± NM	--
35LK1231	3361-02	AC 1/QTU 2	Level 1	FLT	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	3361-03	AC 1/QTU 2	Level 1	COR	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR, WEA
35LK1231	3367-02	AC-1/QTU 3	Level 1	PPT	Buck Mountain	2.8 ± 0.1	NM ± NM	--
35LK1231	3368-01	AC 1/QTU 3	Level 2	COR	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	3374-01-1	AC 1/QTU 4	Surface	BLA	Surveyor Spring	7.1 ± 0.1	NM ± NM	HV
35LK1231	3375-02	AC 1/QTU 4	Level 1	COR	Surveyor Spring	5.0 ± 0.0	NM ± NM	--
35LK1231	3380-02	AC 1/QTU 5	Level 2	COR	Surveyor Spring	4.6 ± 0.1	5.1 ± 0.1	Smaller rim on dorsal surface
35LK1231	3394-01	AC 2/SC 1	Surface	FLT	Surveyor Spring	1.8 ± 0.1	11.2 ± 0.1	REC; smaller rim on ventral margin
35LK1231	3396-01	AC-2/SC 3	Surface	PPT	Cowhead Lake	1.8 ± 0.1	5.5 ± 0.1	Smaller rim on dorsal & ventral margins
35LK1231	3400-01	AC-2/SC 7	Surface	PPT	Buck Mountain	4.7 ± 0.1	NM ± NM	--
35LK1231	3403-01	AC 2/SC 10	Surface	PPT	Unknown Obsidian 1	5.4 ± 0.1	NM ± NM	OPA, DFV
35LK1231	3407-01	AC 2/SC 14	Surface	PPT	Cowhead Lake	7.1 ± 0.1	NM ± NM	--
35LK1231	3408-01	AC-2/SC 15	Surface	PPT	Cowhead Lake	5.5 ± 0.1	NM ± NM	--
35LK1231	3410-01	AC 2/SC 17	Surface	PPT/BUR	Unknown Obsidian 1	5.1 ± 0.1	NM ± NM	OPA
35LK1231	3411-01	AC 2/SC 18	Surface	FLT	Surveyor Spring	9.8 ± 0.1	NM ± NM	REC; DFV, HV
35LK1231	3413-01	AC 2/SC 20	Surface	COR	Surveyor Spring	9.5 ± 0.1	NM ± NM	Ventral surface is HV, UNR (appears same)
35LK1231	3414-01	AC-2/SC 21	Surface	PPT	Blue Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	3416-01	AC-2/SC 23	Surface	PPT	Beatys Butte	4.2 ± 0.1	NM ± NM	REC; DFV
35LK1231	3417-01	AC-2/SC 24	Surface	PPT	Buck Mountain	6.1 ± 0.1	NM ± NM	--
35LK1231	3419-01	AC-2/SC 26	Surface	PPT	Cowhead Lake	6.8 ± 0.1	NM ± NM	--
35LK1231	3422-01	AC-2/SC 29	Surface	PPT	Unknown Obsidian 1	5.7 ± 0.1	NM ± NM	--
35LK1231	3423-01	AC 2/SC 30	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	3425-01	AC 2/SC 32	Surface	COR	Surveyor Spring	6.2 ± 0.1	NM ± NM	Ventral surface is HV, WEA (10-11 microns)
35LK1231	3427-01	AC 2/SC 34	Surface	COR	Surveyor Spring	4.3 ± 0.1	NM ± NM	--
35LK1231	3429-01	AC-2/SC 36	Surface	PPT	Unknown Obsidian 1	1.9 ± 0.1	5.0 ± 0.1	Smaller rim on BRE
35LK1231	3433-01	AC 2/SC 40	Surface	COR	Surveyor Spring	4.4 ± 0.1	NM ± NM	--
35LK1231	3437-01	AC 2/SC 44	Surface	COR	Surveyor Spring	3.9 ± 0.1	NM ± NM	--
35LK1231	3441-01	AC 2/SC 48	Surface	FLT	Surveyor Spring	8.6 ± 0.1	11.2 ± 0.1	REC; larger rim on ventral interior
35LK1231	3444-01	AC 2/SC 51	Surface	COR	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	3447-01	AC 2/SC 54	Surface	COR/ADZ	Surveyor Spring	5.4 ± 0.1	NM ± NM	--
35LK1231	3450-01	AC 2/SC 57	Surface	COR/HA	Surveyor Spring	3.8 ± 0.1	NM ± NM	--
35LK1231	3452-01	AC-2/SC 59	Surface	PPT	Beatys Butte	2.8 ± 0.0	5.6 ± 0.1	Smaller rim on dorsal(?) margin
35LK1231	3458-01	AC-2/SC 65	Surface	PPT	Beatys Butte	4.0 ± 0.1	NM ± NM	--
35LK1231	3471-03	AC-2 QTU 5	Surface	PPT	Beatys Butte	5.5 ± 0.1	NM ± NM	--
35LK1231	3471-04	AC-2 QTU 5	Surface	PPT	Cowhead Lake	5.0 ± 0.1	NM ± NM	--
35LK1231	3475-01	AC 3/SC 1	Surface	BLA	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK1231	3480-01	AC 3/SC 6	Surface	COR	Surveyor Spring	5.1 ± 0.0	NM ± NM	--
35LK1231	3482-01	AC 3/SC 8	Surface	COR	Surveyor Spring	5.1 ± 0.1	8.4 ± 0.1	Larger rim on ventral surface
35LK1231	3489-01	AC 3/SC 15	Surface	COR	Surveyor Spring	1.6 ± 0.1	4.0 ± 0.1	Smaller rim on dorsal surface
35LK1231	3490-01	AC 3/SC 16	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	3493-01	AC 3/SC 19	Surface	COR	Surveyor Spring	5.6 ± 0.1	7.6 ± 0.1	Smaller rim on BRE scar
35LK1231	3499-01	AC 3/SC 25	Surface	COR	Surveyor Spring	5.2 ± 0.1	NM ± NM	--
35LK1231	3501-01	AC 3/SC 27	Surface	FLT	Surveyor Spring	7.9 ± 0.1	NM ± NM	--
35LK1231	3503-01	AC 3/SC 29	Surface	COR	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK1231	3507-01	AC 3/SC 33	Surface	COR	Surveyor Spring	9.5 ± 0.1	NM ± NM	--

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Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	3513-01	AC 3/SC 39	Surface	COR	Surveyor Spring	4.8 ± 0.1	NM ± NM	--
35LK1231	3516-01	AC-3/SC 42	Surface	PPT	Blue Spring	2.4 ± 0.1	5.4 ± 0.1	Smaller rim on dorsal margin
35LK1231	3521-01	AC 3/SC 47	Surface	COR	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK1231	3522-01	AC 3/SC 48	Surface	PPT	Surveyor Spring	2.1 ± 0.0	6.7 ± 0.1	Smaller rim on BRE margin
35LK1231	3523-01	AC 3/SC 49	Surface	PPT	Mosquito Lake	5.2 ± 0.1	NM ± NM	DFV
35LK1231	3528-01	AC-3/SC 54	Surface	PPT	Unknown Obsidian 1	NA ± NA	NM ± NM	REC; UNR, OPA
35LK1231	3548-01	AC 3/SC 74	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	Dorsal surface is BEV, UNR
35LK1231	3551-01	AC 3/SC 77	Surface	COR/ADZ	Surveyor Spring	6.8 ± 0.1	NM ± NM	--
35LK1231	3557-01	AC 3/SC 83	Surface	COR/SCR	Surveyor Spring	1.6 ± 0.1	10.4 ± 0.0	Smaller rim on dorsal margin
35LK1231	3563-01	AC 3/SC 89	Surface	COR	Surveyor Spring	3.9 ± 0.1	NM ± NM	--
35LK1231	3568-01	AC 3/SC 94	Surface	COR	Surveyor Spring	5.8 ± 0.1	10.1 ± 0.1	Smaller rim on dorsal surface
35LK1231	3578-01	AC 3/SC 104	Surface	COR	Surveyor Spring	3.9 ± 0.1	NM ± NM	--
35LK1231	3581-01	AC 3/SC 107	Surface	COR	Surveyor Spring	8.9 ± 0.1	NM ± NM	--
35LK1231	3583-01	AC 3/SC 109	Surface	COR	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK1231	3588-01	AC 3/SC 114	Surface	PPT	Buck Mountain	8.2 ± 0.1	NM ± NM	--
35LK1231	3590-01	AC 3/SC 116	Surface	COR	Surveyor Spring	7.5 ± 0.1	NM ± NM	--
35LK1231	3597-01	AC 3/SC 123	Surface	BLA	Surveyor Spring	4.0 ± 0.1	8.3 ± 0.1	Smaller rim on dorsal scar
35LK1231	3601-01	AC 3/SC 127	Surface	PPT	Buck Mountain	6.2 ± 0.1	NM ± NM	DFV
35LK1231	3605-01	AC 3/SC 131	Surface	COR	Surveyor Spring	4.4 ± 0.0	NM ± NM	--
35LK1231	3610-01	AC 3/SC 136	Surface	BLA	Surveyor Spring	7.9 ± 0.1	NM ± NM	DFV, large rim on ventral (approx. 24 microns)
35LK1231	3611-01	AC 3/SC 137	Surface	COR	Surveyor Spring	4.0 ± 0.1	NM ± NM	--
35LK1231	3612-01	AC 3/SC 138	Surface	COR	Surveyor Spring	4.6 ± 0.1	NM ± NM	--
35LK1231	3617-01	AC-3/SC 143	Surface	PPT	Cowhead Lake	3.1 ± 0.1	5.7 ± 0.1	Smaller rim on dorsal margin

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK1231	3620-01	AC 3/SC 146	Surface	COR	Surveyor Spring	4.5 ± 0.1	NM ± NM	REC
35LK1231	3626-01	AC 3/SC 152	Surface	PPT	Long Valley	6.7 ± 0.1	NM ± NM	--
35LK1231	3634-01	AC 3/SC 160	Surface	PPT	Cowhead Lake	5.3 ± 0.1	NM ± NM	--
35LK1231	3636-01	AC 3/SC 162	Surface	FLT	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK1231	3646-01	AC 3/SC 172	Surface	COR	Surveyor Spring	4.5 ± 0.0	NM ± NM	--
35LK1231	3658-01	AC 3/SC 184	Surface	BLA	Surveyor Spring	6.3 ± 0.1	NM ± NM	--
35LK1231	3661-01	AC 3/SC 187	Surface	BLA	Surveyor Spring	1.7 ± 0.0	6.4 ± 0.1	Smaller rim on BRE scar
35LK1231	3666-01	AC 3/SC 192	Surface	BLA	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK1231	3667-01	AC 3/SC 193	Surface	COR	Surveyor Spring	5.0 ± 0.1	NM ± NM	--
35LK1231	3668-01	AC-3/SC 194	Surface	PPT	Mosquito Lake	2.0 ± 0.1	5.5 ± 0.1	Smaller rim on ventral margin
35LK3856	3-01	SC 3	Surface	DEB	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR
35LK3856	11-01	SC 11	Surface	FLT	Surveyor Spring	10.7 ± 0.1	NM ± NM	HV, DFV
35LK3856	13-01	SC 13	Surface	DEB	Surveyor Spring	10.1 ± 0.1	NM ± NM	HV
35LK3856	15-01	SC 15	Surface	DEB	Cowhead Lake	5.0 ± 0.1	NM ± NM	--
35LK3856	18-01	SC 18	Surface	DEB	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR
35LK3856	19-01	SC 19	Surface	PRE	Cowhead Lake	6.2 ± 0.1	NM ± NM	REC
35LK3856	20-01	SC 20	Surface	DEB	Surveyor Spring	9.9 ± 0.1	NM ± NM	--
35LK3856	21-01	SC 21	Surface	DEB	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK3856	22-01	SC 22	Surface	DEB	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3856	23-01	SC 23	Surface	DEB	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR
35LK3856	25-01	SC 25	Surface	DEB	Surveyor Spring	12.1 ± 0.1	NM ± NM	HV, WEA
35LK3856	26-01	SC 26	Surface	DEB	Surveyor Spring	4.6 ± 0.1	NM ± NM	--
35LK3931	1-01	SC 1	Surface	FLT	Cowhead Lake	NA ± NA	NM ± NM	REC; UNR (possibly burnt)

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3931	2-01	SC 2	Surface	FLT	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3931	3-01	SC 3	Surface	FLT	Surveyor Spring	5.4 ± 0.1	NM ± NM	--
35LK3931	4-01	SC 4	Surface	FLT	Cowhead Lake	5.5 ± 0.1	NM ± NM	--
35LK3931	5-01	SC 5	Surface	FLT	Cowhead Lake	2.2 ± 0.1	NM ± NM	--
35LK3931	6-01	SC 6	Surface	FLT	Surveyor Spring	1.9 ± 0.1	NM ± NM	--
35LK3931	7-01	SC 7	Surface	FLT	Surveyor Spring	7.1 ± 0.1	NM ± NM	--
35LK3931	8-01	SC 8	Surface	FLT	Surveyor Spring	4.2 ± 0.1	8.3 ± 0.1	Smaller rim on ventral margin
35LK3931	9-01	SC 9	Surface	DEB	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3931	10-01	SC 10	Surface	FLT	Surveyor Spring	6.7 ± 0.1	NM ± NM	--
35LK3931	11-01	SC 11	Surface	PRE	Cowhead Lake *	4.6 ± 0.1	NM ± NM	--
35LK3931	12-01	SC 12	Surface	FLT	Surveyor Spring	5.7 ± 0.1	NM ± NM	--
35LK3931	13-01	SC 13	Surface	FLT	Surveyor Spring	7.3 ± 0.1	NM ± NM	--
35LK3931	14-01	SC 14	Surface	FLT	Surveyor Spring	2.1 ± 0.1	6.2 ± 0.1	Smaller rim on dorsal margin
35LK3931	15-01	SC 15	Surface	FLT	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3931	16-01	SC 16	Surface	BLA	Surveyor Spring	5.4 ± 0.1	NM ± NM	--
35LK3931	17-01	SC 17	Surface	FLT	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3931	18-01	SC 18	Surface	COR	Cowhead Lake	2.4 ± 0.1	NM ± NM	--
35LK3931	19-01	SC 19	Surface	FLT	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3931	20-01	SC 20	Surface	BLA	Cowhead Lake *	6.0 ± 0.1	NM ± NM	--
35LK3931	21-01	SC 21	Surface	BLA	Cowhead Lake	6.3 ± 0.1	NM ± NM	--
35LK3931	22-01	SC 22	Surface	FLT	Cowhead Lake	5.2 ± 0.1	NM ± NM	--
35LK3931	23-01	SC 23	Surface	PRE	Cowhead Lake *	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3931	24-01	SC 24	Surface	FLT	Surveyor Spring	6.7 ± 0.1	NM ± NM	REC; DFV, HV

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3931	25-01	SC 25	Surface	FLT	Surveyor Spring	5.9 ± 0.1	NM ± NM	REC; DFV
35LK3931	26-01	SC 26	Surface	DEB	Surveyor Spring	5.2 ± 0.1	NM ± NM	NVH on dorsal scar
35LK3931	27-01	SC 27	Surface	FLT	Surveyor Spring	6.5 ± 0.1	NM ± NM	BRE is UNR
35LK3931	28-01	SC 28	Surface	PPT	Cowhead Lake	4.3 ± 0.1	NM ± NM	--
35LK3931	29-01	SC 29	Surface	DRL	Unknown Obsidian 1	7.0 ± 0.1	NM ± NM	--
35LK3931	32-01	QTU 8	Level 2	FLT	Surveyor Spring	7.9 ± 0.1	NM ± NM	DFV
35LK3931	32-02	QTU 8	Level 2	FLT	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK3931	34-01	QTU 9	Level 2	DEB	Surveyor Spring	5.9 ± 0.1	NM ± NM	--
35LK3931	35-01	QTU 9	Level 5	DEB	Cowhead Lake *	4.4 ± 0.1	NM ± NM	--
35LK3931	36-01-1	QTU 9	Level 8	FLT	Surveyor Spring	5.6 ± 0.1	NM ± NM	--
35LK3931	39-01	QTU 10	Level 3	FLT	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK3931	101-02-1	TU 1	Level 1	FLT	Surveyor Spring	7.6 ± 0.1	NM ± NM	--
35LK3931	103-02-1	TU 1	Level 3	FLT	Cowhead Lake	2.7 ± 0.0	6.4 ± 0.1	Smaller rim on ventral margin
35LK3931	111-02-1	TU 3	Level 3	FLT	Surveyor Spring	5.0 ± 0.1	NM ± NM	--
35LK3931	121-02	TU 5	Level 2	BLA	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK3931	122-02-1	TU 5	Level 3	FLT	Surveyor Spring *	3.2 ± 0.1	NM ± NM	--
35LK3931	125-02-1	TU 6	Level 1	FLT	Cowhead Lake *	5.1 ± 0.1	NM ± NM	--
35LK3931	127-02-1	TU 6	Level 3	FLT	Surveyor Spring *	3.3 ± 0.1	NM ± NM	--
35LK3931	138-03	TU 8	Level 4	FLT	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK3931	143-02-1	TU 9	Level 4	FLT	Surveyor Spring	4.7 ± 0.1	NM ± NM	--
35LK3931	151-02-1	TU 10	Level 4	FLT	Surveyor Spring	4.6 ± 0.1	NM ± NM	--
35LK3931	156-02-1	TU 11	Level 2	FLT	Surveyor Spring	10.6 ± 0.1	NM ± NM	--
35LK3931	166-01	TU 13	Surface	FLT	Cowhead Lake	3.7 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3842	8-01	SC 8	Surface	BLA	Surveyor Spring	5.5 ± 0.1	NM ± NM	--
35LK3842	9-01	SC 9	Surface	PPT	Unknown Obsidian 1	3.6 ± 0.1	NM ± NM	--
35LK3842	10-01	SC 10	Surface	BLA	Surveyor Spring *	4.8 ± 0.1	NM ± NM	--
35LK3842	13-01	SC 13	Surface	FLT	Surveyor Spring	5.0 ± 0.1	NM ± NM	--
35LK3842	14-01	SC 14	Surface	PRE	Surveyor Spring	4.2 ± 0.1	NM ± NM	--
35LK3842	15-01	SC 15	Surface	BLA	Surveyor Spring	5.2 ± 0.1	NM ± NM	--
35LK3842	16-01	SC 16	Surface	CHO	Pope Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	17-01	SC 16	Surface	FLT	Cowhead Lake	5.7 ± 0.1	NM ± NM	--
35LK3842	18-01	SC 16	Surface	FLT	Surveyor Spring	5.0 ± 0.1	NM ± NM	--
35LK3842	19-01	SC 19	Surface	SCR	Surveyor Spring	8.0 ± 0.1	NM ± NM	HV (fissures), DFV
35LK3842	20-01	SC 20	Surface	PPT	Unknown Obsidian 1	4.0 ± 0.1	NM ± NM	REC; BRE is UNR
35LK3842	21-01	SC 21	Surface	PPT	Cowhead Lake *	4.2 ± 0.1	NM ± NM	REC
35LK3842	22-01	SC 22	Surface	PRE	Cowhead Lake *	4.1 ± 0.1	NM ± NM	--
35LK3842	23-01	SC 23	Surface	BLA	Unknown Obsidian 1	3.9 ± 0.1	NM ± NM	--
35LK3842	24-01	SC 24	Surface	PRE	Unknown Obsidian 1 *	3.7 ± 0.1	NM ± NM	--
35LK3842	25-01	SC 25	Surface	SCR	Cowhead Lake	4.5 ± 0.1	NM ± NM	NVH on dorsal margin
35LK3842	34-01	SC 34	Surface	BLA	Cowhead Lake	NA ± NA	NM ± NM	REC; UNR, DFV
35LK3842	37-01	SC 37	Surface	PPT	Cowhead Lake	2.0 ± 0.1	NM ± NM	--
35LK3842	38-01	SC 38	Surface	PPT	Long Valley	4.9 ± 0.1	NM ± NM	--
35LK3842	41-01	SC 41	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	53-01	SC 53	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	55-01	SC 55	Surface	SCR	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	58-01	SC 58	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3842	61-01	SC 61	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	62-01	SC 62	Surface	PPT	Cowhead Lake *	2.0 ± 0.1	NM ± NM	--
35LK3842	63-01	SC 63	Surface	KNI	Long Valley	4.6 ± 0.1	NM ± NM	--
35LK3842	64-01	SC 64	Surface	PPT	Cowhead Lake	4.7 ± 0.1	NM ± NM	--
35LK3842	65-01	SC 65	Surface	FLT	Unknown Obsidian 2	2.0 ± 0.1	NM ± NM	--
35LK3842	66-01	SC 66	Surface	SCR	Surveyor Spring	7.2 ± 0.1	NM ± NM	NVH on BRE
35LK3842	68-01	SC 68	Surface	FLT	Surveyor Spring	6.9 ± 0.1	9.0 ± 0.1	Smaller rim on dorsal surface
35LK3842	69-01	SC 69	Surface	FLT	Cowhead Lake	3.3 ± 0.1	NM ± NM	--
35LK3842	70-01	SC 70	Surface	FLT	Unknown Obsidian 1	4.6 ± 0.1	NM ± NM	OPA, DFV
35LK3842	71-01	SC 71	Surface	FLT	Surveyor Spring	9.4 ± 0.1	NM ± NM	HV (fissures), DFV
35LK3842	72-01	SC 72	Surface	FLT	Unknown Obsidian 2	3.9 ± 0.1	NM ± NM	HV (fissures) on dorsal surface
35LK3842	73-01	SC 73	Surface	FLT	Unknown Obsidian 2	3.8 ± 0.1	NM ± NM	HV (fissures) on dorsal surface
35LK3842	76-01	SC 76	Surface	PRE	Cowhead Lake	4.8 ± 0.1	NM ± NM	--
35LK3842	77-01	SC 77	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	79-01	SC 79	Surface	PPT	Buck Mountain	4.2 ± 0.1	8.0 ± 0.1	Small rim on v/margin of cut B; Rim 3 = 8.1
35LK3842	80-01	SC 80	Surface	FLT	Coyote Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	82-01	SC 82	Surface	PPT	Cowhead Lake	8.1 ± 0.1	NM ± NM	WEA, DFV
35LK3842	96-01	SC 96	Surface	PPT	Cowhead Lake	4.6 ± 0.1	NM ± NM	--
35LK3842	97-01	SC 97	Surface	KNI	Surveyor Spring	1.8 ± 0.1	5.1 ± 0.1	REC; smaller rim on dorsal margin
35LK3842	109-01	SC 109	Surface	PPT	Cowhead Lake *	3.5 ± 0.1	NM ± NM	--
35LK3842	117-01-1	QTU 4	Level 1	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	119-01-1	QTU 6	Surface	PPT	Unknown Obsidian 1	4.4 ± 0.1	NM ± NM	--
35LK3842	235-01	AINW/SC 35	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3842	241-01	AINW/SC 41	Surface	BLA	Cowhead Lake	3.9 ± 0.1	6.0 ± 0.1	Smaller rim on BRE & dorsal scar
35LK3842	242-01	AINW/SC 42	Surface	PPT	Long Valley	2.4 ± 0.0	4.1 ± 0.1	Smaller rim on ventral margin
35LK3842	247-01	AINW/SC 47	Surface	UNI	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	248-01	AINW/SC 48	Surface	PPT	Surveyor Spring	5.0 ± 0.1	NM ± NM	--
35LK3842	254-01	AINW/SC 54	Surface	PPT	Massacre Lake/Guano Valley	4.9 ± 0.1	NM ± NM	--
35LK3842	255-01	AINW/SC 55	Surface	SCR	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	256-01	AINW/SC 56	Surface	PPT	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK3842	266-01	AINW/SC 66	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	285-01	AINW/SC 85	Surface	BLA	Surveyor Spring	5.2 ± 0.1	NM ± NM	REC
35LK3842	296-01	AINW/SC 96	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	305-01	AINW/SC 105	Surface	BLA	Surveyor Spring	2.9 ± 0.1	3.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK3842	307-01	AINW/SC 107	Surface	PEB	Unknown Obsidian 1	3.1 ± 0.1	NM ± NM	NVH on ventral surface
35LK3842	309-01	AINW/SC 109	Surface	PPT	Cowhead Lake	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3842	324-01	AINW/SC 124	Surface	BLA	Cowhead Lake	3.2 ± 0.1	NM ± NM	--
35LK3842	333-01	AINW/SC 133	Surface	KNI	Cowhead Lake	6.1 ± 0.1	NM ± NM	--
35LK3842	355-01	AINW/SC 155	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	430-01	AINW/SC 230	Surface	FLT	Surveyor Spring	3.9 ± 0.0	6.1 ± 0.1	Smaller rim on dorsral margin
35LK3842	476-01	AINW/SC 276	Surface	PPT	Massacre Lake/Guano Valley	6.1 ± 0.1	NM ± NM	DFV
35LK3842	492-01	AINW/SC 292	Surface	PPT	Buck Mountain	4.8 ± 0.1	NM ± NM	--
35LK3842	507-01	AINW/SC 307	Surface	BLA	Surveyor Spring	NA ± NA	NM ± NM	REC; UNR, DFV
35LK3842	508-01	AINW/SC 308	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3842	522-01	AINW/SC 322	Surface	PPT	Cowhead Lake	5.0 ± 0.1	NM ± NM	--
35LK3842	532-01	AINW/SC 332	Surface	PPT	Surveyor Spring *	7.7 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3842	574-01	AINW/QTU 10	Surface	BLA	Unknown Obsidian 2	4.1 ± 0.1	NM ± NM	REC
35LK3842	585-01	AINW/TU 2	Level 1	BLA	Long Valley *	4.7 ± 0.1	NM ± NM	--
35LK3842	591-01	AINW/SC 353	Surface	PPT	Unknown Obsidian 1	3.9 ± 0.1	NM ± NM	DFV
35LK3842	594-01	AINW/SC 356	Surface	PPT	Cowhead Lake	6.1 ± 0.1	NM ± NM	--
35LK3842	595-01	AINW/SC 357	Surface	BLA	Buck Mountain	3.1 ± 0.1	NM ± NM	--
35LK3842	596-01	AINW/SC 358	Surface	FLT	Surveyor Spring	7.7 ± 0.1	NM ± NM	--
35LK3842	597-01	AINW/SC 359	Surface	PPT	Surveyor Spring	9.5 ± 0.1	NM ± NM	--
35LK3842	598-01	AINW/SC 360	Surface	BLA	Cowhead Lake	4.9 ± 0.0	NM ± NM	--
35LK3842	599-01	AINW/SC 361	Surface	PPT	Cowhead Lake	4.3 ± 0.1	NM ± NM	BEV on BRE (appears same)
35LK3842	602-01	AINW/SC 365	Surface	PPT	Buck Mountain *	NA ± NA	NM ± NM	REC; UNR, DFV
35LK3842	603-01	AINW/SC 366	Surface	PPT	Cowhead Lake *	4.8 ± 0.1	NM ± NM	--
35LK3842	607-01	AINW/SC 370	Surface	PPT	Cowhead Lake	4.8 ± 0.1	NM ± NM	--
35LK3327	1-01	SC 1	Surface	DEB	Surveyor Spring	7.2 ± 0.1	NM ± NM	NVH on dorsal margin, HV (fissures)
35LK3327	2-01	SC 2	Surface	DEB	Cowhead Lake	1.9 ± 0.1	NM ± NM	REC; appears burnt
35LK3327	3-01	SC 3	Surface	DEB	Spodue Mountain	6.4 ± 0.1	NM ± NM	NVH on BRE
35LK3327	4-01	SC 4	Surface	DEB	Surveyor Spring	8.5 ± 0.1	NM ± NM	BEV
35LK3327	5-01	SC 5	Surface	DEB	Cowhead Lake	6.5 ± 0.1	NM ± NM	--
35LK3327	6-01	SC 6	Surface	DEB	Surveyor Spring	7.3 ± 0.1	NM ± NM	DFV
35LK3327	7-01	SC 7	Surface	DEB	Surveyor Spring *	6.1 ± 0.1	NM ± NM	DFV
35LK3327	8-01	SC 8	Surface	DEB	Alturas FGV	NA ± NA	NM ± NM	UNR (crystalline)
35LK3327	9-01	SC 9	Surface	DEB	Cowhead Lake	6.3 ± 0.1	NM ± NM	DFV
35LK3327	10-01	SC 10	Surface	DEB	Beatys Butte	NA ± NA	NM ± NM	REC; UNR, DIS, DFV
35LK3327	11-01	SC 11	Surface	PPT	Massacre Lake/Guano Valley	7.4 ± 0.1	NM ± NM	DFV, OPA

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3327	13-01	SC 13	Surface	FLT	Cowhead Lake	3.1 ± 0.1	6.2 ± 0.1	Smaller rim on dorsal & ventral margins
35LK3327	16-01	SC 16	Surface	PPT	Buck Mountain	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3327	17-01	SC 17	Surface	PPT	Surveyor Spring	8.7 ± 0.1	NM ± NM	--
35LK3327	18-01	SC 18	Surface	COR	Cowhead Lake	3.8 ± 0.0	6.6 ± 0.1	Smaller rim on ventral & break margins
35LK3327	21-01	SC 21	Surface	BLA	Unknown Obsidian 2	5.2 ± 0.1	NM ± NM	HV (fissures), BEV
35LK3327	22-01	SC 22	Surface	BLA	Surveyor Spring	6.7 ± 0.1	NM ± NM	DFV
35LK3327	23-01	SC 23	Surface	BLA	Cowhead Lake	6.6 ± 0.1	NM ± NM	REC; DFV, PAT
35LK3327	25-01	SC 25	Surface	BLA	Cowhead Lake	1.7 ± 0.1	NM ± NM	--
35LK3327	27-01	SC 27	Surface	PPT	Cowhead Lake	5.7 ± 0.1	NM ± NM	--
35LK3327	28-01	SC 28	Surface	BLA	Buck Mountain	3.6 ± 0.1	NM ± NM	--
35LK3327	29-01	SC 29	Surface	BLA	Surveyor Spring	6.4 ± 0.1	NM ± NM	--
35LK3327	31-01	SC 31	Surface	PPT	Surveyor Spring	6.6 ± 0.1	NM ± NM	--
35LK3327	34-01	SC 34	Surface	BLA	Sugar Hill	6.5 ± 0.1	NM ± NM	--
35LK3327	36-01	SC 36	Surface	PPT	Badger Creek	3.5 ± 0.0	NM ± NM	--
35LK3327	38-01	SC 38	Surface	PPT	Sugar Hill	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3327	41-01	SC 41	Surface	DRL	Cowhead Lake *	2.6 ± 0.1	NM ± NM	NVH on BRE
35LK3327	42-01	SC 42	Surface	DEB	Unknown Obsidian 2	6.5 ± 0.1	NM ± NM	--
35LK3327	48-01-1	ST 7	0-35	PPT	Surveyor Spring *	5.4 ± 0.1	NM ± NM	--
35LK3327	50-01-1	ST 9	0-50	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3327	57-01-1	QTU 5	Level 1	COR	Surveyor Spring	8.9 ± 0.1	NM ± NM	--
35LK3327	104-04	TU 1	Level 4	FLT	Unknown Obsidian 2	5.0 ± 0.1	NM ± NM	--
35LK3327	108-04	TU 2	Level 4	BLA	Cowhead Lake	4.0 ± 0.1	NM ± NM	--
35LK3327	110-03	TU 3	Level 1	SCR	Surveyor Spring	9.1 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3327	124-02	TU 5	Level 5	DEB	Surveyor Spring	7.7 ± 0.1	NM ± NM	--
35LK3327	126-02	TU 5	Level 7	DEB	Surveyor Spring	7.0 ± 0.1	NM ± NM	--
35LK3327	128-04	TU 5	Level 9	PPT	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK3327	137-02	TU 6	Level 7	FLT	Surveyor Spring	6.0 ± 0.1	NM ± NM	--
35LK3327	138-03	TU 6	Level 8	DEB	Pope Spring B FGV	NM ± NM	NM ± NM	Not cut
35LK3327	153-03	TU 8	Level 5	PPT	Unknown Obsidian 2 *	6.1 ± 0.1	NM ± NM	--
35LK3327	177-02-1	TU 11	Level 7	FLT	Pope Spring B FGV	NM ± NM	NM ± NM	Not cut
35LK3327	186-02	TU 12	Level 8	BLA	Surveyor Spring	6.3 ± 0.1	NM ± NM	--
35LK3327	207-03	TU 14	Level 9	BLA	Surveyor Spring	8.1 ± 0.1	NM ± NM	HV (fissures)
35LK3327	215-03-1	TU 15	Level 7	FLT	Surveyor Spring	7.1 ± 0.1	NM ± NM	NVH on ventral margin (flake scar)
35LK3327	239-04	TU 17	Level 9	BLA	Pope Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3327	243-02	TU 18	Level 3	DEB	Surveyor Spring	6.4 ± 0.1	NM ± NM	Rim located on ventral surface
35LK3327	245-03	TU 18	Level 5	DEB	Surveyor Spring	7.2 ± 0.1	NM ± NM	HV (fissures)
35LK3327	248-04	TU 18	Level 8	PPT	Sugar Hill	6.4 ± 0.1	NM ± NM	REC
35LK3327	257-05	TU 19	Level 7	COR	Pope Spring B FGV	NM ± NM	NM ± NM	Not cut
35LK3327	267-03	TU 20	Level 7	BLA	Cowhead Lake	5.7 ± 0.1	NM ± NM	--
35LK3327	275-02-1	TU 21	Level 7	FLT	Surveyor Spring	6.5 ± 0.1	NM ± NM	Dorsal is UNR, HV (fissures)
35LK3327	289-02	TU 23	Level 4	DEB	Surveyor Spring	8.1 ± 0.1	NM ± NM	REC
35LK3327	292-02-1	TU 23	Level 7	FLT	Pope Spring B FGV	NM ± NM	NM ± NM	Not cut
35LK3327	293-03	TU 23	Level 8	PPT	Beatys Butte *	4.5 ± 0.1	NM ± NM	--
35LK3327	307-02	TU 25	Level 4	PPT	Unknown FGV B	NA ± NA	NM ± NM	UNR (crystalline)
35LK3327	310-02-S1	TU 25	Level 7	DEB	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3327	317-02-3	TU 26	Level 6	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3327	325-02-1	TU 27	Level 6	BLA	Surveyor Spring	8.1 ± 0.1	NM ± NM	REC
35LK3327	351-01	SC 48	Surface	KNI	Cowhead Lake	6.4 ± 0.1	NM ± NM	REC; DFV, HV
35LK4161	1-01	SC 1	Surface	FLT	Surveyor Spring	6.1 ± 0.1	NM ± NM	--
35LK4161	2-01	SC 2	Surface	DEB	Surveyor Spring *	1.6 ± 0.1	5.9 ± 0.1	Smaller rim on dorsal margin
35LK4161	3-01	SC 3	Surface	DEB	Cowhead Lake *	4.5 ± 0.1	NM ± NM	--
35LK4161	4-01	SC 4	Surface	DEB	Cowhead Lake	3.8 ± 0.1	NM ± NM	--
35LK4161	5-01	SC 5	Surface	DEB	Cowhead Lake *	4.1 ± 0.1	NM ± NM	--
35LK4161	6-01	SC 6	Surface	DEB	Cowhead Lake	3.6 ± 0.1	NM ± NM	--
35LK4161	7-01	SC 7	Surface	FLT	Cowhead Lake	3.9 ± 0.1	NM ± NM	--
35LK4161	8-01	SC 8	Surface	DEB	Cowhead Lake	2.6 ± 0.1	4.0 ± 0.1	Smaller rim on dorsal margin
35LK4161	15-01	SC 15	Surface	PPT	Cowhead Lake	3.6 ± 0.1	NM ± NM	--
35LK4161	16-01	SC 16	Surface	PPT	Cowhead Lake	5.1 ± 0.1	NM ± NM	--
35LK4161	18-01	SC 18	Surface	FLT	Cowhead Lake	4.2 ± 0.1	NM ± NM	--
35LK4140	1-01	SC 1	Surface	FLT	Unknown Obsidian 4	NA ± NA	NM ± NM	REC; UNR, OPA
35LK4140	2-01	SC 2	Surface	BLA	Cowhead Lake	3.3 ± 0.1	4.3 ± 0.1	Smaller rim on BRE
35LK4140	3-01	SC 3	Surface	DEB	Unknown Obsidian 2	4.2 ± 0.1	NM ± NM	--
35LK4140	4-01	SC 4	Surface	FLT	Unknown Obsidian 1	3.3 ± 0.1	NM ± NM	--
35LK4140	5-01	SC 5	Surface	DEB	Surveyor Spring	5.1 ± 0.1	NM ± NM	--
35LK4140	6-01	SC 6	Surface	DEB	Cowhead Lake	3.0 ± 0.1	NM ± NM	--
35LK4140	7-01	SC 7	Surface	FLT	Surveyor Spring	6.7 ± 0.1	NM ± NM	--
35LK4140	8-01	SC 8	Surface	FLT	Unknown Obsidian 2	3.7 ± 0.1	NM ± NM	--
35LK4140	9-01	SC 9	Surface	DEB	Unknown Obsidian 2	3.0 ± 0.1	NM ± NM	--
35LK4140	10-01	SC 10	Surface	DEB	Cowhead Lake	4.3 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4140	11-01	SC 11	Surface	PPT	Cowhead Lake *	5.8 ± 0.1	NM ± NM	DFV
35LK4140	12-01	SC 12	Surface	CHO/HA	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4140	13-01	SC 13	Surface	FLT	Not FGV	NM ± NM	NM ± NM	Not cut
35LK4140	14-01	SC 14	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK4140	17-01	SC 17	Surface	BLA	Unknown Obsidian 2	4.3 ± 0.1	NM ± NM	NVH on dorsal margin
35LK4140	18-01	SC 18	Surface	PPT	Rainbow Mines	4.8 ± 0.1	NM ± NM	--
35LK4140	19-01	SC 19	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK4140	21-01	SC 21	Surface	PPT	Parsnip Creek	4.1 ± 0.1	NM ± NM	--
35LK4140	22-01	SC 22	Surface	PPT	Tucker Hill *	1.9 ± 0.0	NM ± NM	--
35LK4140	23-01	SC 23	Surface	PPT	Surveyor Spring *	2.8 ± 0.1	NM ± NM	--
35LK4140	24-01	SC 24	Surface	PPT	Sugar Hill *	1.5 ± 0.1	NM ± NM	BEV on dorsal surface
35LK4140	25-01	SC 25	Surface	PPT	Buck Mountain *	2.0 ± 0.0	NM ± NM	--
35LK4140	26-01	SC 26	Surface	PPT	Massacre Lake/Guano Valley	1.7 ± 0.0	4.3 ± 0.1	Smaller rim on fresh BRE
35LK4140	27-01	SC 27	Surface	FLT	Unknown Obsidian 2	5.2 ± 0.1	NM ± NM	HV (fissures)
35LK4140	28-01	SC 28	Surface	PRE	Cowhead Lake	3.7 ± 0.1	NM ± NM	--
35LK4140	29-01	SC 29	Surface	PPT	Rainbow Mines	6.9 ± 0.1	NM ± NM	--
35LK4140	31-01	SC 31	Surface	PPT	Surveyor Spring	5.3 ± 0.1	NM ± NM	BEV, DFV
35LK4140	32-01	SC 32	Surface	PPT	Sugar Hill	6.6 ± 0.1	NM ± NM	--
35LK4140	33-01	SC 33	Surface	BLA	Surveyor Spring	8.1 ± 0.1	NM ± NM	--
35LK4140	34-01	SC 34	Surface	PPT	Surveyor Spring	5.7 ± 0.1	NM ± NM	--
35LK4140	35-01	SC 35	Surface	CHO	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK4140	37-01	SC 39	Surface	BLA	Cowhead Lake	3.9 ± 0.1	NM ± NM	--
35LK4140	40-01	SC 40	Surface	COR	Unknown FGV	NM ± NM	NM ± NM	Not cut

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4140	41-01	SC 41	Surface	BLA	Cowhead Lake	1.4 ± 0.1	4.0 ± 0.1	Smaller rim on ventral margin
35LK4140	43-01	SC 43	Surface	COR	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4140	44-01	SC 44	Surface	CHO	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4140	45-01	SC 45	Surface	BLA	Massacre Lake/Guano Valley	3.9 ± 0.1	NM ± NM	--
35LK4140	46-01	SC 46	Surface	PPT	Unknown Obsidian 5	2.9 ± 0.1	NM ± NM	--
35LK4140	47-01	SC 47	Surface	BLA	Cowhead Lake	4.4 ± 0.1	8.2 ± 0.1	REC; larger rim on dorsal surface, WEA
35LK4140	48-01	SC 48	Surface	BLA	Surveyor Spring	4.2 ± 0.1	5.2 ± 0.1	REC; smaller rim on BRE
35LK4140	49-01	SC 49	Surface	PPT	Massacre Lake/Guano Valley	5.5 ± 0.1	NM ± NM	--
35LK4140	50-01	SC 50	Surface	SCR	Surveyor Spring	4.1 ± 0.1	7.1 ± 0.1	REC; larger rim on ventral surface
35LK4140	51-01	SC 51	Surface	PPT	Cowhead Lake	6.7 ± 0.0	NM ± NM	DFV
35LK4140	52-01	SC 52	Surface	FLT	Cowhead Lake *	3.2 ± 0.1	NM ± NM	--
35LK4140	53-01-1	QTU 1	Level 1	FLT	Cowhead Lake	2.8 ± 0.1	NM ± NM	--
35LK4140	53-01-2	QTU 1	Level 1	FLT	Cowhead Lake	3.9 ± 0.1	NM ± NM	--
35LK4140	53-01-3	QTU 1	Level 1	FLT	Cowhead Lake *	3.3 ± 0.1	NM ± NM	--
35LK4140	59-01-2	QTU 4	Level 1	FLT	Cowhead Lake	4.8 ± 0.1	NM ± NM	--
35LK4140	59-01-3	QTU 4	Level 2	FLT	Cowhead Lake	4.1 ± 0.1	NM ± NM	REC; possibly burnt
35LK3337	1-01	SC 1	Surface	PPT	Blue Spring	5.3 ± 0.1	NM ± NM	--
35LK3337	2-01	SC 2	Surface	PRE	Surveyor Spring	2.7 ± 0.1	NM ± NM	REC; possibly burnt
35LK3337	3-01	SC 3	Surface	PPT	Buck Mountain	2.0 ± 0.1	NM ± NM	--
35LK3337	4-01	SC 4	Surface	PPT	Cowhead Lake *	2.0 ± 0.1	NM ± NM	--
35LK3337	5-01	SC 5	Surface	PPT	Surveyor Spring	2.2 ± 0.1	8.0 ± 0.1	Smaller rim on dorsal surface
35LK3337	6-01	SC 6	Surface	BLA	Cowhead Lake	2.3 ± 0.1	NM ± NM	--
35LK3337	7-01	SC 7	Surface	PPT	Beatys Butte *	1.6 ± 0.1	3.1 ± 0.0	REC; larger rim on ventral scar

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3337	8-01	SC 8	Surface	PRE	Cowhead Lake	2.3 ± 0.1	NM ± NM	DFV
35LK3337	9-01	SC 9	Surface	PPT	Unknown Obsidian 6 *	2.3 ± 0.1	NM ± NM	--
35LK3337	10-01	SC 10	Surface	PPT	Cowhead Lake	4.8 ± 0.1	NM ± NM	--
35LK3337	11-01	SC 11	Surface	PPT	Cowhead Lake	3.6 ± 0.1	NM ± NM	--
35LK3337	12-01	SC 12	Surface	PPT	Tucker Hill	4.1 ± 0.1	NM ± NM	--
35LK3337	13-01	SC 13	Surface	PPT	Unknown Obsidian 2	2.4 ± 0.1	NM ± NM	--
35LK3337	14-01	SC 14	Surface	PPT	Surveyor Spring	4.1 ± 0.1	NM ± NM	--
35LK3337	15-01	SC 15	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3337	16-01	SC 16	Surface	BLA	Massacre Lake/Guano Valley	4.1 ± 0.1	NM ± NM	--
35LK3337	17-01	SC 17	Surface	FLT	Cowhead Lake	6.3 ± 0.1	NM ± NM	--
35LK3337	18-01	SC 18	Surface	PPT	Cowhead Lake *	2.2 ± 0.1	NM ± NM	--
35LK3337	19-01	SC 19	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3337	20-01	SC 20	Surface	FLT	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3337	21-01	SC 21	Surface	FLT	Cowhead Lake	2.0 ± 0.1	NM ± NM	--
35LK3337	22-01	SC 22	Surface	PPT	Rainbow Mines *	2.9 ± 0.1	NM ± NM	REC
35LK3337	23-01	SC 23	Surface	BLA	Cowhead Lake	2.0 ± 0.1	NM ± NM	--
35LK3337	24-01	SC 24	Surface	PPT	Mosquito Lake	3.2 ± 0.0	NM ± NM	REC
35LK3337	25-01	SC 25	Surface	BLA	Cowhead Lake	3.2 ± 0.1	4.7 ± 0.1	REC; larger rim on dorsal surface
35LK3337	26-01	SC 26	Surface	PPT	Rainbow Mines	6.4 ± 0.1	NM ± NM	--
35LK3337	27-01	SC 27	Surface	PPT	Parsnip Creek	3.3 ± 0.1	NM ± NM	NVH on BRE
35LK3337	29-01	SC 29	Surface	PPT	Blue Spring	2.5 ± 0.1	NM ± NM	--
35LK3337	30-01	SC 30	Surface	PPT	Sugar Hill	2.7 ± 0.0	NM ± NM	--
35LK3337	32-01	SC 32	Surface	PPT	Surveyor Spring	6.1 ± 0.1	NM ± NM	DFV, appears burnt

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3337	34-01	SC 34	Surface	PPT	Cowhead Lake	3.6 ± 0.1	NM ± NM	--
35LK3337	36-01	SC 36	Surface	FLT	Surveyor Spring	2.0 ± 0.1	NM ± NM	DFV, appears burnt
35LK3337	38-01	SC 38	Surface	FLT	Cowhead Lake	5.4 ± 0.1	5.5 ± 0.1	Larger rim on dorsal surface
35LK3337	39-01	SC 39	Surface	PPT	Surveyor Spring	7.4 ± 0.1	NM ± NM	--
35LK3337	40-01	SC 40	Surface	PPT	Drews Creek/Butcher Flat	4.2 ± 0.1	NM ± NM	--
35LK3337	41-01	SC 41	Surface	PPT	Unknown FGV B *	NM ± NM	NM ± NM	Not cut
35LK3337	42-01	SC 42	Surface	PPT	Buck Mountain *	2.6 ± 0.1	NM ± NM	--
35LK3337	48-03-1	QTU 5	Level 3	FLT	Cowhead Lake	1.9 ± 0.1	NM ± NM	--
35LK3337	60-01	QTU 6	Level 6	BLA	Cowhead Lake	NA ± NA	NM ± NM	REC; UNR, NVH?
35LK3337	62-01	QTU 9	Level 1	BLA	Unknown Obsidian 4	3.7 ± 0.1	NM ± NM	--
35LK3337	64-03	QTU 11	Level 1	FLT	Cowhead Lake *	2.0 ± 0.1	NM ± NM	REC; NVH on BRE
35LK3337	65-01-1	QTU 11	Level 2	FLT	Blue Spring	2.4 ± 0.1	NM ± NM	--
35LK3337	67-01-1	QTU 12	Level 1	FLT	Surveyor Spring	3.8 ± 0.1	NM ± NM	--
35LK3337	98-05	QTU 19	Level 3	FLT	Cowhead Lake	2.0 ± 0.1	4.9 ± 0.1	Smaller rim on BRE
35LK3337	201-01	SC 43	Surface	PPT	Cowhead Lake	2.6 ± 0.1	NM ± NM	--
35LK3337	202-01	SC 44	Surface	PRE	Surveyor Spring	5.0 ± 0.1	NM ± NM	--
35LK3337	203-01	SC 45	Surface	PPT	Tucker Hill	3.6 ± 0.0	NM ± NM	--
35LK3337	204-01	SC 46	Surface	PPT	Beatys Butte *	1.7 ± 0.1	NM ± NM	--
35LK3337	205-01	SC 47	Surface	FLT	Sugar Hill	2.7 ± 0.1	NM ± NM	--
35LK3337	283-02	TU 15	Surface	PPT	Massacre Lake/Guano Valley *	2.4 ± 0.1	NM ± NM	--
35LK3337	283-03	TU 15	Surface	PPT	Tucker Hill *	1.6 ± 0.1	NM ± NM	REC
35LK3337	283-04	TU 15	Surface	PPT	Surveyor Spring *	3.2 ± 0.1	NM ± NM	DES, DFV
35LK3337	284-02	QTU 15	Level 1	BLA	Unknown FGV	NM ± NM	NM ± NM	Not cut

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3337	284-03	TU 15	Level 1	PRE	Blue Spring *	1.9 ± 0.1	NM ± NM	--
35LK3337	284-04	TU 15	Level 1	PPT	McComb Butte *	1.4 ± 0.1	NM ± NM	--
35LK3337	284-05	TU 15	Level 1	PPT	Cowhead Lake *	2.3 ± 0.1	NM ± NM	--
35LK3337	284-07	TU 15	Level 1	PPT	Massacre Lake/Guano Valley *	2.6 ± 0.1	4.9 ± 0.1	Smaller rim on BRE
35LK3337	284-08	TU 15	Level 1	PRE	Massacre Lake/Guano Valley *	2.2 ± 0.1	NM ± NM	--
35LK3337	290-02	TU 16	Surface	PPT	Cowhead Lake *	2.1 ± 0.1	NM ± NM	--
35LK3337	291-03	TU 16	Level 1	PPT	Rainbow Mines *	2.5 ± 0.1	3.1 ± 0.1	Smaller rim on BRE
35LK3337	291-04	TU 16	Level 1	PRE	Surveyor Spring	2.4 ± 0.1	NM ± NM	--
35LK3337	291-05	TU 16	Level 1	PRE	Massacre Lake/Guano Valley *	3.4 ± 0.1	NM ± NM	--
35LK3337	291-06	TU 16	Level 1	PPT	Rainbow Mines *	2.3 ± 0.1	NM ± NM	REC; DFV, HV
35LK3337	295-01	TU 17	Level 1	PRE	Cowhead Lake	2.2 ± 0.1	NM ± NM	--
35LK3337	295-02	TU 17	Surface	PPT	Buck Mountain *	2.4 ± 0.1	NM ± NM	DFV
35LK3337	295-04	TU 17	Level 1	PPT	Surveyor Spring *	3.1 ± 0.1	NM ± NM	--
35LK3337	295-05	TU 17	Level 1	DRL	Cowhead Lake *	2.0 ± 0.1	NM ± NM	--
35LK3337	295-08	TU 17	Level 1	PPT	Buck Mountain *	2.8 ± 0.1	NM ± NM	DES
35LK3337	296-02	TU 17	Level 2	PPT	Mosquito Lake *	5.9 ± 0.1	NM ± NM	--
35LK3337	296-04	TU 17	Level 2	PRE	Surveyor Spring *	1.7 ± 0.1	NM ± NM	--
35LK3337	301-03	TU 18	Level 1	PPT	Surveyor Spring *	2.7 ± 0.1	NM ± NM	--
35LK3337	301-06	TU 18	Level 1	FLT	Cowhead Lake	2.3 ± 0.0	5.8 ± 0.1	Larger rim on dorsal surface
35LK3337	302-02	TU 18	Level 2	PPT	Massacre Lake/Guano Valley	2.8 ± 0.1	NM ± NM	--
35LK3337	305-01	TU 19	Surface	FLT	Unknown Obsidian 4 *	NA ± NA	NM ± NM	OPA, UNR
35LK3337	306-02	TU 19	Level 1	PPT	Tucker Hill *	1.7 ± 0.1	3.7 ± 0.1	PAT (possibly burnt)
35LK3337	306-03	TU 19	Level 1	PPT	Unknown Obsidian 2	3.0 ± 0.1	NM ± NM	WEA

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						Rim 1	Rim 2	
35LK3337	306-06	TU 19	Level 1	PRE	Buck Mountain *	2.8 ± 0.1	NM ± NM	--
35LK3337	306-06-1	TU 19	Level 1	PPT	Cowhead Lake *	2.3 ± 0.1	3.2 ± 0.1	Larger rim on ventral scar
35LK3337	306-06-2	TU 19	Level 1	PPT	Massacre Lake/Guano Valley *	2.2 ± 0.1	NM ± NM	--
35LK3337	306-06-3	TU 19	Level 1	PPT	Cowhead Lake *	2.2 ± 0.1	NM ± NM	--
35LK3337	307-05	TU 19	Level 2	PRE	Massacre Lake/Guano Valley *	1.7 ± 0.1	NM ± NM	OPA
35LK3337	312-03	TU 20	Level 1	PRE	Cowhead Lake *	2.0 ± 0.1	NM ± NM	PAT on BRE (appears same)
35LK3337	312-03-1	TU 20	Level 1	PPT	Cowhead Lake *	2.4 ± 0.1	NM ± NM	PAT on BRE (appears same)
35LK3337	312-03-2	TU 20	Level 1	PPT	Surveyor Spring *	1.3 ± 0.0	2.4 ± 0.1	Smaller rim on BRE
35LK3337	312-03-3	TU 20	Level 1	PPT	Cowhead Lake	5.0 ± 0.1	5.1 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK3337	312-03-4	TU 20	Level 1	PPT	Unknown Obsidian 1 *	2.1 ± 0.0	5.9 ± 0.1	Larger rim on dorsal margin
35LK3337	312-03-5	TU 20	Level 1	DRL	Sugar Hill? *	2.0 ± 0.1	NM ± NM	--
35LK3337	317-16	TU 20	Level 1	PPT	Buck Mountain *	1.5 ± 0.1	NM ± NM	DFV
35LK3337	320-04	TU 21	Level 3	PPT	Buck Mountain	NA ± NA	NM ± NM	REC; NVH (appears burnt)
35LK3337	334-02	TU 23	Level 3	PRE	Surveyor Spring *	1.9 ± 0.1	NM ± NM	--
35LK3337	335-03	TU 23	Level 4	PRE	Buck Mountain *	1.3 ± 0.1	NM ± NM	--
35LK3337	343-04	TU 24	Level 2	FLT	Cowhead Lake	3.5 ± 0.1	NM ± NM	NVH on dorsal scar
35LK3337	357-01	SC 1000	Surface	DRL	Unknown FGV F *	NM ± NM	NM ± NM	Not cut
35LK3337	358-01	SC 1001	Surface	PPT	Cowhead Lake *	2.1 ± 0.1	NM ± NM	--
35LK3337	359-01	SC 1002	Surface	PPT	Unknown Obsidian 1 *	2.2 ± 0.1	NM ± NM	REC; OPA, DFV
35LK3337	360-01	SC 1003	Surface	KNI	Tucker Hill	4.4 ± 0.1	NM ± NM	Ventral surface is BEV, appears same.
35LK3337	361-01	SC 1004	Surface	BLA	Unknown Obsidian 2	4.8 ± 0.1	NM ± NM	Ventral surface not included in cut
35LK3337	362-01	SC 1005	Surface	PRE	Surveyor Spring *	NA ± NA	NM ± NM	REC; UNR, WEA, DFV
35LK3337	363-01	SC 1006	Surface	PPT	Buck Mountain	5.1 ± 0.1	NM ± NM	NVH on dorsal margin; ventral surface is UNR

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3337	364-01	SC 1007	Surface	PRE	Cowhead Lake *	1.8 ± 0.0	NM ± NM	--
35LK3337	366-01	SC 1009	Surface	DRL	Buck Mountain	1.8 ± 0.1	2.4 ± 0.0	Rim 1 = cut A; Rims 2 & 3 (5.6 mic.) = cut B
35LK3337	367-01	SC 1010	Surface	BUR	Silver Lake/Sycan Marsh	5.7 ± 0.1	5.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B (B is DFV)
35LK3337	368-01	SC 1011	Surface	FLT	Unknown Obsidian 4	NA ± NA	NM ± NM	NVH, OPA
35LK3337	370-01	SC 1013	Surface	KNI	Cowhead Lake	2.1 ± 0.1	4.0 ± 0.1	Smaller rim on ventral margin
35LK3337	371-01	SC 1014	Surface	PPT	Surveyor Spring	6.3 ± 0.1	NM ± NM	--
35LK3337	372-01	SC 1015	Surface	PRE	Unknown Obsidian 4 *	4.7 ± 0.1	NM ± NM	--
35LK3337	374-01	SC 1017	Surface	PPT	Cowhead Lake	3.6 ± 0.1	3.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK3337	375-01	SC 1018	Surface	PPT	Rainbow Mines *	3.1 ± 0.1	NM ± NM	--
35LK3337	377-01	SC 1018	Surface	PPT	Spodue Mountain	NA ± NA	NM ± NM	REC; NVH (possibly burnt)
35LK3337	378-01	SC 1021	Surface	PPT	Tucker Hill	4.1 ± 0.1	NM ± NM	--
35LK3337	380-01	SC 1023	Surface	BLA	Sugar Hill	2.6 ± 0.1	NM ± NM	--
35LK3337	381-01	SC 1024	Surface	BLA	Drews Creek/Butcher Flat	2.3 ± 0.1	5.9 ± 0.0	Larger rim on platform; dorsal is BEV, UNR
35LK3337	382-01	SC 1025	Surface	PPT	Surveyor Spring	5.0 ± 0.1	5.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK3337	383-01	SC 1026	Surface	BLA	Surveyor Spring	1.7 ± 0.1	NM ± NM	--
35LK3337	384-01	SC 1027	Surface	PPT	Unknown Obsidian 1	5.4 ± 0.1	5.4 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK3337	385-01	SC 1028	Surface	PPT	Cowhead Lake *	1.7 ± 0.1	3.0 ± 0.1	Rim 3 = 5.4 microns
35LK3916	1-01	SC 1	Surface	DEB	Long Valley *	1.9 ± 0.1	NM ± NM	PAT, DFV
35LK3916	2-01	SC 2	Surface	COR	Long Valley	4.9 ± 0.1	8.4 ± 0.1	Rim 3 = 5.0 microns
35LK3916	3-01	SC 3	Surface	DEB	Buck Mountain *	4.2 ± 0.1	NM ± NM	--
35LK3916	4-01	SC 4	Surface	DEB	Cowhead Lake	1.7 ± 0.0	5.0 ± 0.1	Smaller rim on BRE
35LK3916	6-01	SC 6	Surface	DEB	Cowhead Lake *	1.3 ± 0.1	NM ± NM	--
35LK3916	7-01	SC 7	Surface	DEB	Cowhead Lake *	4.8 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3916	8-01	SC 8	Surface	DEB	Buck Mountain *	4.1 ± 0.1	NM ± NM	--
35LK3916	10-01	SC 10	Surface	FLT	Blue Spring	1.3 ± 0.1	NM ± NM	Same rim on all surfaces
35LK3891	1-01	SC 1	Surface	PRE	Silver Lake/Sycan Marsh	1.7 ± 0.1	NM ± NM	--
35LK3891	3-01	SC 3	Surface	PRE	Massacre Lake/Guano Valley	4.6 ± 0.1	NM ± NM	--
35LK3891	4-01	SC 4	Surface	BLA	Cowhead Lake	3.4 ± 0.1	NM ± NM	--
35LK3891	5-01	SC 5	Surface	BLA	Cowhead Lake	3.4 ± 0.1	NM ± NM	--
35LK3891	6-01	SC 6	Surface	PRE	Mosquito Lake	5.1 ± 0.1	NM ± NM	--
35LK3891	8-01	SC 8	Surface	PPT	Cowhead Lake	5.1 ± 0.1	NM ± NM	DFV
35LK3891	9-01	SC 9	Surface	PPT	Sugar Hill *	1.8 ± 0.1	NM ± NM	--
35LK3891	10-01	SC 10	Surface	DEB	Unknown FGV B *	4.2 ± 0.1	NM ± NM	DFV (crystalline)
35LK3891	11-01	SC 11	Surface	FLT	Cowhead Lake *	4.5 ± 0.1	NM ± NM	--
35LK3891	13-01	SC 13	Surface	FLT	Surveyor Spring	8.0 ± 0.1	NM ± NM	--
35LK3891	14-01	SC 14	Surface	PPT	Beatys Butte	1.4 ± 0.1	3.3 ± 0.1	Smaller rim on BRE
35LK3891	15-01	SC 15	Surface	FLT	Surveyor Spring	9.2 ± 0.1	NM ± NM	PAT
35LK3891	17-01	SC 17	Surface	DEB	Cowhead Lake	6.6 ± 0.1	NM ± NM	--
35LK3891	19-01	SC 19	Surface	DEB	Parsnip Creek	5.0 ± 0.1	NM ± NM	--
35LK3891	20-01	SC 20	Surface	PPT	Rainbow Mines *	2.3 ± 0.1	NM ± NM	--
35LK3891	21-01	SC 21	Surface	BLA	Dismal Spring FGV	NM ± NM	NM ± NM	Not cut
35LK3891	22-01	SC 22	Surface	DEB	Cowhead Lake *	3.9 ± 0.1	NM ± NM	--
35LK3891	23-01	SC 23	Surface	BLA	Cowhead Lake	6.2 ± 0.1	NM ± NM	--
35LK3891	24-01	SC 24	Surface	PRE	Rainbow Mines	1.8 ± 0.1	6.1 ± 0.1	Smaller rim on BRE & ventral scar; REC
35LK3891	29-01	QTU 3	Level 5	DEB	Buck Mountain	3.1 ± 0.1	NM ± NM	--
35LK3886	1-01	SC 1	Surface	DEB	Drews Creek/Butcher Flat *	2.2 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3886	2-01	SC 2	Surface	FLT	Cowhead Lake	1.5 ± 0.1	NM ± NM	--
35LK3886	3-01	SC 3	Surface	DEB	Cowhead Lake *	2.3 ± 0.1	NM ± NM	--
35LK3886	4-01	SC 4	Surface	DEB	Drews Creek/Butcher Flat *	1.7 ± 0.1	NM ± NM	--
35LK3886	5-01	SC 5	Surface	DEB	Cowhead Lake *	1.4 ± 0.1	NM ± NM	--
35LK3886	6-01	SC 6	Surface	DEB	Drews Creek/Butcher Flat *	NA ± NA	NM ± NM	NVH
35LK3886	7-01	SC 7	Surface	DEB	Drews Creek/Butcher Flat *	2.1 ± 0.1	NM ± NM	--
35LK3886	8-01	SC 8	Surface	DEB	Drews Creek/Butcher Flat *	1.5 ± 0.1	NM ± NM	--
35LK3886	9-01	SC 9	Surface	DEB	Drews Creek/Butcher Flat *	2.4 ± 0.0	NM ± NM	--
35LK3886	10-01	SC 10	Surface	DEB	Drews Creek/Butcher Flat *	2.0 ± 0.1	NM ± NM	--
35LK3889	1-01	SC 2	Surface	DEB	Buck Mountain	4.0 ± 0.1	NM ± NM	--
35LK3889	2-01	SC 3	Surface	FLT	Cowhead Lake *	3.4 ± 0.1	NM ± NM	DFV, PAT
35LK3889	3-01	SC 4	Surface	DEB	Cowhead Lake	4.7 ± 0.1	NM ± NM	--
35LK3889	4-01	SC 5	Surface	DEB	Sugar Hill	3.9 ± 0.1	NM ± NM	--
35LK3889	5-01	SC 6	Surface	DEB	Cowhead Lake *	6.6 ± 0.1	NM ± NM	--
35LK3889	6-01	SC 7	Surface	DEB	Cowhead Lake *	4.0 ± 0.1	NM ± NM	--
35LK3889	7-01	SC 8	Surface	DEB	Cowhead Lake *	4.0 ± 0.1	NM ± NM	--
35LK3889	9-01	SC 10	Surface	DEB	Cowhead Lake *	3.9 ± 0.1	NM ± NM	--
35LK3889	11-01	SC 12	Surface	PPT	Cowhead Lake	4.5 ± 0.1	NM ± NM	--
35LK3889	25-01	QTU 1	Surface	DEB	Cowhead Lake	6.0 ± 0.1	NM ± NM	DFV
35LK3889	25-01-S1	QTU 1	Surface	DEB	Buck Mountain	4.5 ± 0.1	NM ± NM	--
35LK4067	1-01	SC 1	Surface	DEB	Cowhead Lake *	3.8 ± 0.1	NM ± NM	--
35LK4067	2-01	SC 2	Surface	DEB	Sugar Hill *	4.8 ± 0.1	NM ± NM	--
35LK4067	3-01	SC 3	Surface	DEB	Drews Creek/Butcher Flat *	4.9 ± 0.0	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4067	4-01	SC 4	Surface	DEB	Sugar Hill *	1.8 ± 0.1	4.8 ± 0.1	Smaller rim on dorsal margin
35LK4067	5-01	SC 5	Surface	DEB	Cowhead Lake *	4.1 ± 0.1	NM ± NM	--
35LK4067	6-01	SC 6	Surface	DEB	Unknown FGV B *	NA ± NA	NM ± NM	UNR (crystalline)
35LK4067	7-01	SC 7	Surface	DEB	Unknown Obsidian 4 *	NA ± NA	NM ± NM	UNR, OPA
35LK4067	8-01	SC 8	Surface	DEB	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4067	9-01	SC 9	Surface	DEB	Drews Creek/Butcher Flat *	6.9 ± 0.0	NM ± NM	DFV
35LK4067	10-01	SC 10	Surface	DEB	Alturas FGV	NA ± NA	NM ± NM	UNR (crystalline)
35LK3996	1-01	SC 1	Surface	DEB	Unknown FGV B	NA ± NA	NM ± NM	REC; UNR (crystalline)
35LK3996	2-01	SC 2	Surface	DEB	Drews Creek/Butcher Flat *	5.9 ± 0.1	NM ± NM	--
35LK3996	3-01	SC 3	Surface	DEB	Sugar Hill	4.6 ± 0.1	NM ± NM	--
35LK3996	5-01	SC 5	Surface	DEB	Alturas FGV *	NA ± NA	NM ± NM	UNR (crystalline)
35LK3996	6-01	SC 6	Surface	DEB	Sugar Hill *	4.2 ± 0.1	NM ± NM	--
35LK3996	7-01	SC 7	Surface	DEB	Alturas FGV *	8.5 ± 0.1	NM ± NM	DFV
35LK3996	8-01	SC 8	Surface	DEB	Rainbow Mines	4.8 ± 0.1	NM ± NM	--
35LK3996	9-01	SC 9	Surface	DEB	Cowhead Lake	4.5 ± 0.1	NM ± NM	--
35LK3996	10-01	SC 10	Surface	DEB	Unknown FGV B *	NA ± NA	NM ± NM	UNR (crystalline)
35LK3996	11-01	SC 11	Surface	DEB	Sugar Hill	4.9 ± 0.1	NM ± NM	NVH on dorsal margin
35LK3986	1-01	SC 1	Surface	DEB	Alturas FGV	8.3 ± 0.1	NM ± NM	DFV (crystalline)
35LK3986	2-01	SC 2	Surface	DEB	Unknown Obsidian 6	3.8 ± 0.1	NM ± NM	--
35LK3986	3-01	SC 3	Surface	DEB	Buck Mountain	3.9 ± 0.1	NM ± NM	--
35LK3986	4-01	SC 4	Surface	DEB	Sugar Hill	3.9 ± 0.0	NM ± NM	IRR (fissures)
35LK3986	5-01	SC 5	Surface	DEB	Sugar Hill	4.2 ± 0.1	NM ± NM	--
35LK3986	6-01	SC 6	Surface	DEB	Sugar Hill	4.0 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3986	7-01	SC 7	Surface	FLT	Rainbow Mines	6.7 ± 0.1	NM ± NM	--
35LK3986	8-01	SC 8	Surface	DEB	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3986	9-01	SC 9	Surface	DEB	Sugar Hill *	4.2 ± 0.1	NM ± NM	--
35LK3986	10-01	SC 10	Surface	DEB	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3986	11-01	SC 11	Surface	COR	Sugar Hill	3.9 ± 0.0	6.2 ± 0.1	Smaller rim on dorsal surface
35LK3986	13-01	SC 13	Surface	PPT	Buck Mountain	4.1 ± 0.1	NM ± NM	--
35LK3986	15-01	SC 15	Surface	PPT	Blue Spring	3.6 ± 0.1	NM ± NM	DFV
35LK3986	16-01	SC 16	Surface	FLT	Unknown FGV B	NA ± NA	NM ± NM	UNR (crystalline)
35LK3986	17-01	SC 17	Surface	FLT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3986	18-01	SC 18	Surface	COR	Sugar Hill	4.2 ± 0.0	NM ± NM	--
35LK3982	1-01	SC 1	Surface	DEB	Blue Spring *	3.9 ± 0.1	NM ± NM	--
35LK3982	2-01	SC 2	Surface	DEB	Unknown FGV B *	NA ± NA	NM ± NM	UNR (crystalline)
35LK3982	3-01	SC 3	Surface	DEB	Sugar Hill *	3.9 ± 0.1	NM ± NM	--
35LK3982	5-01	SC 5	Surface	DEB	Blue Spring *	3.6 ± 0.1	NM ± NM	--
35LK3982	6-01	SC 6	Surface	DEB	Sugar Hill *	4.6 ± 0.1	NM ± NM	--
35LK3982	7-01	SC 7	Surface	DEB	Buck Mountain *	4.5 ± 0.0	NM ± NM	--
35LK3982	8-01	SC 8	Surface	COR	Sugar Hill	3.7 ± 0.1	NM ± NM	PAT
35LK3982	9-01	SC 9	Surface	DEB	Sugar Hill	4.3 ± 0.1	NM ± NM	--
35LK3982	10-01	SC 10	Surface	DEB	Buck Mountain *	3.6 ± 0.1	NM ± NM	--
35LK3982	11-01	SC 11	Surface	DEB	Blue Spring	3.6 ± 0.1	NM ± NM	--
35LK3990	5-01	SC 5	Surface	FLT	Rainbow Mines	5.2 ± 0.1	NM ± NM	--
35LK3990	8-01	SC 8	Surface	DEB	Cowhead Lake	6.1 ± 0.1	NM ± NM	--
35LK3990	9-01	SC 9	Surface	DEB	Unknown FGV B	NM ± NM	NM ± NM	Not cut

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3990	10-01	SC 10	Surface	DEB	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3990	13-01	SC 13	Surface	FLT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3990	14-01	SC 14	Surface	BLA	Blue Spring	6.1 ± 0.1	NM ± NM	HV, DFV
35LK3990	15-01	SC 15	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3990	52-01	QTU 10	Surface	DEB	Cowhead Lake	5.9 ± 0.1	NM ± NM	--
35LK3990	55-01	QTU 13	Surface	PPT	Buck Mountain	5.2 ± 0.1	NM ± NM	--
35LK3990	55-02	QTU 13	Surface	DEB	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK3989	1-01	SC 1	Surface	DEB	Cowhead Lake	6.3 ± 0.1	NM ± NM	--
35LK3989	2-01	SC 2	Surface	DEB	Sugar Hill	4.5 ± 0.1	NM ± NM	--
35LK3989	3-01	SC 3	Surface	DEB	Cowhead Lake	6.5 ± 0.1	NM ± NM	--
35LK3989	4-01	SC 4	Surface	DEB	Cowhead Lake	5.9 ± 0.1	NM ± NM	--
35LK3989	6-01	SC 6	Surface	DEB	Sugar Hill	3.6 ± 0.1	NM ± NM	--
35LK3989	7-01	SC 7	Surface	DEB	Buck Mountain	5.4 ± 0.1	NM ± NM	--
35LK3989	8-01	SC 8	Surface	DEB	Cowhead Lake	5.7 ± 0.1	NM ± NM	--
35LK3989	10-01	SC 10	Surface	DEB	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3989	13-01	SC 13	Surface	FLT	Tucker Hill	4.8 ± 0.1	NM ± NM	--
35LK3989	14-01	SC 14	Surface	SCR	Cowhead Lake	6.1 ± 0.1	NM ± NM	--
35LK3989	16-01	SC 16	Surface	COR	Cowhead Lake	6.1 ± 0.1	NM ± NM	--
35LK3989	17-01	SC 17	Surface	FLT	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK3989	18-01	SC 18	Surface	FLT	Cowhead Lake	2.8 ± 0.1	NM ± NM	--
35LK3989	21-01	SC 21	Surface	FLT	Sugar Hill	5.9 ± 0.1	NM ± NM	--
35LK3989	22-01	SC 22	Surface	FLT	Blue Spring	5.9 ± 0.1	NM ± NM	--
35LK3989	24-01	SC 24	Surface	KNI	Cowhead Lake	2.3 ± 0.0	5.9 ± 0.1	Smaller rim on ventral surface

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3989	25-01	SC 25	Surface	FLT	Surveyor Spring	6.5 ± 0.1	8.6 ± 0.1	Smaller rim on ventral margin
35LK3989	29-01	SC 29	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3989	37-01	SC 37	Surface	PPT	Tucker Hill	4.9 ± 0.1	NM ± NM	NVH on BRE
35LK3989	43-01	QTU 7	Level 1	FLT	Blue Spring	5.2 ± 0.1	NM ± NM	--
35LK3896	1-01	SC 1	Surface	DEB	Sugar Hill	6.2 ± 0.1	NM ± NM	--
35LK3896	2-01	SC 2	Surface	DEB	Cowhead Lake	6.0 ± 0.1	NM ± NM	--
35LK3896	3-01	SC 3	Surface	DEB	Sugar Hill	6.1 ± 0.1	NM ± NM	--
35LK3896	4-01	SC 4	Surface	DEB	Mosquito Lake	7.0 ± 0.1	NM ± NM	--
35LK3896	5-01	SC 5	Surface	DEB	Sugar Hill	5.8 ± 0.1	NM ± NM	--
35LK3896	6-01	SC 6	Surface	DEB	Cowhead Lake	6.7 ± 0.1	NM ± NM	--
35LK3896	8-01	SC 8	Surface	DEB	Sugar Hill	6.0 ± 0.1	NM ± NM	--
35LK3896	9-01	SC 9	Surface	DEB	Rainbow Mines	6.3 ± 0.1	NM ± NM	--
35LK3896	10-01	SC 10	Surface	FLT	Cowhead Lake	2.0 ± 0.1	12.4 ± 0.1	Larger rim on dorsal surface
35LK3896	11-01	SC 11	Surface	KNI	Buck Mountain	6.2 ± 0.1	NM ± NM	--
35LK3896	12-01	SC 12	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3896	14-01	SC 14	Surface	PPT	Sugar Hill	5.5 ± 0.1	NM ± NM	--
35LK3896	15-01	SC 15	Surface	KNI	Glass Buttes 3	4.1 ± 0.1	NM ± NM	--
35LK3896	17-01	SC 17	Surface	SCR	Sugar Hill	6.2 ± 0.1	NM ± NM	--
35LK3896	18-01	SC 18	Surface	SCR	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK3896	19-01	SC 19	Surface	SCR	Cowhead Lake	6.3 ± 0.1	NM ± NM	--
35LK3896	20-01	SC 20	Surface	PPT	Unknown Obsidian 10	7.0 ± 0.1	NM ± NM	--
35LK3896	22-01	SC 22	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3896	23-01	SC 23	Surface	BLA	Unknown Obsidian 11	7.2 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3896	26-01	SC 26	Surface	KNI	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3896	33-01	SC 33	Surface	BLA	Spodue Mountain *	6.1 ± 0.1	NM ± NM	--
35LK3896	34-01	SC 34	Surface	PPT	Cowhead Lake *	6.5 ± 0.1	NM ± NM	--
35LK3896	35-01	SC 35	Surface	BLA	Cowhead Lake	5.4 ± 0.1	NM ± NM	IRR, WEA
35LK3896	36-01	SC 36	Surface	KNI	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK3896	38-01	SC 38	Surface	PPT	Buck Mountain	5.0 ± 0.1	NM ± NM	WEA
35LK3896	56-01-1	QTU 4	Level 2	BLA	Del Prat Spring	6.1 ± 0.1	NM ± NM	DFV
35LK3896	62-01	QTU 8	Level 1	PPT	Silver Lake/Sycan Marsh	6.0 ± 0.1	NM ± NM	--
35LK3896	65-01	QTU 9	Surface	PPT	Buck Mountain	6.0 ± 0.1	NM ± NM	--
35LK3896	66-01-1	QTU 9	Level 2	FLT	Rainbow Mines	5.2 ± 0.1	NM ± NM	--
35LK3896	69-01	QTU 11	Surface	KNI	Cowhead Lake	6.7 ± 0.0	NM ± NM	--
35LK3896	70-01	QTU 12	Level 1	PPT	McComb Butte	4.5 ± 0.1	NM ± NM	--
35LK3896	71-02	QTU 13	Level 1	PPT	Cowhead Lake *	1.9 ± 0.0	NM ± NM	--
35LK3896	74-01	QTU 15	Surface	KNI	Blue Spring	5.3 ± 0.1	NM ± NM	WEA, UNR on BRE (appears same)
35LK3896	78-01	QTU 16	Surface	PPT	Buck Mountain	4.1 ± 0.1	NM ± NM	--
35LK3896	80-02	QTU 17	Level 1	FLT	Cowhead Lake	5.5 ± 0.1	NM ± NM	--
35LK3896	82-01	QTU 18	Level 1	PPT	Sugar Hill	5.9 ± 0.1	NM ± NM	--
35LK3896	90-01	QTU 23	Level 1	PPT	Sugar Hill	6.2 ± 0.1	NM ± NM	--
35LK3898	1-01	SC 1	Surface	DEB	Buck Mountain *	4.8 ± 0.1	NM ± NM	--
35LK3898	2-01	SC 2	Surface	PPT	Buck Mountain	3.2 ± 0.1	NM ± NM	Same rim on all surfaces
35LK3898	3-01	SC 3	Surface	DEB	Rainbow Mines	3.3 ± 0.1	NM ± NM	--
35LK3898	6-01	SC 6	Surface	DEB	Cowhead Lake	5.6 ± 0.1	NM ± NM	WEA, DFV
35LK3898	9-01	SC 9	Surface	DEB	Unknown FGV E *	NM ± NM	NM ± NM	Not cut

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3898	10-01	SC 10	Surface	DEB	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3898	11-01	SC 11	Surface	FLT	Blue Mountain	1.5 ± 0.1	2.9 ± 0.1	REC; smaller rim on BRE and dorsal scar
35LK3898	13-01	SC 13	Surface	DEB	Cowhead Lake	3.9 ± 0.1	NM ± NM	--
35LK3898	15-01	SC 15	Surface	DEB	Drews Creek/Butcher Flat	3.9 ± 0.1	NM ± NM	--
35LK3898	19-01	QTU 2	Level 1	DEB	Sugar Hill	6.0 ± 0.1	NM ± NM	--
35LK3898	27-01	QTU 9	Level 1	BLA	Alturas FGV	NA ± NA	NM ± NM	UNR (crystalline)
35LK3898	30-01	EPG/SC 2	Surface	DEB	Rainbow Mines *	7.7 ± 0.1	NM ± NM	REC; HV
35LK3903	1-01	SC 1	Surface	FLT	Blue Spring	4.4 ± 0.1	5.0 ± 0.1	REC; smaller rim on BRE
35LK3903	2-01	SC 2	Surface	BLA	Buck Mountain	NA ± NA	NM ± NM	REC; UNR (crystalline)
35LK3903	4-01	SC 4	Surface	DEB	Buck Mountain *	NA ± NA	NM ± NM	REC; UNR, HV (fissures)
35LK3903	5-01	SC 5	Surface	FLT	Cowhead Lake	6.5 ± 0.1	NM ± NM	--
35LK3903	6-01	SC 6	Surface	DEB	Unknown Obsidian 3	4.1 ± 0.1	NM ± NM	REC
35LK3903	7-01	SC 7	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3903	8-01	SC 8	Surface	DEB	Rainbow Mines	5.8 ± 0.1	NM ± NM	--
35LK3903	9-01	SC 9	Surface	SCR	Buck Mountain?	5.0 ± 0.1	NM ± NM	--
35LK3903	10-01	SC 10	Surface	DEB	Sugar Hill	6.3 ± 0.1	NM ± NM	--
35LK3903	11-01	SC 11	Surface	DEB	Buck Mountain	4.8 ± 0.1	NM ± NM	--
35LK3903	12-01	SC 12	Surface	FLT	Unknown FGV B *	NA ± NA	NM ± NM	UNR (crystalline)
35LK3903	13-01	SC 13	Surface	DEB	Blue Spring	4.8 ± 0.1	NM ± NM	Same rim on both surfaces
35LK4175	1-01	QTU 2	Level 1	PRE	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4176	1-01	QTU 1	Level 1	FLT	Unknown FGV B *	NA ± NA	NM ± NM	UNR (crystalline)
35LK4176	2-01	QTU 2	Level 2	DEB	Blue Spring *	3.9 ± 0.1	NM ± NM	--
35LK4176	3-01	QTU 2	Level 3	DEB	Harris Flat? *	3.6 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4176	4-01	QTU 2	Level 5	DEB	Sugar Hill *	3.9 ± 0.1	NM ± NM	--
35LK4176	5-01	QTU 4	Level 1	DEB	Cowhead Lake? *	6.9 ± 0.1	NM ± NM	DFV
35LK4176	6-01	QTU 4	Level 3	DEB	Silver Lake/Sycan Marsh *	6.6 ± 0.1	NM ± NM	--
35LK4173	1-01	SC 1	Surface	DEB	Sugar Hill	5.2 ± 0.1	NM ± NM	--
35LK4173	2-01	SC 2	Surface	FLT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK4173	3-01	SC 3	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4173	4-01	SC 4	Surface	COR	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4173	7-01	SC 7	Surface	FLT	Buck Mountain	5.1 ± 0.1	NM ± NM	--
35LK4173	6-01	SC 6	Surface	SCR	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4173	10-01	SC 10	Surface	COR	Sugar Hill	3.2 ± 0.1	NM ± NM	--
35LK4173	11-01	SC 11	Surface	BLA	Rainbow Mines	5.2 ± 0.1	NM ± NM	--
35LK4173	13-01	SC 13	Surface	FLT	Buck Mountain	5.4 ± 0.1	NM ± NM	--
35LK4173	14-01	SC 14	Surface	PPT	Tucker Hill	5.7 ± 0.1	NM ± NM	--
35LK4173	17-01	SC 17	Surface	BLA	Unknown Obsidian 9	NA ± NA	NM ± NM	OPA
35LK4173	19-01	SC 19	Surface	PPT	Drews Creek/Butcher Flat	5.8 ± 0.1	NM ± NM	NVH on BRE, rim from dorsal surface
35LK4173	20-01	SC 20	Surface	DEB	Buck Mountain *	5.5 ± 0.1	NM ± NM	--
35LK4173	22-01	SC 22	Surface	PPT	Blue Spring	5.5 ± 0.1	NM ± NM	WEA, DFV
35LK4173	23-01	SC 23	Surface	PPT	Witham Creek	3.4 ± 0.1	NM ± NM	--
35LK4173	24-01	SC 24	Surface	FLT	Rainbow Mines	6.1 ± 0.1	NM ± NM	--
35LK4173	25-01	SC 25	Surface	PPT	Badger Creek	1.7 ± 0.1	NM ± NM	Rim from dorsal margin
35LK4173	26-01	SC 26	Surface	KNI	Not FGV	NM ± NM	NM ± NM	Not cut
35LK4173	27-01	SC 27	Surface	PPT	Cowhead Lake	7.5 ± 0.1	NM ± NM	REC on BRE (same on all surfaces)
35LK4173	28-01	SC 28	Surface	KNI	Sugar Hill	6.3 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4173	29-01	SC 29	Surface	BLA	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4173	30-01	SC 30	Surface	PPT	Buck Mountain	6.1 ± 0.1	NM ± NM	--
35LK4173	31-01	SC 31	Surface	PPT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK4173	32-01	SC 32	Surface	PPT	Spodue Mountain	6.5 ± 0.1	NM ± NM	--
35LK4173	34-01	SC 34	Surface	SCR	Buck Mountain	9.4 ± 0.1	NM ± NM	DFV
35LK4173	35-01	SC 35	Surface	PPT	Spodue Mountain	NA ± NA	NM ± NM	UNR, WEA
35LK4173	36-01	SC 36	Surface	PRE	Cowhead Lake	6.5 ± 0.1	NM ± NM	--
35LK4173	37-01	SC 37	Surface	KNI	McComb Butte	4.0 ± 0.1	4.8 ± 0.1	Smaller rim on BRE
35LK4173	38-01	SC 38	Surface	BLA	Blue Mountain	1.7 ± 0.1	NM ± NM	--
35LK4173	39-01	SC 39	Surface	FLT	Buck Mountain	7.2 ± 0.1	NM ± NM	REC
35LK4173	40-01	SC 40	Surface	BLA	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4173	42-01	SC 42	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4173	44-01	SC 44	Surface	BLA	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4173	50-01	SC 50	Surface	KNI	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4173	54-01	SC 54	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4173	55-01	SC 55	Surface	COR	Rainbow Mines	4.1 ± 0.1	NM ± NM	--
35LK4173	56-01	SC 56	Surface	PPT	Unknown Obsidian 1	4.2 ± 0.1	NM ± NM	--
35LK4173	57-01	SC 57	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4173	58-01	SC 58	Surface	DEB	Cowhead Lake	6.0 ± 0.1	NM ± NM	--
35LK4173	59-01	SC 59	Surface	DEB	Sugar Hill	8.0 ± 0.1	NM ± NM	REC
35LK4173	60-01	SC 60	Surface	COR	Cowhead Lake	7.3 ± 0.1	NM ± NM	--
35LK4173	63-01	SC 63	Surface	DEB	Unknown FGV C	NM ± NM	NM ± NM	Not cut
35LK4173	65-01	SC 65	Surface	DEB	Cowhead Lake *	5.9 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4173	66-01	SC 66	Surface	BLA	Drews Creek/Butcher Flat	5.2 ± 0.1	7.1 ± 0.1	Smaller rim on ventral surface
35LK4173	67-01	SC 67	Surface	BLA	Sugar Hill	7.8 ± 0.1	NM ± NM	--
35LK4173	71-01	SC 71	Surface	PPT	Spodue Mountain	NA ± NA	NM ± NM	REC; UNR, WEA (approx. 6.1 microns)
35LK4173	78-01	SC 78	Surface	BLA	Sugar Hill	4.3 ± 0.1	5.2 ± 0.1	Smaller rim on BRE
35LK4173	82-01	SC 82	Surface	DEB	Cowhead Lake	7.0 ± 0.1	NM ± NM	--
35LK4173	84-01	SC 84	Surface	FLT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK4172	2-01	SC 2	Surface	PPT	Buck Mountain	5.4 ± 0.1	NM ± NM	DFV
35LK4172	3-01	SC 3	Surface	PPT	Cowhead Lake	6.2 ± 0.1	NM ± NM	DFV
35LK4172	4-01	SC 4	Surface	DEB	Cowhead Lake	6.7 ± 0.1	NM ± NM	--
35LK4172	5-01	SC 5	Surface	WFL	Cowhead Lake	6.8 ± 0.1	NM ± NM	HV, DFV
35LK4172	6-01	SC 6	Surface	DEB	Cowhead Lake *	7.9 ± 0.1	NM ± NM	HV, DFV
35LK4134	1-01	SC 1	Surface	DEB	Buck Mountain	4.9 ± 0.1	NM ± NM	--
35LK4134	2-01	SC 2	Surface	DEB	Sugar Hill	7.0 ± 0.1	NM ± NM	--
35LK4134	3-01	SC 3	Surface	FLT	Buck Mountain	2.2 ± 0.1	NM ± NM	Dorsal surface is BEV, DFV
35LK4134	4-01	SC 4	Surface	FLT	Buck Mountain	4.1 ± 0.1	NM ± NM	--
35LK4134	5-01	SC 5	Surface	PRE	Buck Mountain	3.4 ± 0.1	NM ± NM	--
35LK4134	6-01	SC 6	Surface	DEB	Sugar Hill	2.3 ± 0.1	NM ± NM	--
35LK4134	7-01	SC 7	Surface	FLT	Buck Mountain	7.1 ± 0.1	NM ± NM	HV
35LK4134	8-01	SC 8	Surface	DEB	Cowhead Lake	5.8 ± 0.1	NM ± NM	--
35LK4134	9-01	SC 9	Surface	FLT	Cowhead Lake	3.5 ± 0.1	7.1 ± 0.1	Smaller rim on dorsal & ventral margins
35LK4134	10-01	SC 10	Surface	COR	Rainbow Mines	3.6 ± 0.1	NM ± NM	--
35LK4134	11-01	SC 11	Surface	COR	Buck Mountain	4.5 ± 0.1	NM ± NM	--
35LK4134	13-01	SC 13	Surface	BLA	Buck Mountain	3.8 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4134	14-01	SC 14	Surface	BIF	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4134	15-01	SC 15	Surface	BLA	Sugar Hill	4.1 ± 0.1	NM ± NM	--
35LK4134	16-01	SC 16	Surface	BLA	Buck Mountain	4.0 ± 0.1	3.9 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK4134	17-01	SC 17	Surface	BIF	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4134	18-01	SC 18	Surface	PRE	Cowhead Lake	3.2 ± 0.1	NM ± NM	DFV
35LK4134	19-01	SC 19	Surface	BLA	Sugar Hill	3.8 ± 0.1	NM ± NM	--
35LK4134	20-01	SC 20	Surface	PPT	Sugar Hill *	5.3 ± 0.1	NM ± NM	--
35LK4134	21-01	SC 21	Surface	PPT	Spodue Mountain	NA ± NA	NM ± NM	WEA, UNR (rim is approx. 10.5 microns)
35LK4134	22-01	SC 22	Surface	PPT	Cougar Mountain	4.6 ± 0.1	NM ± NM	REC; NVH on BRE
35LK4134	24-01	SC 24	Surface	PPT	Cowhead Lake *	3.9 ± 0.1	NM ± NM	--
35LK4134	25-01	SC 25	Surface	FLT	Cowhead Lake	6.8 ± 0.1	NM ± NM	--
35LK4134	27-01	SC 27	Surface	BLA	Buck Mountain	4.8 ± 0.1	NM ± NM	WEA, HV, dorsal is UNR
35LK4134	33-01	SC 33	Surface	BLA	Sugar Hill	3.0 ± 0.1	NM ± NM	--
35LK4134	34-01	SC 34	Surface	CRE	Sugar Hill	NM ± NM	NM ± NM	Not cut
35LK4134	35-01	SC 35	Surface	KNI	Rainbow Mines	7.1 ± 0.1	NM ± NM	DFV (crystalline)
35LK4134	36-01	SC 36	Surface	BLA	Tucker Hill	4.2 ± 0.1	4.2 ± 0.1	WEA, DFV; same rims on A & B cuts
35LK4134	37-01	SC 37	Surface	BLA	Mosquito Lake	7.1 ± 0.1	NM ± NM	--
35LK4134	38-01	SC 38	Surface	PPT	Buck Mountain	3.6 ± 0.1	NM ± NM	--
35LK4134	39-01	SC 39	Surface	PPT	Buck Mountain	1.1 ± 0.1	4.4 ± 0.1	Rims 1 & 2 = cut A; Rim 3 = cut B (4.5 mic.)
35LK4134	40-01	SC 40	Surface	PPT	GF/LIW/RS	1.5 ± 0.1	4.7 ± 0.1	Rims 1 & 2 = cut A; Rim 3 = cut B (4.7 mic.)
35LK4134	41-01	SC 41	Surface	PPT	Buck Mountain	6.0 ± 0.1	NM ± NM	WEA, DFV (crystalline), BRE is UNR
35LK4134	42-01	SC 42	Surface	PPT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK4134	43-01	SC 43	Surface	KNI	Unknown FGV C	NM ± NM	NM ± NM	Not cut

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4134	44-01	SC 44	Surface	PPT	Cowhead Lake	4.4 ± 0.1	NM ± NM	--
35LK4134	45-01	SC 45	Surface	PPT	Cowhead Lake	4.5 ± 0.1	NM ± NM	--
35LK4134	47-01	SC 47	Surface	BLA	Sugar Hill	3.6 ± 0.1	NM ± NM	--
35LK4134	49-01	SC 49	Surface	BLA	Del Prat Spring	5.6 ± 0.1	NM ± NM	--
35LK4134	61-01	SC 61	Surface	BLA	Rainbow Mines	4.6 ± 0.1	NM ± NM	--
35LK4134	62-01	SC 62	Surface	KNI	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4134	63-01	SC 63	Surface	PPT	Buck Mountain	3.2 ± 0.1	NM ± NM	--
35LK4134	64-01	SC 64	Surface	PPT	Cowhead Lake	3.4 ± 0.1	3.4 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK4134	65-01	SC 65	Surface	PPT	Silver Lake/Sycan Marsh	2.9 ± 0.1	NM ± NM	WEA, DFV
35LK4134	66-01	SC 66	Surface	COR	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4134	74-01	SC 74	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4134	75-01	SC 75	Surface	COR	Buck Mountain	4.8 ± 0.1	NM ± NM	--
35LK4134	77-01	SC 77	Surface	PRE	Tucker Hill *	4.8 ± 0.1	NM ± NM	--
35LK4134	81-01	SC 81	Surface	PPT	Blue Mountain	1.7 ± 0.1	NM ± NM	--
35LK4134	82-01	SC 82	Surface	DEB	Cowhead Lake	5.5 ± 0.1	NM ± NM	--
35LK4134	83-01	SC 83	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4134	88-01	SC 88	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4134	92-01	SC 92	Surface	SCR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4134	97-01	SC 97	Surface	COS	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4134	114-01-1	QTU-1	Level 1	FLT	East Medicine Lake	5.8 ± 0.1	NM ± NM	--
35LK4135	1-01	SC 1	Surface	BLA	Sugar Hill	3.2 ± 0.1	NM ± NM	--
35LK4135	4-01	SC 4	Surface	DEB	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4135	5-01	SC 5	Surface	FLT	Buck Mountain	4.6 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4135	6-01	SC 6	Surface	DEB	Buck Mountain	3.1 ± 0.1	NM ± NM	--
35LK4135	7-01	SC 7	Surface	DEB	Rainbow Mines	6.4 ± 0.1	NM ± NM	NVH on dorsal scar
35LK4135	8-01	SC 8	Surface	DEB	Sugar Hill	4.5 ± 0.1	NM ± NM	--
35LK4135	9-01	SC 9	Surface	DEB	Cowhead Lake	4.3 ± 0.1	NM ± NM	NVH on dorsal margin
35LK4135	10-01	SC 10	Surface	FLT	Sugar Hill	8.5 ± 0.1	NM ± NM	--
35LK4135	12-01	SC 12	Surface	PPT	Buck Mountain	5.2 ± 0.1	NM ± NM	--
35LK4135	13-01	SC 13	Surface	PPT	Rainbow Mines *	1.5 ± 0.1	4.3 ± 0.1	Smaller rim on BRE
35LK4135	17-01	SC 17	Surface	SCR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4135	18-01	SC 18	Surface	FLT	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4135	21-01	SC 21	Surface	DEB	Blue Spring	5.3 ± 0.1	NM ± NM	--
35LK4135	22-01	SC 22	Surface	SCR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4135	26-01	SC 26	Surface	FLT	Buck Mountain	5.8 ± 0.1	NM ± NM	NVH on dorsal margin
35LK4135	28-01	SC 28	Surface	SCR	Cowhead Lake	7.3 ± 0.1	NM ± NM	--
35LK4135	29-01	SC 29	Surface	SCR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4135	34-01	SC 34	Surface	DEB	Cowhead Lake	6.6 ± 0.1	NM ± NM	--
35LK4130	2-01	SC 2	Surface	BLA	Rainbow Mines	6.9 ± 0.1	NM ± NM	--
35LK4130	4-01	SC 4	Surface	BLA	Buck Mountain	8.4 ± 0.1	NM ± NM	--
35LK4130	6-01	SC 6	Surface	DRL	Blue Mountain	2.1 ± 0.1	NM ± NM	DFV
35LK4130	8-01	SC 8	Surface	BLA	Blue Mountain	2.8 ± 0.1	NM ± NM	--
35LK4130	9-01	SC 9	Surface	PPT	Grasshopper Group *	7.6 ± 0.1	NM ± NM	DFV
35LK4130	13-01	SC 13	Surface	FLT	Sugar Hill	7.1 ± 0.1	NM ± NM	HV
35LK4130	16-01	SC 16	Surface	KNI	Unknown FGV C	NM ± NM	NM ± NM	Not cut
35LK4130	18-01	SC 18	Surface	FLT	Buck Mountain	6.1 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4130	19-01	SC 19	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4130	20-01	SC 20	Surface	PPT	Spodue Mountain	6.2 ± 0.1	NM ± NM	--
35LK4130	30-01	SC 30	Surface	COR	Buck Mountain	6.8 ± 0.1	NM ± NM	--
35LK4130	33-01	SC 33	Surface	PPT	Spodue Mountain	NA ± NA	NM ± NM	UNR, HV (5.2 - 6.0 microns on all surfaces)
35LK4130	35-01	SC 35	Surface	PPT	Sugar Hill	4.7 ± 0.1	NM ± NM	--
35LK4130	36-01	SC 36	Surface	DEB	Buck Mountain	4.3 ± 0.1	NM ± NM	NVH on BRE
35LK4130	37-01	SC 37	Surface	FLT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK4130	40-01	SC 40	Surface	BUR	Buck Mountain	6.0 ± 0.1	NM ± NM	--
35LK4130	42-01	SC 42	Surface	KNI	Tucker Hill	5.8 ± 0.1	NM ± NM	PAT, DFV
35LK4130	46-01	SC 46	Surface	DEB	Sugar Hill	4.7 ± 0.1	NM ± NM	REC
35LK4130	47-01	SC 47	Surface	DEB	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4130	49-01	SC 49	Surface	PPT	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4130	51-01	SC 51	Surface	COR	Harris Flat?	5.1 ± 0.1	NM ± NM	--
35LK4130	52-01	SC 52	Surface	SCR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4130	55-01	SC 55	Surface	PPT	Blue Mountain	2.2 ± 0.1	NM ± NM	--
35LK4130	56-01	SC 56	Surface	DEB	Sugar Hill	3.3 ± 0.1	NM ± NM	--
35LK4130	58-01	SC 58	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4130	59-01	SC 59	Surface	PPT	Blue Spring	1.9 ± 0.1	NM ± NM	Appears burnt
35LK4130	60-01	SC 60	Surface	PPT	Buck Mountain *	4.1 ± 0.1	NM ± NM	NVH on BRE
35LK4130	61-01	SC 61	Surface	PPT	Cowhead Lake	2.1 ± 0.1	NM ± NM	--
35LK4130	65-01	SC 65	Surface	KNI	Blue Mountain	3.2 ± 0.1	NM ± NM	--
35LK4130	66-01	SC 66	Surface	PPT	Spodue Mountain	8.4 ± 0.1	NM ± NM	NVH on ventral surface
35LK4130	68-01	SC 68	Surface	FLT	Buck Mountain	5.2 ± 0.1	6.8 ± 0.1	Smaller rim on dorsal surface

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4130	69-01	SC 69	Surface	PPT	Unknown FGV C	NM ± NM	NM ± NM	Not cut
35LK4130	71-01	SC 71	Surface	PPT	Blue Spring	6.3 ± 0.1	NM ± NM	--
35LK4130	74-01	SC 74	Surface	KNI	Tucker Hill	4.8 ± 0.1	NM ± NM	--
35LK4130	75-01	SC 75	Surface	PPT	GF/LIW/RS	5.0 ± 0.1	NM ± NM	NVH on BRE
35LK4130	76-01	SC 76	Surface	PRE	Buck Mountain *	1.9 ± 0.1	NM ± NM	--
35LK4130	86-01	ST 34	0-40	BUR	Cowhead Lake	6.0 ± 0.1	NM ± NM	--
35LK4130	89-01	ST 42	0-44	COR	Sugar Hill	4.3 ± 0.1	NM ± NM	--
35LK4130	116-02	QTU 2	Level 5	PPT	Blue Spring	5.0 ± 0.1	NM ± NM	PAT, DFV
35LK4130	124-01-1	QTU-4	Level 1	FLT	Buck Mountain	10.2 ± 0.1	NM ± NM	--
35LK4130	153-02	QTU 12	Level 6	PPT	Tucker Hill	5.0 ± 0.1	NM ± NM	--
35LK4130	167-01-2	QTU-16	Level 2	PPT	Buck Mountain *	4.8 ± 0.1	NM ± NM	--
35LK4130	175-02	QTU-18	Level 1	FLT	Buck Mountain	7.1 ± 0.1	NM ± NM	NVH on dorsal margin
35LK4130	192-01-1	QTU-22	Level 1	FLT	Unknown FGV E	NM ± NM	NM ± NM	Not cut
35LK4130	197-01-1	TU-26	Level 4	FLT	Buck Mountain	5.0 ± 0.1	NM ± NM	--
35LK4130	214-01	SC 79	Surface	PPT	McComb Butte	4.8 ± 0.1	NM ± NM	--
35LK4130	215-01	SC 80	Surface	PPT	Blue Mountain	2.1 ± 0.1	NM ± NM	NVH on BRE
35LK4130	216-01	SC 81	Surface	FLT	Sugar Hill	7.7 ± 0.1	NM ± NM	REC
35LK4130	217-01	SC 82	Surface	PPT	Buck Mountain	5.3 ± 0.1	NM ± NM	--
35LK4130	220-01	SC 85	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4130	221-01	SC 86	Surface	SCR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4130	222-01	SC 87	Surface	SCR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4130	224-01	SC 89	Surface	KNI	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4130	232-02-1-1	QTU-23	Level 3	FLT	Rainbow Mines	4.9 ± 0.1	NM ± NM	REC

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4130	237-01-1	QTU-23	Level 8	FLT	Cowhead Lake	5.4 ± 0.1	NM ± NM	Dorsal surface is HV (fissures)
35LK4130	309-03	TU A02	Level 4	PPT	Cowhead Lake	7.0 ± 0.1	NM ± NM	NVH on dorsal margin
35LK4130	309-04	TU A02	Level 4	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4130	320-03	TU-A04	Level 3	PPT	Buck Mountain *	5.1 ± 0.1	NM ± NM	--
35LK4130	326-02-1	TU-A06	Level 1	COR	Blue Spring	6.3 ± 0.1	NM ± NM	--
35LK4130	326-04-1	TU-A06	Level 1	FLT	Buck Mountain	5.1 ± 0.1	NM ± NM	--
35LK4130	333-02-1	TU-A07	Level 3	COR	Sugar Hill	6.9 ± 0.1	NM ± NM	--
35LK4130	359-04	TU B02	Level 4	PPT	Sugar Hill	4.1 ± 0.1	NM ± NM	--
35LK4130	360-02	TU B02	--	PPT	Grasshopper Group *	4.3 ± 0.1	NM ± NM	--
35LK4130	368-03	TU B03	Level 2	PPT	Rainbow Mines *	5.3 ± 0.1	NM ± NM	--
35LK4130	393-03	TU B05	Level 5	PPT	Buck Mountain *	2.3 ± 0.1	5.3 ± 0.0	Larger rim on dorsal surface
35LK4130	406-02-1	TU-B06	Level 8	FLT	Buck Mountain	3.4 ± 0.1	NM ± NM	Ventral surface is PAT, UNR (burnt?)
35LK4130	412-02-1	TU-B07	Level 5	BLA	Sugar Hill	5.9 ± 0.1	NM ± NM	PAT, DFV
35LK4130	421-03	TU-B08	Level 4	FLT	Sugar Hill	3.3 ± 0.1	NM ± NM	Ventral surface is PAT, DFV
35LK4130	421-04	TU B08	Level 4	PPT	Cowhead Lake *	3.5 ± 0.1	NM ± NM	REC
35LK4130	423-04	TU B08	Level 6	PPT	Buck Mountain *	6.5 ± 0.1	NM ± NM	BEV on dorsal, rim appears same on all
35LK4130	424-02-1	TU-B08	Level 7	PRE	Buck Mountain	3.4 ± 0.1	NM ± NM	PAT, DFV
35LK4130	427-02-1	TU-B08	Level 10	FLT	Sugar Hill	3.3 ± 0.1	NM ± NM	--
35LK4130	427-03	TU B08	Level 10	PPT	Grasshopper Group	3.4 ± 0.1	NM ± NM	NVH on BRE
35LK4130	452-02-1	TU-C01	Level 1	FLT	Sugar Hill	6.7 ± 0.1	NM ± NM	--
35LK4130	452-03	TU C01	Level 1	PPT	Grasshopper Group	5.9 ± 0.1	NM ± NM	BEV, DFV
35LK4130	479-02	TU C06	Level 2	PPT	Spodue Mountain	7.0 ± 0.1	NM ± NM	NVH on ventral surface
35LK4130	490-02-1	TU-C08	Level 3	FLT	Cowhead Lake	8.1 ± 0.1	NM ± NM	REC; rim from ventral surface

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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						Rim 1	Rim 2	
35LK4130	516-02	TU-D04	Level 3	BUR	Unknown Obsidian 10	6.2 ± 0.1	NM ± NM	--
35LK4130	518-02	TU D04	Level 5	BLA	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4130	520-02-1	TU-D05	Level 2	COR	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK4130	522-02	TU D05	Level 4	PPT	Tucker Hill	3.9 ± 0.1	3.9 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK4130	539-02	TU D09	Level 1	PPT	Blue Spring *	5.3 ± 0.1	NM ± NM	Dorsal surface is BEV, UNR
35LK4130	548-01	SC 1001	Surface	PRE	Unknown Obsidian 2	7.4 ± 0.1	NM ± NM	--
35LK4131	2-01	QTU 1	Level 3	DEB	Sugar Hill *	3.4 ± 0.1	NM ± NM	--
35LK4131	3-01	QTU 3	Level 1	DEB	Sugar Hill	3.6 ± 0.1	NM ± NM	--
35LK4068	1-01	SC 1	Surface	FLT	Blue Mountain	1.9 ± 0.1	NM ± NM	--
35LK4068	2-01	SC 2	Surface	FLT	Sugar Hill	3.1 ± 0.1	4.4 ± 0.1	Smaller rim on dorsal surface
35LK4068	3-01	SC 3	Surface	FLT	Sugar Hill	3.8 ± 0.1	NM ± NM	--
35LK4068	4-01	SC 4	Surface	FLT	Sugar Hill	4.1 ± 0.1	NM ± NM	--
35LK4068	5-01	SC 5	Surface	FLT	Cowhead Lake	6.3 ± 0.1	NM ± NM	--
35LK4068	6-01	SC 6	Surface	FLT	Sugar Hill	4.5 ± 0.1	NM ± NM	--
35LK4068	7-01	SC 7	Surface	FLT	Blue Spring	3.0 ± 0.1	NM ± NM	--
35LK4068	9-01	SC 9	Surface	FLT	Sugar Hill	6.5 ± 0.1	NM ± NM	--
35LK4068	10-01	SC 10	Surface	FLT	Blue Spring	6.3 ± 0.1	NM ± NM	--
35LK4068	11-01	SC 11	Surface	PPT	Unknown Obsidian 6	4.1 ± 0.1	NM ± NM	--
35LK4068	12-01	SC 12	Surface	PPT	Sugar Hill	4.0 ± 0.1	NM ± NM	--
35LK4068	13-01	SC 13	Surface	BLA	Cowhead Lake	3.8 ± 0.1	NM ± NM	--
35LK4068	14-01	SC 14	Surface	PPT	Sugar Hill	5.7 ± 0.1	NM ± NM	--
35LK4068	18-01	SC 18	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	22-01	SC 22	Surface	PPT	Blue Mountain	3.7 ± 0.1	NM ± NM	REC; DFV

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						Rim 1	Rim 2	
35LK4068	32-01	SC 32	Surface	PPT	Cowhead Lake	2.8 ± 0.1	NM ± NM	--
35LK4068	33-01	SC 33	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	34-01	SC 34	Surface	PPT	Sugar Hill	4.6 ± 0.1	NM ± NM	--
35LK4068	39-01	SC 39	Surface	DRL	Sugar Hill *	3.6 ± 0.1	NM ± NM	REC; BEV, DFV
35LK4068	44-01	SC 44	Surface	KNI	Cowhead Lake	2.8 ± 0.1	NM ± NM	REC
35LK4068	49-01	SC 49	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	54-01	SC 54	Surface	CHO	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	55-01	SC 55	Surface	COR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	59-01	SC 59	Surface	CHO	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	63-01	SC 63	Surface	PPT	Buck Mountain	6.1 ± 0.1	NM ± NM	--
35LK4068	66-01	SC 66	Surface	PPT	Cowhead Lake *	5.9 ± 0.1	NM ± NM	--
35LK4068	68-01	SC 68	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	70-01	SC 70	Surface	PPT	Drews Creek/Butcher Flat	5.2 ± 0.1	NM ± NM	REC
35LK4068	72-01	SC 72	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	73-01	SC 73	Surface	CHO	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	74-01	SC 74	Surface	CHO	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	78-01	SC 78	Surface	PPT	Cowhead Lake *	2.3 ± 0.1	NM ± NM	--
35LK4068	118-01	EPG/ QTU 2	Level 2	BUR	East Medicine Lake	5.2 ± 0.1	NM ± NM	--
35LK4068	125-01	EPG/ QTU 12	Level 1	PPT	Cowhead Lake *	5.1 ± 0.1	NM ± NM	--
35LK4068	126-03-1	EPG/ QTU 12	Level 2	TRM	Sugar Hill	5.5 ± 0.1	NM ± NM	--
35LK4068	127-01-1	EPG/ QTU 12	Level 3	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4068	136-01	SC 105	Surface	PPT	Drews Creek/Butcher Flat	4.8 ± 0.1	NM ± NM	--
35LK4068	168-01	QTU 14	Surface	DEB	Sugar Hill	3.5 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4129	1-01	SC 1	Surface	DEB	Sugar Hill *	NA ± NA	NM ± NM	REC; UNR, DFV
35LK4129	2-01	SC 2	Surface	DEB	Cowhead Lake *	7.6 ± 0.1	NM ± NM	--
35LK4129	3-01	SC 3	Surface	WFL	Sugar Hill	4.7 ± 0.1	NM ± NM	--
35LK4129	4-01	SC 4	Surface	DEB	Cowhead Lake? *	NA ± NA	NM ± NM	UNR, HV
35LK4129	5-01	SC 5	Surface	DEB	Cowhead Lake *	6.5 ± 0.1	NM ± NM	--
35LK4129	6-01	SC 6	Surface	KNI	Drews Creek/Butcher Flat	5.4 ± 0.1	NM ± NM	Same rim on all surfaces
35LK4129	8-01	SC 8	Surface	DEB	Unknown FGV B	NA ± NA	NM ± NM	UNR (crystalline)
35LK3920	3-01	SC 3	Surface	PPT	Buck Mountain *	3.5 ± 0.1	NM ± NM	DFV
35LK3920	7-01	SC 7	Surface	PRE	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35LK3920	8-01	SC 8	Surface	PPT	Sugar Hill *	3.3 ± 0.1	NM ± NM	--
35LK3920	11-01	SC 11	Surface	FLT	Cowhead Lake	12.5 ± 0.1	NM ± NM	HV
35LK3920	14-01	SC 14	Surface	PPT	Unknown Obsidian 1 *	4.7 ± 0.1	NM ± NM	--
35LK3920	15-01	SC 15	Surface	PPT	Unknown FGV B *	NM ± NM	NM ± NM	Not cut
35LK3920	18-01	SC 18	Surface	PPT	Buck Mountain *	3.8 ± 0.1	NM ± NM	REC; HV
35LK3920	21-01	SC 21	Surface	PPT	Sugar Hill *	4.3 ± 0.1	NM ± NM	--
35LK3920	22-01	SC 22	Surface	KNI	Blue Mountain	2.0 ± 0.1	NM ± NM	--
35LK3920	23-01	SC 23	Surface	PPT	Beatys Butte	2.3 ± 0.1	NM ± NM	--
35LK3920	24-01	SC 24	Surface	PPT	GF/LIW/RS	3.7 ± 0.1	NM ± NM	--
35LK3920	25-01	SC 25	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3920	27-01	SC 27	Surface	DRL	Cowhead Lake	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3920	29-01	SC 29	Surface	COR	Drews Creek/Butcher Flat	6.5 ± 0.1	NM ± NM	IRR, DFV
35LK3920	30-01	SC 30	Surface	FLT	Sugar Hill	5.2 ± 0.1	NM ± NM	REC
35LK3920	33-01	SC 33	Surface	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3920	34-01	SC 34	Surface	PPT	Sugar Hill	3.8 ± 0.1	NM ± NM	--
35LK3920	35-01	SC 35	Surface	PPT	Sugar Hill	5.9 ± 0.1	NM ± NM	--
35LK3920	36-01	SC 36	Surface	PPT	Cowhead Lake	1.5 ± 0.1	3.3 ± 0.1	Smaller rim on BRE scar
35LK3920	37-01	SC 37	Surface	BLA	Sugar Hill	4.3 ± 0.1	NM ± NM	--
35LK3920	38-01	SC 38	Surface	PPT	Buck Mountain	1.3 ± 0.1	2.8 ± 0.1	Smaller rim on BRE scar
35LK3920	39-01	SC 39	Surface	FLT	Sugar Hill	2.7 ± 0.1	NM ± NM	--
35LK3920	40-01	SC 40	Surface	BLA	Cowhead Lake	4.8 ± 0.1	NM ± NM	--
35LK3920	41-01	SC 41	Surface	BLA	Cowhead Lake	3.6 ± 0.1	NM ± NM	--
35LK3920	42-01	SC 42	Surface	BLA	Blue Mountain	1.9 ± 0.1	NM ± NM	--
35LK3920	46-01	SC 46	Surface	COR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3920	47-01	SC 47	Surface	COR	Unknown Obsidian 6	3.0 ± 0.0	NM ± NM	--
35LK3920	48-01	SC 48	Surface	BLA	Buck Mountain	3.2 ± 0.0	5.2 ± 0.1	Smaller rim on ventral scar
35LK3920	49-01	SC 49	Surface	BLA	Cowhead Lake	3.9 ± 0.1	NM ± NM	Dorsal surface is UNR, BEV
35LK3920	50-01	SC 50	Surface	FLT	Cowhead Lake	2.9 ± 0.0	4.1 ± 0.1	Smaller rim on dorsal surface
35LK3920	57-01	SC 57	Surface	PPT	Sugar Hill	3.2 ± 0.1	NM ± NM	REC
35LK3920	59-01	SC 59	Surface	PPT	Tucker Hill	2.5 ± 0.1	NM ± NM	DFV
35LK3920	61-01	SC 61	Surface	COR	Rainbow Mines	3.9 ± 0.1	NM ± NM	--
35LK3920	62-01	SC 62	Surface	PPT	Spodue Mountain *	4.6 ± 0.1	NM ± NM	--
35LK3920	63-01	SC 63	Surface	PPT	Tucker Hill	5.2 ± 0.1	NM ± NM	REC; HV (possibly burnt)
35LK3920	64-01	SC 64	Surface	PPT	Massacre Lake/Guano Valley	4.9 ± 0.1	NM ± NM	--
35LK3920	65-01	SC 65	Surface	PPT	Spodue Mountain *	3.0 ± 0.1	NM ± NM	--
35LK3920	67-01	SC 67	Surface	BLA	Drews Creek/Butcher Flat	3.7 ± 0.1	NM ± NM	--
35LK3920	69-01	SC 69	Surface	PPT	Rainbow Mines *	NA ± NA	NM ± NM	UNR (crystalline)

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3920	70-01	SC 70	Surface	KNI	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK3920	71-01	SC 71	Surface	PPT	Blue Mountain	2.1 ± 0.1	NM ± NM	--
35LK3920	72-01	SC 72	Surface	PPT	Cowhead Lake	7.1 ± 0.1	NM ± NM	--
35LK3920	73-01	SC 73	Surface	FLT	Sugar Hill	3.5 ± 0.1	NM ± NM	--
35LK3920	89-01	SC 89	Surface	SCR	Unknown FGV F	NM ± NM	NM ± NM	Not cut
35LK3920	90-01	SC 90	Surface	COR	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3920	91-01	SC 91	Surface	PPT	Sugar Hill	3.2 ± 0.1	NM ± NM	Ventral surface is BEV, appears same
35LK3920	95-01	SC 95	Surface	PRE	Not FGV	NM ± NM	NM ± NM	Not cut
35LK3920	97-01	SC 97	Surface	PPT	Buck Mountain?	NA ± NA	NM ± NM	REC; UNR, DFV
35LK3920	98-01	SC 98	Surface	PRE	Cowhead Lake	1.8 ± 0.1	NM ± NM	--
35LK3920	99-01	SC 99	Surface	PPT	Tucker Hill	1.4 ± 0.1	NM ± NM	REC
35LK3920	100-01	SC 100	Surface	PPT	Rainbow Mines	3.4 ± 0.1	NM ± NM	--
35LK3920	101-01	SC 101	Surface	KNI	Not FGV	NM ± NM	NM ± NM	Not cut
35LK3920	105-01	SC 105	Surface	BLA	Drews Creek/Butcher Flat	2.9 ± 0.1	NM ± NM	--
35LK3920	110-01	SC 110	Surface	PPT	Sugar Hill	4.9 ± 0.1	NM ± NM	--
35LK3920	114-01	SC 114	Surface	PPT	South Warners	4.0 ± 0.1	3.9 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK3920	115-01	SC 115	Surface	COR	Cowhead Lake	4.3 ± 0.1	NM ± NM	--
35LK3920	118-01	SC 118	Surface	PPT	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK3920	120-01	SC 120	Surface	PPT	Buck Mountain	4.2 ± 0.1	NM ± NM	Dorsal surface is BEV, appears same
35LK3920	124-01	SC 124	Surface	BUR	Cowhead Lake	6.1 ± 0.1	NM ± NM	--
35LK3920	128-01	SC 128	Surface	PPT	GF/LIW/RS *	3.7 ± 0.1	NM ± NM	NVH on BRE
35LK3920	129-01	SC 129	Surface	PRE	Blue Mountain	3.2 ± 0.1	NM ± NM	--
35LK3920	130-01	SC 130	Surface	BLA	Massacre Lake/Guano Valley	4.5 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3920	131-01	SC 131	Surface	PPT	Buck Mountain	4.1 ± 0.1	NM ± NM	--
35LK3920	132-01	SC 132	Surface	PPT	Buck Mountain *	3.8 ± 0.1	4.6 ± 0.1	Smaller rim on BRE; DFV
35LK3920	134-01	SC 134	Surface	PPT	Unknown Obsidian 6	3.3 ± 0.1	3.3 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK3920	135-01	SC 135	Surface	PPT	Rainbow Mines *	NA ± NA	NM ± NM	UNR (crystalline)
35LK3920	145-01	SC 145	Surface	PPT	Spodue Mountain *	1.9 ± 0.1	3.2 ± 0.1	REC; smaller rim on tip BRE
35LK3920	146-01	SC 146	Surface	FLT	Buck Mountain	2.8 ± 0.1	NM ± NM	--
35LK3920	153-01	SC 153	Surface	FLT	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3920	156-01	SC 156	Surface	PPT	Cowhead Lake	2.2 ± 0.0	3.3 ± 0.1	Smaller rim on dorsal margin
35LK3920	158-01	SC 158	Surface	COR	Buck Mountain	5.5 ± 0.1	NM ± NM	--
35LK3920	160-01	SC 160	Surface	SCR	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK3920	165-01	SC 165	Surface	FLT	Buck Mountain	4.1 ± 0.1	NM ± NM	--
35LK3920	171-01	SC 171	Surface	KNI	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3920	174-01	SC 174	Surface	PPT	Cowhead Lake	4.6 ± 0.1	NM ± NM	--
35LK3920	177-01	SC 177	Surface	PRE	Cowhead Lake	4.1 ± 0.1	NM ± NM	--
35LK3920	181-01	SC 181	Surface	PPT	Blue Spring	3.6 ± 0.1	NM ± NM	--
35LK3920	182-01	SC 182	Surface	PPT	Cowhead Lake	4.0 ± 0.1	NM ± NM	--
35LK3920	184-01	SC 184	Surface	BLA	Drews Creek/Butcher Flat	4.1 ± 0.1	NM ± NM	--
35LK3920	189-01	SC 189	Surface	SCR	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3920	190-01	SC 190	Surface	PPT	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK3920	191-01	SC 191	Surface	PRE	Buck Mountain	3.2 ± 0.1	NM ± NM	--
35LK3920	192-01	SC 192	Surface	BLA	Buck Mountain	3.5 ± 0.1	NM ± NM	--
35LK3920	193-01	SC 193	Surface	BLA	Buck Mountain	5.1 ± 0.1	NM ± NM	IRR, DFV
35LK3920	196-01	SC 196	Surface	PPT	Cowhead Lake	2.7 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3920	198-01	SC 198	Surface	PPT	Cowhead Lake *	3.9 ± 0.1	NM ± NM	Ventral surface is BEV, appears same
35LK3920	203-01	SC 203	Surface	BLA	Cowhead Lake	3.0 ± 0.1	NM ± NM	--
35LK3920	204-01	SC 204	Surface	BLA	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3920	206-01	SC 206	Surface	KNI	Cowhead Lake	4.9 ± 0.1	NM ± NM	--
35LK3920	207-01	SC 207	Surface	PPT	Spodue Mountain	3.3 ± 0.1	NM ± NM	REC
35LK3920	209-01	SC 209	Surface	BLA	Buck Mountain	3.1 ± 0.1	NM ± NM	--
35LK3920	217-01-1	QTU 1	Level 1	SCR	Sugar Hill	3.1 ± 0.1	NM ± NM	--
35LK3920	217-02	QTU 1	Level 1	PRE	Buck Mountain *	5.9 ± 0.1	NM ± NM	--
35LK3920	217-02-2	QTU 1	Level 1	PPT	Sugar Hill *	3.8 ± 0.1	NM ± NM	--
35LK3920	230-01	QTU 5	Level 1	PRE	Beatys Butte	1.4 ± 0.1	NM ± NM	--
35LK3920	234-04-2	QTU 6	Level 2	FLT	Rainbow Mines	4.0 ± 0.1	6.9 ± 0.1	Smaller rim on ventral surface
35LK3920	234-04-3	QTU 6	Level 2	FLT	Sugar Hill	1.2 ± 0.0	NM ± NM	--
35LK3920	234-04-4	QTU 6	Level 2	FLT	Cowhead Lake *	1.6 ± 0.1	NM ± NM	--
35LK3920	235-01	QTU 6	Level 3	KNI	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK3920	235-02-1	QTU 6	Level 3	COR	Cowhead Lake	5.6 ± 0.1	NM ± NM	--
35LK3920	238-01-1	QTU 7	Level 1	FLT	Cowhead Lake	2.4 ± 0.1	NM ± NM	--
35LK3920	240-01	QTU 9	Level 1	BLA	Glass Mountain	1.1 ± 0.0	NM ± NM	--
35LK3920	240-02	QTU 9	Level 1	PPT	Cowhead Lake	2.0 ± 0.1	2.8 ± 0.1	Larger rim on ventral surface
35LK3920	240-03	QTU 9	Level 1	FLT	Buck Mountain	3.4 ± 0.1	NM ± NM	--
35LK3920	241-01-1	QTU 9	Level 2	SCR	Cowhead Lake *	1.7 ± 0.1	NM ± NM	--
35LK3920	249-02-1	QTU 10	Level 3	FLT	Blue Spring	3.8 ± 0.1	NM ± NM	--
35LK3920	301-01	SC A4	Surface	PPT	Rainbow Mines *	5.1 ± 0.0	NM ± NM	--
35LK3920	302-01	SC A2	Surface	FLT	Unknown FGV	NM ± NM	NM ± NM	Not cut

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Northwest Research Obsidian Studies Laboratory

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						Rim 1	Rim 2	
35LK3920	304-01	SC A5	Surface	PPT	Blue Spring	2.5 ± 0.1	NM ± NM	--
35LK3920	305-01	SC A6	Surface	PPT	Buck Mountain	3.7 ± 0.1	NM ± NM	--
35LK3920	306-01	SC A7	Surface	BLA	Unknown FGV B	NM ± NM	NM ± NM	Not cut
35LK3920	307-01	SC A1	Surface	KNI	Sugar Hill	1.2 ± 0.1	NM ± NM	--
35LK3920	308-01	SC A8	Surface	PRE	Blue Mountain	2.4 ± 0.1	NM ± NM	--
35LK3920	310-04-2	TU 1	Level 2	COR	Buck Mountain	4.8 ± 0.1	NM ± NM	--
35LK3920	311-05-1	TU 1	Level 3	BLA	Cowhead Lake	4.6 ± 0.1	NM ± NM	--
35LK3920	313-01-1	TU 2	Level 1	PPT	Cowhead Lake *	5.4 ± 0.1	NM ± NM	--
35LK3920	313-01-4	TU 2	Level 1	FLT	Cowhead Lake	1.6 ± 0.0	NM ± NM	--
35LK3920	313-01-5	TU 2	Level 1	SCR	Cowhead Lake	2.9 ± 0.1	NM ± NM	--
35LK3920	314-01-1	TU 2	Level 2	FLT	Not FGV	NM ± NM	NM ± NM	Not cut
35LK3920	317-02	TU 3	Level 2	PPT	Unknown Obsidian 1 *	3.0 ± 0.1	NM ± NM	--
35LK3920	317-03	TU 3	Level 2	PRE	Sugar Hill *	3.7 ± 0.1	NM ± NM	--
35LK3920	317-04-1	TU 3	Level 2	COS	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK3920	317-04-7	TU 3	Level 2	FLT	Cowhead Lake *	2.1 ± 0.1	NM ± NM	--
35LK3920	317-04-9	TU 3	Level 2	FLT	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK3920	318-03-3	TU 3	Level 3	FLT	Buck Mountain *	1.9 ± 0.0	NM ± NM	--
35LK3920	318-03-4	TU 3	Level 3	FLT	Sugar Hill	3.0 ± 0.1	NM ± NM	--
35LK3920	318-03-5	TU 3	Level 3	PPT	Cowhead Lake *	1.2 ± 0.0	NM ± NM	--
35LK3920	319-06	TU 3	Level 4	FLT	Sugar Hill	3.1 ± 0.1	NM ± NM	--
35LK3920	319-07	TU 3	Level 4	FLT	Cowhead Lake *	2.9 ± 0.1	NM ± NM	--
35LK3920	336-02-1	TU 7	Level 5	BUR	Sugar Hill *	5.8 ± 0.1	NM ± NM	--
35LK3920	339-02-1	TU 8	Level 2	COR	Buck Mountain	5.1 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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						Rim 1	Rim 2	
35LK3920	339-03	TU 8	Level 2	SCR	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3920	346-02-1	TU 9	Level 4	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3920	346-02-2	TU 9	Level 4	BLA	Unknown FGV D	NM ± NM	NM ± NM	Not cut
35LK3920	348-03	TU 10	Level 1	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3920	350-03	TU 10	Level 3	BUR	Spodue Mountain *	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35LK3920	355-02	TU 11	Level 2	PPT	GF/LIW/RS *	4.3 ± 0.1	NM ± NM	DFV
35LK3920	355-03-2	TU 11	Level 2	FLT	Cowhead Lake *	4.6 ± 0.1	4.6 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK3920	355-04	TU 11	Level 2	PPT	Cowhead Lake *	4.2 ± 0.1	NM ± NM	--
35LK3920	356-02-1	TU 11	Level 3	BUR	Cowhead Lake *	5.3 ± 0.1	NM ± NM	REC
35LK3920	360-02	TU 12	Level 2	COR	Blue Spring	NM ± NM	NM ± NM	REC; UNR, DIS
35LK3920	361-09-1	TU 12	Level 3	PRE	Cowhead Lake	6.7 ± 0.1	NM ± NM	--
35LK3920	365-01	TU 13	Level 2	PPT	Cowhead Lake	4.4 ± 0.1	NM ± NM	Dorsal surface is BEV, UNR
35LK3920	365-02-1	TU 13	Level 2	FLT	Buck Mountain	4.8 ± 0.1	NM ± NM	--
35LK3920	367-02	TU 13	Level 4	PRE	Spodue Mountain *	1.9 ± 0.0	NM ± NM	DFV
35LK3920	372-02-1	TU 14	Level 3	BLA	Buck Mountain	4.7 ± 0.0	NM ± NM	--
35LK3920	375-02-1	TU 14	Level 5	BLA	Cowhead Lake *	5.2 ± 0.1	NM ± NM	--
35LK3920	375-02-2	TU 14	Level 5	FLT	Cowhead Lake	6.7 ± 0.1	NM ± NM	HV, IRR
35LK3920	379-02-1	TU 15	Level 3	COR	Buck Mountain	6.5 ± 0.0	NM ± NM	Dorsal is HV
35LK3920	380-04	TU 15	Level 4	KNI	Grasshopper Group	4.2 ± 0.1	NM ± NM	--
35LK3920	380-05-2	TU 15	Level 4	PPT	Buck Mountain	4.6 ± 0.1	NM ± NM	--
35LK3920	384-03	TU 16	Level 2	PPT	Cowhead Lake *	5.5 ± 0.1	NM ± NM	--
35LK3920	385-03	TU 16	Level 3	PPT	Sugar Hill	5.8 ± 0.1	NM ± NM	DFV
35LK3920	386-02	TU 16	Level 4	PPT	Cowhead Lake	2.3 ± 0.1	NM ± NM	REC

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3920	386-03	TU 16	Level 4	PPT	Cowhead Lake *	1.5 ± 0.1	NM ± NM	Possibly burnt
35LK3920	386-05-1	TU 16	Level 4	UNI	Cowhead Lake	1.5 ± 0.1	NM ± NM	Possibly burnt
35LK3920	386-05-3	TU 16	Level 4	FLT	Cowhead Lake	5.1 ± 0.1	NM ± NM	--
35LK3920	388-04-1	TU 16	Level 6	KNI	Alturas FGV	NA ± NA	NM ± NM	UNR (crystalline)
35LK3920	388-04-2	TU 16	Level 6	FLT	Cowhead Lake	5.7 ± 0.1	NM ± NM	--
35LK3920	389-02-1	TU 16	Level 7	PPT	Buck Mountain *	3.9 ± 0.1	NM ± NM	--
35LK3920	390-03	TU 17	Level 1	PPT	Sugar Hill	4.1 ± 0.1	NM ± NM	--
35LK3920	390-03-1	TU 17	10 cm	PPT	Sugar Hill	2.7 ± 0.1	NM ± NM	--
35LK3920	392-03-3	TU 17	Level 3	BLA	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK3920	393-01-1	TU 17	Level 4	FLT	Cowhead Lake	3.2 ± 0.1	NM ± NM	--
35LK3920	394-02	TU 18	Level 1	PPT	Sugar Hill *	2.3 ± 0.1	NM ± NM	--
35LK3920	394-03-1	TU 18	Level 1	COR	Buck Mountain	3.8 ± 0.1	NM ± NM	--
35LK3920	394-03-2	TU 18	Level 1	KNI	Tucker Hill	3.1 ± 0.1	NM ± NM	IRR, DFV
35LK3920	394-03-3	TU 18	Level 1	KNI	Sugar Hill *	1.9 ± 0.1	NM ± NM	--
35LK3920	394-03-4	TU 18	Level 1	KNI	Sugar Hill	5.0 ± 0.1	NM ± NM	REC
35LK3920	395-03-3	TU 18	Level 2	FLT	Cowhead Lake	3.3 ± 0.1	NM ± NM	--
35LK3920	395-03-4	TU 18	Level 2	KNI	Unknown FGV C	NM ± NM	NM ± NM	Not cut
35LK3920	395-04	TU 18	Level 2	FLT	Sugar Hill	3.9 ± 0.1	NM ± NM	--
35LK3920	395-05	TU 18	Level 2	PRE	Buck Mountain *	2.5 ± 0.1	NM ± NM	--
35LK3920	397-02	TU 19	Level 1	COR	Sugar Hill	3.1 ± 0.1	NM ± NM	--
35LK3920	397-03-1	TU 19	Level 1	BLA	Buck Mountain	4.2 ± 0.0	NM ± NM	--
35LK3920	397-03-3	TU 19	Level 1	FLT	Sugar Hill	3.0 ± 0.1	NM ± NM	--
35LK3920	397-04	TU 19	Level 1	PPT	Buck Mountain *	3.4 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3920	401-03-3	TU 20	Level 1	FLT	Sugar Hill	3.9 ± 0.1	NM ± NM	--
35LK3920	401-03-5	TU 20	Level 1	FLT	Sugar Hill	3.2 ± 0.1	NM ± NM	--
35LK3920	401-03-6	TU 20	Level 1	FLT	Sugar Hill	3.8 ± 0.1	NM ± NM	Ventral scar is BEV, appears same
35LK3920	402-02	TU 20	Level 2	PPT	Buck Mountain *	2.5 ± 0.1	NM ± NM	--
35LK3920	402-04-3	TU 20	Level 2	FLT	Sugar Hill	3.0 ± 0.1	NM ± NM	--
35LK3920	404-03-1	TU 20	Level 4	COR	Blue Spring	3.9 ± 0.1	NM ± NM	--
35LK3920	404-03-2	TU 20	Level 4	FLT	Sugar Hill	1.9 ± 0.1	NM ± NM	--
35LK3920	405-02	TU 21	Level 1	BLA	Cowhead Lake	3.0 ± 0.1	NM ± NM	--
35LK3920	406-03-2	TU 21	Level 2	PPT	Grasshopper Group *	2.8 ± 0.1	2.7 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35LK3920	407-08	TU 21	Level 3	BLA	Spodue Mountain	2.8 ± 0.0	NM ± NM	--
35LK3920	409-02	TU 22	Level 1	PPT	Cowhead Lake *	1.3 ± 0.1	NM ± NM	--
35LK3920	410-04	TU 22	Level 2	FLT	Cowhead Lake	1.5 ± 0.1	NM ± NM	--
35LK3920	410-07	TU 22	Level 2	PPT	Unknown Obsidian 6 *	1.9 ± 0.1	NM ± NM	--
35LK3920	413-02	TU 23	Level 2	FLT	Sugar Hill	3.8 ± 0.1	NM ± NM	--
35LK3920	417-04	TU 24	Level 1	PPT	Cowhead Lake	6.0 ± 0.1	NM ± NM	--
35LK3920	426-02-2	TU 25	Level 2	FLT	Buck Mountain	1.2 ± 0.1	3.6 ± 0.1	Smaller rim on dorsal margin
35LK3920	427-04	TU 25	Level 3	PRE	East Medicine Lake	4.1 ± 0.1	4.7 ± 0.1	Rim 1 = cut A; Rim 2 = cut B; REC
35LK3920	431-03	TU 26	Level 1	PPT	Grasshopper Group *	1.6 ± 0.1	NM ± NM	--
35LK3920	432-06	TU 26	Level 2	PRE	Unknown FGV C *	NM ± NM	NM ± NM	Not cut
35LK3920	433-02-3	TU 26	Level 3	FLT	Buck Mountain	1.2 ± 0.1	NM ± NM	--
35LK3920	438-05	TU 28	Level 1	PRE	Unknown Obsidian 6	1.3 ± 0.1	NM ± NM	--
35LK3920	438-08-3	TU 28	Level 1	FLT	Sugar Hill	2.3 ± 0.1	NM ± NM	--
35LK3920	438-08-4	TU 28	Level 1	FLT	Buck Mountain	NM ± NM	NM ± NM	UNR (crystalline)

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK3920	439-02-1	TU 28	Level 2	COR	Buck Mountain	1.6 ± 0.0	NM ± NM	--
35LK3920	439-02-3	TU 28	Level 2	FLT	Buck Mountain	1.3 ± 0.1	NM ± NM	--
35LK3920	439-03	TU 28	Level 2	PPT	Buck Mountain	1.0 ± 0.1	3.1 ± 0.1	Rims 1 & 2 = cut A (d/v); Rim 3 = cut B (3.1)
35LK3920	442-03	TU 29	Level 1	BUR	Blue Mountain	2.4 ± 0.1	2.4 ± 0.1	Rim 1 = cut A; Rim 2 = cut B; REC
35LK3920	444-02	TU 29	Level 3	FLT	Alturas FGV	NM ± NM	NM ± NM	Not cut
35LK3920	444-04-1	TU 29	Level 3	FLT	Buck Mountain *	1.3 ± 0.1	NM ± NM	--
35LK3920	444-05	TU 29	Level 3	FLT	Unknown Obsidian 6	1.9 ± 0.1	NM ± NM	--
35LK3920	445-03-5	TU 30	Level 1	FLT	Cowhead Lake *	4.1 ± 0.1	NM ± NM	--
35LK3920	445-03-6	TU 30	Level 1	FLT	Buck Mountain	3.7 ± 0.1	NM ± NM	--
35LK3920	447-03-1	TU 30	Level 3	FLT	Blue Mountain	1.3 ± 0.1	NM ± NM	--
35LK3920	447-03-2	TU 30	Level 3	COR	Sugar Hill	4.5 ± 0.1	NM ± NM	--
35LK3920	450-02-2	TU 31	Level 2	FLT	Cowhead Lake	4.8 ± 0.1	NM ± NM	--
35LK4279	1-01	SC 1	Surface	FLT	Blue Mountain *	1.9 ± 0.1	NM ± NM	NVH on BRE
35LK4279	2-01	SC 2	Surface	SCR	Buck Mountain	2.0 ± 0.1	NM ± NM	--
35LK4279	3-01	SC 3	Surface	FLT	Unknown Vitrophyre 1	NA ± NA	NM ± NM	UNR, OPA
35LK4279	4-01	SC 4	Surface	DEB	Buck Mountain *	3.5 ± 0.1	NM ± NM	--
35LK4279	6-01	SC 6	Surface	DEB	Cowhead Lake	5.1 ± 0.0	NM ± NM	--
35LK4279	8-01	SC 8	Surface	DEB	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4279	9-01	SC 9	Surface	MAN	Unknown Obsidian 7	3.9 ± 0.1	NM ± NM	--
35LK4279	11-01	SC 11	Surface	DEB	Buck Mountain	5.0 ± 0.0	NM ± NM	--
35LK4279	12-01	SC 12	Surface	TRM	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4279	16-01	SC 16	Surface	DEB	Unknown Vitrophyre 2	NA ± NA	NM ± NM	UNR, OPA
35LK4279	17-01	SC 17	Surface	DEB	Sugar Hill *	4.5 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4279	18-01	SC 18	Surface	FLT	Rainbow Mines	6.3 ± 0.1	NM ± NM	--
35LK4279	20-01	SC 20	Surface	DEB	Cowhead Lake *	4.9 ± 0.1	NM ± NM	--
35LK4279	31-01	QTU 7	Level 1	DEB	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4279	32-01	SC 20	Surface	COR	Blue Mountain	1.6 ± 0.0	NM ± NM	--
35LK4279	33-01	SC 21	Surface	TRM	Unknown Obsidian 8	NA ± NA	NM ± NM	NVH, OPA
35LK4279	34-01	SC 22	Surface	MAN	Unknown FGV	NA ± NA	NM ± NM	UNR, OPA
35LK4220	10-01-S1	QTU 4	Level 4	DEB	Blue Mountain	1.9 ± 0.1	NM ± NM	--
10/1819-AZW-4	1-01	SC 1	Surface	KNI	McComb Butte	3.5 ± 0.1	NM ± NM	--
35LK4132	2-01	SC 2	Surface	DEB	Sugar Hill *	1.7 ± 0.1	NM ± NM	--
35LK4132	3-01	SC 3	Surface	UNI	Unknown FGV	NM ± NM	NM ± NM	Not cut
35LK4132	5-01	SC 5	Surface	DEB	Buck Mountain	1.6 ± 0.0	NM ± NM	--
35LK4132	6-01	SC 6	Surface	DEB	Blue Mountain	1.7 ± 0.0	NM ± NM	--
35LK4132	7-01	SC 7	Surface	PPT	Cowhead Lake *	2.5 ± 0.0	NM ± NM	--
35LK4132	10-01	SC 10	Surface	DEB	Sugar Hill *	3.3 ± 0.1	NM ± NM	REC
35LK4132	11-01	SC 11	Surface	DEB	Cowhead Lake *	2.5 ± 0.1	NM ± NM	--
35LK4132	12-01	SC 12	Surface	DEB	Blue Mountain *	1.9 ± 0.1	NM ± NM	DFV
35LK4132	13-01	SC 13	Surface	DEB	Blue Mountain	1.6 ± 0.1	NM ± NM	--
35LK4132	14-01	SC 14	Surface	SCR	Blue Mountain	1.5 ± 0.1	NM ± NM	DFV
35LK4132	15-01	SC 15	Surface	BLA	Sugar Hill	3.1 ± 0.1	NM ± NM	--
35LK4132	16-01	SC 16	Surface	FLT	Buck Mountain *	1.5 ± 0.1	NM ± NM	--
35LK4132	17-01	SC 17	Surface	DEB	Buck Mountain *	1.5 ± 0.1	NM ± NM	--
35LK4132	18-01	SC 18	Surface	SCR	Unknown FGV B	NA ± NA	NM ± NM	UNR (crystalline)
35LK4221	1-01	SC 1	Surface	DEB	Sugar Hill *	3.0 ± 0.1	NM ± NM	DFV

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35LK4221	2-01	SC 2	Surface	COR	Unknown Obsidian 6	5.3 ± 0.1	NM ± NM	--
35LK4221	3-01	SC 3	Surface	KNI	GF/LIW/RS	5.0 ± 0.0	NM ± NM	NVH on ventral scar
35LK4221	5-01	SC 5	Surface	DEB	Cowhead Lake	8.5 ± 0.1	NM ± NM	DFV
35LK4221	6-01	SC 6	Surface	BUR	Surveyor Spring	3.1 ± 0.1	NM ± NM	--
35LK4221	7-01	SC 7	Surface	FLT	Cowhead Lake *	2.9 ± 0.1	NM ± NM	--
35LK4221	8-01	SC 8	Surface	DEB	Buck Mountain *	4.0 ± 0.1	NM ± NM	--
35LK4221	9-01	SC 9	Surface	SCR	Blue Mountain	2.8 ± 0.1	NM ± NM	--
35LK4221	10-01	SC 10	Surface	BLA	Blue Mountain	3.3 ± 0.1	NM ± NM	--
35LK4221	11-01	SC 11	Surface	COR	Buck Mountain	3.2 ± 0.1	NM ± NM	--
35LK4221	12-01	SC 12	Surface	FLT	Buck Mountain	3.2 ± 0.1	NM ± NM	--
35LK4221	13-01	SC 13	Surface	CHO	Unknown FGV A	NM ± NM	NM ± NM	Not cut
35LK4221	14-01	SC 14	Surface	DEB	Blue Mountain	1.6 ± 0.1	NM ± NM	--
35LK4221	15-01	SC 15	Surface	COR	Buck Mountain	3.3 ± 0.1	NM ± NM	--
35LK4221	16-01	SC 16	Surface	PPT	Buck Mountain	2.5 ± 0.1	NM ± NM	--
35LK4221	17-01	SC 17	Surface	DEB	Buck Mountain *	2.6 ± 0.1	NM ± NM	--
35LK4221	18-01	SC 18	Surface	KNI	Blue Mountain	1.2 ± 0.1	NM ± NM	REC
35LK4221	19-01	SC 19	Surface	PPT	Badger Creek	NA ± NA	NM ± NM	NVH
35LK4221	20-01	SC 20	Surface	COR	Cowhead Lake	2.9 ± 0.1	NM ± NM	--
35LK4221	21-01	SC 21	Surface	KNI	Cowhead Lake	3.7 ± 0.1	NM ± NM	--
35LK4221	22-01	SC 22	Surface	COR	Cowhead Lake	6.1 ± 0.1	NM ± NM	--
35LK4221	23-01	SC 23	Surface	PPT	Cowhead Lake	4.6 ± 0.1	NM ± NM	HV (fissures)
35LK4221	24-01	SC 24	Surface	BLA	Blue Mountain	3.4 ± 0.1	NM ± NM	REC; NVH on ventral surface
35LK4221	25-01	SC 25	Surface	FLT	Cowhead Lake	5.5 ± 0.1	NM ± NM	REC; DFV

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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						Rim 1	Rim 2	
35LK4221	26-01	SC 26	Surface	PPT	Unknown FGV B	NA ± NA	NM ± NM	UNR (crystalline)
35LK4221	27-01	SC 27	Surface	KNI	Spodue Mountain	5.0 ± 0.1	NM ± NM	--
35LK4221	28-01	SC 28	Surface	FLT	Buck Mountain	2.3 ± 0.1	NM ± NM	REC
35LK4221	29-01	SC 29	Surface	PPT	Cowhead Lake *	1.1 ± 0.0	NM ± NM	--
35LK4221	30-01	SC 30	Surface	PPT	Blue Spring	1.6 ± 0.1	NM ± NM	DFV
35LK4221	31-01	SC 31	Surface	DEB	Cowhead Lake *	3.1 ± 0.1	NM ± NM	--
35LK4221	32-01	SC 32	Surface	FLT	Cowhead Lake	1.8 ± 0.1	NM ± NM	--
35LK4221	33-01	SC 33	Surface	BUR	Blue Mountain *	1.9 ± 0.1	NM ± NM	--
35LK4221	34-01	SC 34	Surface	PPT	Blue Mountain	1.6 ± 0.1	NM ± NM	--
35LK4221	35-01	SC 35	Surface	FLT	Blue Mountain	3.2 ± 0.1	NM ± NM	NVH on BRE
35LK4221	36-01	SC 36	Surface	COR	Sugar Hill	4.7 ± 0.0	NM ± NM	--
35LK4221	37-01	SC 37	Surface	BLA	Cowhead Lake	NA ± NA	NM ± NM	REC; UNR, PAT
35LK4221	38-01	SC 38	Surface	PPT	Cowhead Lake	3.1 ± 0.1	NM ± NM	--
35LK4221	39-01	SC 39	Surface	COR	Not Obsidian	NM ± NM	NM ± NM	Not cut
35LK4221	56-01	SP 45	38 cmbs	DEB	Blue Mountain	2.0 ± 0.1	NM ± NM	--
35LK4221	62-01-S2	QTU 1	Level 5	DEB	Sugar Hill	6.7 ± 0.1	NM ± NM	--
35LK4221	63-01-1	QTU 1	Level 6	COR	Massacre Lake/Guano Valley	5.2 ± 0.1	NM ± NM	--
35LK4221	65-01	QTU 1	Level 8	BUR	Buck Mountain *	3.6 ± 0.1	NM ± NM	--
35LK4221	81-01	QTU 5	Level 3	DEB	Blue Spring *	5.9 ± 0.1	NM ± NM	--
35LK4221	85-01-1	QTU 6	Level 1	FLT	Blue Mountain	2.1 ± 0.1	NM ± NM	--
35LK4221	91-01-S1	QTU 6	Level 7	DEB	Buck Mountain	4.2 ± 0.1	NM ± NM	--
35LK4221	100-01	QTU 8	Surface	DEB	Unknown FGV D	NM ± NM	NM ± NM	Not cut
35LK4221	103-01	QTU 8	Level 3	DEB	Unknown FGV	NM ± NM	NM ± NM	Not cut

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						Rim 1	Rim 2	
35LK4221	111-01	SC 40	Surface	CRE	Unknown Obsidian 2	NM ± NM	NM ± NM	Not cut
35LK4221	112-01	SC 41	Surface	KNI	Blue Mountain	NA ± NA	NM ± NM	REC; UNR, DFV
35LK4221	113-01	SC 42	Surface	KNI	Blue Mountain	1.4 ± 0.0	NM ± NM	NVH on BRE
35LK4221	114-01	SC 43	Surface	FLT	Unknown Obsidian 6 *	2.4 ± 0.1	NM ± NM	--
35KL1947	3-01	SC 3	Surface	DEB	Blue Mountain *	1.3 ± 0.1	NM ± NM	--
35KL1947	4-01	SC 4	Surface	DEB	Blue Spring	2.6 ± 0.1	NM ± NM	--
35KL1947	5-01	SC 5	Surface	DEB	Blue Mountain *	1.7 ± 0.1	NM ± NM	--
35KL3262	1-01	SC 1	Surface	BLA	Silver Lake/Sycan Marsh	3.7 ± 0.1	3.8 ± 0.0	Rim 1=cut A; Rim 2= B; Rim 3=C= 1.8 and 3.7
35KL3262	2-01	SC 2	Surface	KNI	Spodue Mountain	7.0 ± 0.1	NM ± NM	--
35KL3262	3-01	SC 3	Surface	KNI	Silver Lake/Sycan Marsh	1.9 ± 0.1	2.0 ± 0.0	Rim 1 = cut A; Rim 2 = cut B (possibly burnt)
35KL3262	4-01	SC 4	Surface	PPT	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3262	5-01	SC 5	Surface	PPT	Blue Mountain *	3.4 ± 0.1	NM ± NM	--
35KL3262	7-01	SC 7	Surface	DEB	Blue Mountain	2.5 ± 0.1	NM ± NM	--
35KL3262	8-01	SC 8	Surface	PPT	Cowhead Lake *	2.9 ± 0.1	2.8 ± 0.1	REC; Rim 1 = cut A; Rim 2 = cut B
35KL3262	9-01	SC 9	Surface	DEB	Cowhead Lake	3.1 ± 0.1	NM ± NM	--
35KL3262	13-01	SC 13	Surface	PPT	Unknown Obsidian 10 *	NA ± NA	NM ± NM	REC; NVH (possibly burnt)
35KL3262	14-01	SC 14	Surface	BLA	Unknown FGV	NM ± NM	NM ± NM	Not cut
35KL3262	15-01	SC 15	Surface	PPT	Buck Mountain *	6.5 ± 0.1	NM ± NM	--
35KL3262	16-01	SC 16	Surface	DEB	Buck Mountain *	3.3 ± 0.1	NM ± NM	--
35KL3262	17-01	SC 17	Surface	PPT	Grasshopper Group	4.8 ± 0.1	NM ± NM	REC; IRR, HV
35KL3262	18-01	SC 18	Surface	SCR	Blue Mountain	1.5 ± 0.1	NM ± NM	--
35KL3262	19-01	SC 19	Surface	DEB	Blue Mountain	1.9 ± 0.1	NM ± NM	--
35KL3262	22-01	SC 22	Surface	DEB	Blue Mountain	1.6 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	23-01	SC 23	Surface	PPT	Buck Mountain	4.4 ± 0.1	4.5 ± 0.1	Rim 1=cut A; Rim 2= B; Rim 3=C= (4.5 mic.)
35KL3262	24-01	SC 24	Surface	DEB	Blue Mountain	2.9 ± 0.1	3.2 ± 0.0	Smaller rim on dorsal surface
35KL3262	25-01	SC 25	Surface	SCR	Grasshopper Group	5.1 ± 0.1	NM ± NM	--
35KL3262	27-01	SC 27	Surface	DEB	Cowhead Lake	4.7 ± 0.1	NM ± NM	REC
35KL3262	28-01	SC 28	Surface	BLA	Blue Mountain	2.6 ± 0.1	NM ± NM	NVH on ventral margin
35KL3262	29-01	SC 29	Surface	PRE	Spodue Mountain	5.2 ± 0.1	NM ± NM	Ventral scar is BEV, UNR
35KL3262	30-01	SC 30	Surface	FLT	East Medicine Lake *	3.8 ± 0.1	NM ± NM	--
35KL3262	31-01	SC 31	Surface	DEB	Blue Mountain *	1.3 ± 0.1	NM ± NM	--
35KL3262	32-01	SC 32	Surface	DRL	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	33-01	SC 33	Surface	KNI	GF/LIW/RS *	NA ± NA	NM ± NM	REC; UNR (possibly burnt)
35KL3262	34-01	SC 34	Surface	PPT	Cowhead Lake *	4.4 ± 0.1	NM ± NM	--
35KL3262	35-01	SC 35	Surface	PPT	Cowhead Lake *	6.2 ± 0.1	6.2 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35KL3262	37-01	SC 37	Surface	PPT	Cowhead Lake *	5.0 ± 0.1	NM ± NM	--
35KL3262	38-01	SC 38	Surface	PPT	Blue Mountain	3.5 ± 0.1	1.4 ± 0.0	Rim 1 = cut A; Rims 2 & 3 (3.5 mic.) = cut B
35KL3262	39-01	SC 39	Surface	PPT	Spodue Mountain? *	3.5 ± 0.1	NM ± NM	--
35KL3262	41-01	SC 41	Surface	PPT	Cowhead Lake	5.5 ± 0.1	5.5 ± 0.1	--
35KL3262	42-01	SC 42	Surface	PPT	Cowhead Lake *	3.6 ± 0.0	NM ± NM	--
35KL3262	43-01	SC 43	Surface	BLA	Blue Mountain	2.3 ± 0.1	NM ± NM	--
35KL3262	45-01	SC 45	Surface	PPT	Cowhead Lake *	3.4 ± 0.1	NM ± NM	DFV
35KL3262	46-01	SC 46	Surface	PPT	Spodue Mountain *	6.3 ± 0.1	6.3 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35KL3262	47-01	SC 47	Surface	PRE	Blue Mountain *	2.5 ± 0.1	NM ± NM	--
35KL3262	48-01	SC 48	Surface	BLA	Cowhead Lake	1.7 ± 0.1	NM ± NM	--
35KL3262	55-02	QTU 4	Level 1	PPT	Blue Mountain *	1.6 ± 0.1	1.7 ± 0.1	Rim 1 = cut A; Rim 2 = cut B

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	59-01-S1	QTU 10	Level 2	DEB	Cougar Butte *	5.0 ± 0.1	NM ± NM	REC
35KL3262	60-01-S1	QTU 10	Level 3	DEB	Blue Mountain	3.6 ± 0.1	NM ± NM	--
35KL3262	61-01-S1	QTU 10	Level 4	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	61-01-S2	QTU 10	Level 4	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	61-01-S3	QTU 10	Level 4	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	NVH on ventral surface
35KL3262	61-01-S4	QTU 10	Level 4	DEB	Blue Mountain *	1.5 ± 0.1	NM ± NM	--
35KL3262	65-01-S1	QTU 11	Level 1	DEB	Cowhead Lake *	3.1 ± 0.1	NM ± NM	--
35KL3262	65-01-S2	QTU 11	Level 1	DEB	Cowhead Lake	3.6 ± 0.0	NM ± NM	--
35KL3262	65-01-S3	QTU 11	Level 1	DEB	Cowhead Lake *	6.1 ± 0.1	NM ± NM	--
35KL3262	66-01-S1	QTU 11	Level 2	DEB	Blue Mountain *	2.3 ± 0.1	NM ± NM	--
35KL3262	66-01-S2	QTU 11	Level 2	DEB	Blue Mountain *	2.3 ± 0.1	NM ± NM	--
35KL3262	67-01-S1	QTU 11	Level 3	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	67-01-S2	QTU 11	Level 3	DEB	Blue Mountain *	1.5 ± 0.1	NM ± NM	DFV
35KL3262	67-01-S3	QTU 11	Level 3	DEB	Blue Mountain *	1.7 ± 0.1	NM ± NM	--
35KL3262	71-01	QTU 12	Level 1	PRE	Cowhead Lake *	3.3 ± 0.1	NM ± NM	--
35KL3262	71-02-S1	QTU 12	Level 1	DEB	Blue Mountain *	2.9 ± 0.1	NM ± NM	DFV, PAT
35KL3262	72-01-S1	QTU 12	Level 2	DEB	Blue Mountain	2.4 ± 0.1	NM ± NM	--
35KL3262	73-01-S1	QTU 12	Level 3	DEB	Blue Mountain *	3.4 ± 0.1	NM ± NM	--
35KL3262	73-01-S2	QTU 12	Level 3	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	78-01-S1	QTU 14	Level 1	DEB	Blue Mountain	2.4 ± 0.1	NM ± NM	--
35KL3262	78-01-S2	QTU 14	Level 1	DEB	Blue Mountain *	1.7 ± 0.1	NM ± NM	--
35KL3262	78-01-S3	QTU 14	Level 1	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	79-01-S1	QTU 14	Level 2	DEB	Cowhead Lake *	3.2 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	80-01-S1	QTU 14	Level 3	DEB	Blue Mountain	2.1 ± 0.1	NM ± NM	--
35KL3262	80-01-S2	QTU 14	Level 3	DEB	Cowhead Lake *	3.7 ± 0.1	NM ± NM	--
35KL3262	80-01-S3	QTU 14	Level 3	DEB	Blue Mountain *	3.7 ± 0.1	NM ± NM	--
35KL3262	81-01-S1	QTU 14	Level 4	DEB	Blue Mountain *	3.3 ± 0.1	NM ± NM	--
35KL3262	82-01-S1	QTU 14	Level 5	DEB	Blue Mountain	2.6 ± 0.1	NM ± NM	NVH on ventral surface
35KL3262	82-01-S2	QTU 14	Level 5	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	NVH on BRE
35KL3262	84-01-S1	QTU 15	Level 1	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	84-01-S2	QTU 15	Level 1	DEB	Cougar Butte *	2.9 ± 0.0	NM ± NM	--
35KL3262	85-01-S1	QTU 15	Level 2	DEB	Blue Mountain *	3.4 ± 0.1	NM ± NM	--
35KL3262	90-01-S1	QTU 17	Level 1	DEB	Spodue Mountain *	5.6 ± 0.1	NM ± NM	--
35KL3262	90-01-S2	QTU 17	Level 1	DEB	Cowhead Lake *	5.0 ± 0.1	NM ± NM	--
35KL3262	90-01-S3	QTU 17	Level 1	DEB	Cowhead Lake *	2.6 ± 0.1	NM ± NM	--
35KL3262	92-01-S1	QTU 17	Level 3	DEB	Blue Mountain *	1.5 ± 0.1	NM ± NM	--
35KL3262	95-10	QTU 18	Level 2	SCR	Cowhead Lake	2.1 ± 0.1	NM ± NM	--
35KL3262	97-01-S1	QTU 22	Level 3	DEB	Blue Mountain *	2.9 ± 0.1	NM ± NM	--
35KL3262	98-01	QTU 22	Level 4	DEB	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3262	100-01	QTU 25	Level 1	DEB	Cowhead Lake *	5.1 ± 0.1	NM ± NM	--
35KL3262	102-01-S1	QTU 25	Level 3	DEB	Spodue Mountain *	3.4 ± 0.1	NM ± NM	--
35KL3262	102-01-S2	QTU 25	Level 3	DEB	Spodue Mountain *	3.4 ± 0.1	NM ± NM	--
35KL3262	104-01	QTU 28	Level 2	DEB	Blue Mountain *	1.9 ± 0.1	NM ± NM	--
35KL3262	107-01-S1	QTU 30	Level 2	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	107-01-S2	QTU 30	Level 2	DEB	Cowhead Lake *	5.0 ± 0.1	NM ± NM	--
35KL3262	108-01-S1	QTU 30	Level 3	DEB	Blue Mountain *	2.8 ± 0.1	3.7 ± 0.1	Larger rim on dorsal surface

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	108-01-S2	QTU 30	Level 3	DEB	Blue Mountain *	1.7 ± 0.0	NM ± NM	--
35KL3262	109-01-S1	QTU 30	Level 4	DEB	Blue Mountain *	4.9 ± 0.1	NM ± NM	--
35KL3262	110-01-1	QTU 30	Level 5	BLA	Spodue Mountain	5.1 ± 0.1	NM ± NM	REC
35KL3262	110-01-S1	QTU 30	Level 5	DEB	Blue Mountain *	2.4 ± 0.0	NM ± NM	NVH on BRE
35KL3262	111-01-S1	QTU 30	Level 6	DEB	Cowhead Lake *	4.6 ± 0.1	NM ± NM	--
35KL3262	111-01-S2	QTU 30	Level 6	DEB	Blue Mountain *	2.3 ± 0.1	4.9 ± 0.0	Smaller rim on dorsal surface
35KL3262	114-01-S1	QTU 31	Level 2	DEB	Blue Mountain *	1.8 ± 0.0	NM ± NM	--
35KL3262	114-01-S2	QTU 31	Level 2	DEB	Cowhead Lake	2.6 ± 0.1	4.6 ± 0.1	Smaller rim on ventral margin
35KL3262	115-01-S1	QTU 31	Level 3	DEB	Cowhead Lake *	2.4 ± 0.1	NM ± NM	--
35KL3262	117-01	QTU 31	Wall	DEB	Blue Mountain	1.8 ± 0.1	NM ± NM	--
35KL3262	139-02-S1	TU 1	Level 3	DEB	Blue Mountain *	1.9 ± 0.1	NM ± NM	--
35KL3262	142-02-S1	TU 2	Level 1	DEB	Cowhead Lake *	5.7 ± 0.1	NM ± NM	REC; DFV
35KL3262	143-02-1	TU 2	Level 2	FLT	East Medicine Lake *	3.6 ± 0.1	NM ± NM	--
35KL3262	144-02-S1	TU 2	Level 3	DEB	Blue Mountain *	1.9 ± 0.1	NM ± NM	--
35KL3262	144-02-S2	TU 2	Level 3	DEB	Blue Mountain *	3.6 ± 0.1	NM ± NM	--
35KL3262	145-02-S1	TU 2	Level 4	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	148-02-S1	TU 3	Level 2	DEB	Blue Mountain	2.6 ± 0.1	NM ± NM	--
35KL3262	148-02-S2	TU 3	Level 2	DEB	Blue Mountain *	2.5 ± 0.1	NM ± NM	--
35KL3262	149-02-2	TU 3	Level 3	FLT	Blue Mountain	1.8 ± 0.1	NM ± NM	--
35KL3262	149-02-S1	TU 3	Level 3	DEB	Cowhead Lake	5.9 ± 0.1	NM ± NM	HV
35KL3262	149-02-S3	TU 3	Level 3	DEB	Blue Mountain *	1.9 ± 0.1	NM ± NM	--
35KL3262	150-02-S1	TU 3	Level 4	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	151-02	TU 3	Level 5	DEB	Blue Mountain *	1.5 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	152-02-4	TU 4	Level 1	FLT	Blue Mountain	2.2 ± 0.1	NM ± NM	--
35KL3262	152-02-5	TU 4	Level 1	FLT	Cowhead Lake	2.9 ± 0.1	NM ± NM	--
35KL3262	153-02-S1	TU 4	Level 2	DEB	Blue Mountain *	3.0 ± 0.1	NM ± NM	--
35KL3262	153-02-S2	TU 4	Level 2	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	154-02-S1	TU 4	Level 3	DEB	Cowhead Lake *	1.6 ± 0.0	NM ± NM	--
35KL3262	154-02-S2	TU 4	Level 3	DEB	Cougar Butte *	5.2 ± 0.1	NM ± NM	--
35KL3262	155-02-S1	TU 4	Level 4	DEB	Cowhead Lake *	2.7 ± 0.1	NM ± NM	--
35KL3262	155-02-S2	TU 4	Level 4	DEB	Blue Mountain *	1.8 ± 0.0	NM ± NM	--
35KL3262	155-02-S3	TU 4	Level 4	DEB	Blue Mountain *	2.9 ± 0.1	NM ± NM	--
35KL3262	158-02-S1	TU 5	Level 1	DEB	Cowhead Lake *	1.8 ± 0.1	NM ± NM	--
35KL3262	158-02-S2	TU 5	Level 1	DEB	Blue Mountain *	4.0 ± 0.1	NM ± NM	--
35KL3262	159-02-3	TU 5	Level 2	FLT	Cougar Butte *	2.1 ± 0.1	NM ± NM	--
35KL3262	159-02-S1	TU 5	Level 2	DEB	Blue Mountain *	3.3 ± 0.1	NM ± NM	--
35KL3262	160-02-S1	TU 5	Level 3	DEB	Blue Mountain *	4.0 ± 0.1	NM ± NM	--
35KL3262	160-02-S2	TU 5	Level 3	DEB	Buck Mountain *	4.6 ± 0.0	NM ± NM	--
35KL3262	164-02-S1	TU 6	Level 1	DEB	Cowhead Lake *	4.1 ± 0.1	NM ± NM	--
35KL3262	164-02-S2	TU 6	Level 1	DEB	Blue Mountain *	3.9 ± 0.1	NM ± NM	--
35KL3262	165-02-S1	TU 6	Level 2	DEB	Spodue Mountain *	3.1 ± 0.1	NM ± NM	--
35KL3262	166-02-S1	TU 6	Level 3	DEB	Blue Mountain *	1.7 ± 0.1	NM ± NM	--
35KL3262	166-02-S2	TU 6	Level 3	DEB	Blue Mountain *	1.5 ± 0.1	NM ± NM	--
35KL3262	166-02-S3	TU 6	Level 3	DEB	Unknown Obsidian 6 *	4.2 ± 0.1	NM ± NM	--
35KL3262	167-02	TU 6	Level 4	PRE	Blue Mountain	2.3 ± 0.1	NM ± NM	--
35KL3262	167-03-S1	TU6	Level 4	DEB	Blue Mountain *	3.7 ± 0.1	NM ± NM	--

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						Rim 1	Rim 2	
35KL3262	167-03-S2	TU 6	Level 4	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	167-03-S3	TU 6	Level 4	DEB	Blue Mountain *	2.0 ± 0.0	NM ± NM	--
35KL3262	169-02	TU 6	Level 6	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	170-01-S1	TU 7	Surface	DEB	Blue Mountain *	2.6 ± 0.1	NM ± NM	--
35KL3262	172-02-S1	TU 7	Level 2	DEB	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3262	172-02-S2	TU 7	Level 2	DEB	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3262	172-02-S3	TU 7	Level 2	DEB	Cowhead Lake *	4.1 ± 0.1	NM ± NM	--
35KL3262	172-02-S4	TU 7	Level 2	DEB	Cowhead Lake *	3.4 ± 0.1	NM ± NM	--
35KL3262	173-02-S1	TU 7	Level 3	DEB	Blue Mountain *	1.6 ± 0.1	NM ± NM	--
35KL3262	173-02-S2	TU 7	Level 3	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	173-02-S3	TU 7	Level 3	DEB	Drews Creek/Butcher Flat *	NA ± NA	NM ± NM	UNR, WEA
35KL3262	174-02-3	TU 7	Level 4	FLT	Blue Mountain *	1.6 ± 0.1	NM ± NM	--
35KL3262	174-02-S1	TU 7	Level 4	DEB	Cowhead Lake	4.7 ± 0.1	NM ± NM	--
35KL3262	174-02-S2	TU 7	Level 4	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	REC
35KL3262	174-02-S4	TU 7	Level 4	DEB	Blue Mountain	4.4 ± 0.1	NM ± NM	REC
35KL3262	175-02-S1	TU 7	Level 5	DEB	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3262	176-02	TU 7	Level 6	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	178-02-S1	TU 8	Level 1	DEB	Cowhead Lake *	5.1 ± 0.1	NM ± NM	--
35KL3262	179-02-2	TU 8	Level 2	PPT	Blue Mountain *	2.3 ± 0.1	NM ± NM	--
35KL3262	179-02-S1	TU 8	Level 2	DEB	Blue Mountain *	1.9 ± 0.1	NM ± NM	REC
35KL3262	180-02-S1	TU 8	Level 3	DEB	Blue Mountain *	2.3 ± 0.1	NM ± NM	--
35KL3262	180-02-S2	TU 8	Level 3	DEB	Cowhead Lake *	4.6 ± 0.1	NM ± NM	--
35KL3262	181-02-S1	TU 8	Level 4	DEB	Cowhead Lake *	4.0 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	184-02-S1	TU 9	Level 1	DEB	Cowhead Lake *	5.5 ± 0.1	NM ± NM	--
35KL3262	185-02-1	TU 9	Level 2	SCR	Blue Mountain *	2.1 ± 0.1	NM ± NM	REC
35KL3262	185-02-S2	TU 9	Level 2	DEB	Blue Mountain *	1.9 ± 0.1	NM ± NM	--
35KL3262	186-02-S1	TU 9	Level 3	DEB	Cowhead Lake *	4.0 ± 0.1	NM ± NM	--
35KL3262	186-02-S2	TU 9	Level 3	DEB	Blue Mountain *	2.1 ± 0.0	NM ± NM	--
35KL3262	187-03-S1	TU 9	Level 4	DEB	Cowhead Lake *	4.2 ± 0.1	NM ± NM	--
35KL3262	187-03-S2	TU 9	Level 4	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	188-02-S1	TU 9	Level 5	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	188-02-S2	TU 9	Level 5	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	191-02-S1	TU 10	Level 3	DEB	Cowhead Lake *	4.0 ± 0.1	NM ± NM	--
35KL3262	191-02-S2	TU 10	Level 3	DEB	Cowhead Lake *	3.9 ± 0.1	NM ± NM	--
35KL3262	192-02-S1	TU 10	Level 4	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	193-02	TU 10	Level 5	DEB	Cowhead Lake *	2.8 ± 0.1	NM ± NM	--
35KL3262	196-02-S1	TU 11	Level 2	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	196-02-S2	TU 11	Level 2	DEB	Alturas FGV *	NM ± NM	NM ± NM	Not cut
35KL3262	196-02-S3	TU 11	Level 2	DEB	Cowhead Lake *	4.0 ± 0.1	NM ± NM	--
35KL3262	197-02-S1	TU 11	Level 3	DEB	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3262	198-02-S1	TU 11	Level 4	DEB	Cowhead Lake *	4.1 ± 0.1	NM ± NM	--
35KL3262	198-02-S2	TU 11	Level 4	DEB	Blue Mountain *	2.5 ± 0.1	NM ± NM	--
35KL3262	199-01-S1	TU 12	Surface	DEB	Cowhead Lake *	4.5 ± 0.1	NM ± NM	--
35KL3262	200-02-S1	TU 12	Level 1	DEB	Cowhead Lake *	4.4 ± 0.1	NM ± NM	--
35KL3262	200-02-S2	TU 12	Level 1	DEB	Blue Mountain *	1.7 ± 0.1	NM ± NM	--
35KL3262	201-02-S1	TU 12	Level 2	DEB	Blue Mountain *	1.6 ± 0.0	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	201-02-S2	TU 12	Level 2	DEB	Grasshopper Group *	4.1 ± 0.1	NM ± NM	--
35KL3262	201-02-S3	TU 12	Level 2	DEB	Cowhead Lake	4.1 ± 0.1	NM ± NM	--
35KL3262	202-03	TU12	Level 3	PPT	Blue Mountain	1.8 ± 0.1	NM ± NM	--
35KL3262	204-01-S1	TU 13	Surface	DEB	Blue Mountain *	3.2 ± 0.1	NM ± NM	--
35KL3262	204-01-S2	TU 13	Surface	DEB	Cowhead Lake *	4.2 ± 0.0	NM ± NM	--
35KL3262	205-01-1	TU 13	Level 1	DEB	Cougar Butte	3.5 ± 0.1	NM ± NM	--
35KL3262	205-02-S1	TU 13	Level 1	DEB	Blue Mountain *	2.9 ± 0.1	NM ± NM	REC; DFV
35KL3262	206-05-S1	TU 13	Level 2	DEB	Cowhead Lake *	4.2 ± 0.1	NM ± NM	--
35KL3262	206-05-S2	TU 13	Level 2	DEB	Blue Mountain *	1.8 ± 0.1	NM ± NM	DFV
35KL3262	206-05-S3	TU 13	Level 2	DEB	Blue Mountain *	1.7 ± 0.1	NM ± NM	--
35KL3262	207-02-S1	TU 13	Level 3	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	207-02-S2	TU 13	Level 3	DEB	Cowhead Lake *	4.3 ± 0.1	NM ± NM	--
35KL3262	209-01-S1	TU 14	Surface	DEB	Blue Mountain	2.8 ± 0.1	NM ± NM	--
35KL3262	210-02-5	TU 14	Level 1	COR	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	210-02-S1	TU 14	Level 1	DEB	Blue Mountain *	4.3 ± 0.1	NM ± NM	--
35KL3262	211-02-S1	TU 14	Level 2	DEB	Sugar Hill *	4.4 ± 0.1	NM ± NM	--
35KL3262	211-02-S2	TU 14	Level 2	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	212-02-S1	TU 14	Level 3	DEB	Blue Mountain *	2.9 ± 0.1	NM ± NM	--
35KL3262	212-02-S2	TU 14	Level 3	DEB	East Medicine Lake *	3.8 ± 0.1	NM ± NM	--
35KL3262	213-02	TU 14	Level 4	DEB	Blue Mountain	3.8 ± 0.2	NM ± NM	--
35KL3262	215-02	TU 15	Level 1	PRE	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	215-03-S1	TU 15	Level 1	DEB	Blue Mountain *	2.4 ± 0.0	NM ± NM	--
35KL3262	215-03-S2	TU 15	Level 1	DEB	Cowhead Lake *	6.1 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	216-02-2	TU 15	Level 2	FLT	Blue Mountain	4.0 ± 0.1	NM ± NM	--
35KL3262	216-02-S2	TU 15	Level 2	DEB	Blue Mountain	1.6 ± 0.1	NM ± NM	--
35KL3262	217-03-2	TU 15	Level 3	FLT	Cowhead Lake	4.0 ± 0.1	NM ± NM	--
35KL3262	218-03-1	TU 15	Level 4	FLT	Blue Mountain *	NA ± NA	NM ± NM	UNR (crystalline)
35KL3262	218-03-S2	TU 15	Level 4	DEB	Blue Mountain *	2.1 ± 0.0	NM ± NM	--
35KL3262	219-02-S1	TU 15	Level 5	DEB	Blue Mountain *	1.6 ± 0.0	NM ± NM	--
35KL3262	221-02-S1	TU 16	Level 1	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	222-02-S1	TU 16	Level 2	DEB	Cowhead Lake *	4.5 ± 0.1	NM ± NM	--
35KL3262	222-02-S2	TU 16	Level 2	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	222-02-S3	TU 16	Level 2	DEB	Blue Mountain	2.0 ± 0.1	NM ± NM	--
35KL3262	223-02-S1	TU 16	Level 3	DEB	Cowhead Lake *	4.3 ± 0.1	NM ± NM	--
35KL3262	223-02-S2	TU 16	Level 3	DEB	Blue Mountain *	3.9 ± 0.1	NM ± NM	--
35KL3262	223-03	TU 16	Level 3	KNI	Drews Creek/Butcher Flat *	4.4 ± 0.1	4.4 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35KL3262	226-01-1	TU 17	Surface	DEB	Grasshopper Group	2.9 ± 0.1	NM ± NM	--
35KL3262	227-02-2	TU 17	Level 1	COR	Buck Mountain *	3.0 ± 0.1	NM ± NM	REC
35KL3262	228-02-5	TU 17	Level 2	FLT	Cowhead Lake *	3.8 ± 0.1	NM ± NM	--
35KL3262	228-02-S1	TU 17	Level 2	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	229-02-1	TU 17	Level 3	PPT	Sugar Hill *	5.0 ± 0.1	NM ± NM	--
35KL3262	229-02-S1	TU 17	Level 3	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	229-03	TU 17	Level 3	DEB	Blue Mountain *	1.9 ± 0.1	NM ± NM	--
35KL3262	232-01-S1	TU 18	Level 1	DEB	Blue Mountain *	2.1 ± 0.0	NM ± NM	--
35KL3262	233-02-2	TU 18	Level 2	FLT	Blue Mountain	2.0 ± 0.1	NM ± NM	--
35KL3262	233-02-S1	TU 18	Level 2	DEB	Blue Mountain *	1.6 ± 0.1	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	233-02-S2	TU 18	Level 2	DEB	Blue Mountain *	2.5 ± 0.0	NM ± NM	--
35KL3262	233-02-S3	TU 18	Level 2	DEB	Sugar Hill *	2.2 ± 0.0	NM ± NM	--
35KL3262	234-02-S1	TU 18	Level 3	DEB	Cowhead Lake *	4.2 ± 0.1	NM ± NM	--
35KL3262	237-02-2	TU 19	Level 1	BUR	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	237-02-S1	TU 19	Level 1	DEB	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3262	237-02-S2	TU 19	Level 1	DEB	Cowhead Lake *	4.6 ± 0.1	NM ± NM	--
35KL3262	238-02-S1	TU 19	Level 2	DEB	Cowhead Lake *	4.5 ± 0.1	NM ± NM	--
35KL3262	238-02-S2	TU 19	Level 2	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	239-02-S1	TU 19	Level 3	DEB	Blue Mountain *	1.9 ± 0.1	2.5 ± 0.1	REC; smaller rim on ventral surface
35KL3262	239-02-S2	TU 19	Level 3	DEB	Blue Mountain *	1.9 ± 0.0	NM ± NM	--
35KL3262	240-02	TU 19	Level 4	PRE	Cowhead Lake *	3.8 ± 0.1	NM ± NM	--
35KL3262	241-02-2	TU 20	Level 1	SCR	Blue Mountain	3.2 ± 0.1	NM ± NM	REC
35KL3262	241-02-S1	TU 20	Level 1	DEB	Blue Mountain *	3.3 ± 0.1	NM ± NM	--
35KL3262	241-02-S2	TU 20	Level 1	DEB	Cowhead Lake *	4.6 ± 0.1	NM ± NM	--
35KL3262	242-02-5	TU 20	Level 2	FLT	Blue Mountain *	2.5 ± 0.1	NM ± NM	--
35KL3262	242-02-6	TU 20	Level 2	FLT	Blue Mountain *	1.7 ± 0.1	NM ± NM	--
35KL3262	242-02-S3	TU 20	Level 2	DEB	Cowhead Lake *	4.1 ± 0.1	NM ± NM	--
35KL3262	243-02-S1	TU 20	Level 3	DEB	Blue Mountain *	1.6 ± 0.1	NM ± NM	--
35KL3262	243-02-S2	TU 20	Level 3	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	244-02-S1	TU 20	Level 4	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	246-02	TU 21	Surface	KNI	Cowhead Lake *	5.0 ± 0.1	NM ± NM	--
35KL3262	247-02-1	TU 21	Level 1	FLT	Cowhead Lake	1.7 ± 0.1	NM ± NM	--
35KL3262	247-02-S1	TU 21	Level 1	DEB	Blue Mountain *	2.4 ± 0.0	NM ± NM	--

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Northwest Research Obsidian Studies Laboratory

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	248-02-4	TU 21	Level 2	PPT	Blue Mountain *	1.4 ± 0.1	NM ± NM	--
35KL3262	249-02-S1	TU 21	Level 3	DEB	Cowhead Lake *	4.6 ± 0.1	NM ± NM	--
35KL3262	249-02-S2	TU 21	Level 3	DEB	Blue Mountain *	2.4 ± 0.1	NM ± NM	--
35KL3262	249-02-S3	TU 21	Level 3	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	250-02-S1	TU 21	Level 4	DEB	Blue Mountain *	1.6 ± 0.1	NM ± NM	--
35KL3262	253-03-2	TU 22	Level 1	BLA	Cowhead Lake *	4.9 ± 0.1	NM ± NM	--
35KL3262	253-03-S1	TU 22	Level 1	DEB	Blue Mountain *	1.7 ± 0.0	NM ± NM	DFV (crystalline)
35KL3262	254-02-2	TU 22	Level 2	BUR	Spodue Mountain *	2.1 ± 0.1	5.9 ± 0.1	Smaller rim on BRE, ventral is BEV, UNR
35KL3262	254-02-9	TU 22	Level 2	FLT	Blue Mountain	1.6 ± 0.1	NM ± NM	--
35KL3262	254-02-S1	TU 22	Level 2	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	255-03-1	TU 22	Level 3	FLT	Blue Mountain	2.0 ± 0.1	NM ± NM	--
35KL3262	255-03-2	TU 22	Level 3	BUR	Cowhead Lake	4.0 ± 0.1	5.1 ± 0.1	Smaller rim on ventral surface
35KL3262	255-03-S1	TU 22	Level 3	DEB	Cowhead Lake *	4.8 ± 0.1	NM ± NM	--
35KL3262	255-04	TU 22	Level 3	PRE	East Medicine Lake *	4.1 ± 0.1	NM ± NM	--
35KL3262	255-05	TU 22	Level 3	PRE	East Medicine Lake *	3.6 ± 0.1	NM ± NM	Ventral surface is BEV, appears same
35KL3262	256-02-1	TU 22	Level 4	FLT	East Medicine Lake	5.3 ± 0.1	NM ± NM	--
35KL3262	256-03	TU 22	Level 4	PRE	Cowhead Lake *	3.7 ± 0.1	NM ± NM	REC; NVH on BRE
35KL3262	259-02-S1	TU 23	Level 2	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	259-02-S2	TU 23	Level 2	DEB	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3262	260-02-S1	TU 23	Level 3	DEB	Blue Mountain	2.3 ± 0.1	NM ± NM	--
35KL3262	264-01-1	TU 24	Surface	FLT	Blue Mountain	3.8 ± 0.1	NM ± NM	--
35KL3262	264-01-S1	TU 24	Surface	DEB	Blue Mountain *	2.7 ± 0.1	NM ± NM	--
35KL3262	265-02	TU 24	Level 1	PRE	Sugar Hill *	3.9 ± 0.0	5.5 ± 0.1	Smaller rim on BRE margin

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	265-03-1	TU 24	Level 1	FLT	Cowhead Lake	5.0 ± 0.1	NM ± NM	--
35KL3262	265-03-S1	TU 24	Level 1	DEB	Cowhead Lake *	5.5 ± 0.1	NM ± NM	--
35KL3262	266-02-3	TU 24	Level 2	BUR	Cowhead Lake *	2.4 ± 0.1	4.9 ± 0.1	Smaller rim on dorsal (?) margin
35KL3262	266-02-5	TU 24	Level 2	FLT	Blue Mountain *	3.1 ± 0.1	NM ± NM	--
35KL3262	267-02-4	TU 24	Level 3	FLT	Blue Mountain *	1.6 ± 0.1	NM ± NM	--
35KL3262	267-02-S2	TU 24	Level 3	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	271-02-S1	TU 25	Level 1	DEB	Cowhead Lake *	4.0 ± 0.1	NM ± NM	--
35KL3262	271-02-S2	TU 25	Level 1	DEB	Blue Mountain *	NA ± NA	NM ± NM	REC; UNR, IRR
35KL3262	272-02-2	TU 25	Level 2	BLA	Buck Mountain *	3.3 ± 0.0	NM ± NM	DFV
35KL3262	272-02-S2	TU 25	Level 2	DEB	Blue Mountain *	4.0 ± 0.1	NM ± NM	--
35KL3262	273-02-S1	TU 25	Level 3	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	274-01-S1	TU 26	Surface	DEB	Cowhead Lake *	6.5 ± 0.1	NM ± NM	--
35KL3262	274-02	TU 26	Surface	PRE	East Medicine Lake *	4.9 ± 0.1	6.0 ± 0.1	Smaller rim on BRE
35KL3262	275-01-S1	TU 26	Level 1	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	REC; DFV, HV
35KL3262	276-02-2	TU 26	Level 2	BUR	Cowhead Lake *	4.8 ± 0.1	NM ± NM	--
35KL3262	276-02-4	TU 26	Level 2	FLT	Blue Mountain	1.7 ± 0.1	NM ± NM	--
35KL3262	276-02-S2	TU 26	Level 2	DEB	Cowhead Lake *	4.6 ± 0.1	NM ± NM	--
35KL3262	276-03	TU 26	Level 2	PRE	East Medicine Lake	4.0 ± 0.1	4.0 ± 0.1	Rim 1 = cut A; Rim 2 = cut B
35KL3262	277-03-S1	TU 26	Level 3	DEB	Spodue Mountain *	3.5 ± 0.1	NM ± NM	--
35KL3262	277-03-S2	TU 26	Level 3	DEB	Blue Mountain	2.0 ± 0.1	NM ± NM	--
35KL3262	278-02-S1	TU 26	Level 4	DEB	Blue Mountain *	2.1 ± 0.0	NM ± NM	--
35KL3262	280-01-S1	TU 27	Level 1	DEB	Blue Mountain *	3.1 ± 0.1	NM ± NM	--
35KL3262	280-01-S2	TU 27	Level 1	DEB	Cowhead Lake *	4.3 ± 0.1	NM ± NM	--

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						Rim 1	Rim 2	
35KL3262	281-02-3	TU 27	Level 2	FLT	Cowhead Lake *	6.4 ± 0.1	NM ± NM	IRR, HV (fissures)
35KL3262	281-02-S1	TU 27	Level 2	DEB	Blue Mountain *	2.4 ± 0.1	NM ± NM	--
35KL3262	281-02-S2	TU 27	Level 2	DEB	Cowhead Lake *	6.4 ± 0.1	NM ± NM	--
35KL3262	282-02-S1	TU 27	Level 3	DEB	Cowhead Lake *	4.3 ± 0.1	NM ± NM	--
35KL3262	282-02-S2	TU 27	Level 3	DEB	Blue Mountain *	2.3 ± 0.1	NM ± NM	--
35KL3262	283-02-1	TU 27	Level 4	FLT	Blue Mountain	1.7 ± 0.1	NM ± NM	--
35KL3262	284-03-S1	TU 27	Level 5	DEB	Blue Mountain *	1.9 ± 0.0	NM ± NM	--
35KL3262	284-03-S2	TU 27	Level 5	DEB	Blue Mountain *	1.7 ± 0.1	NM ± NM	--
35KL3262	286-01	TU 28	Surface	DEB	Blue Mountain *	2.6 ± 0.1	NM ± NM	--
35KL3262	287-02-2	TU 28	Level 1	PRE	Cowhead Lake	5.1 ± 0.1	NM ± NM	--
35KL3262	287-02-3	TU 28	Level 1	BLA	Cougar Butte	5.4 ± 0.0	NM ± NM	--
35KL3262	287-02-S1	TU 28	Level 1	DEB	Cowhead Lake *	3.9 ± 0.1	NM ± NM	--
35KL3262	287-02-S2	TU 28	Level 1	DEB	Blue Mountain *	3.9 ± 0.1	NM ± NM	--
35KL3262	288-02	TU 28	Level 2	PPT	Grasshopper Group *	3.5 ± 0.1	NM ± NM	--
35KL3262	288-03-S1	TU 28	Level 2	DEB	Blue Mountain *	2.4 ± 0.1	NM ± NM	--
35KL3262	288-03-S2	TU 28	Level 2	DEB	Blue Mountain *	2.1 ± 0.0	NM ± NM	--
35KL3262	288-03-S3	TU 28	Level 2	DEB	Cowhead Lake *	4.6 ± 0.1	NM ± NM	--
35KL3262	289-02-S1	TU 28	Level 3	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3262	289-02-S2	TU 28	Level 3	DEB	Blue Mountain	2.2 ± 0.1	NM ± NM	--
35KL3262	290-02-1	TU 28	Level 4	FLT	Blue Mountain	2.0 ± 0.1	NM ± NM	--
35KL3262	290-02-S1	TU 28	Level 4	DEB	Cowhead Lake *	4.2 ± 0.1	NM ± NM	--
35KL3262	290-02-S2	TU 28	Level 4	DEB	Blue Mountain	2.0 ± 0.1	NM ± NM	--
35KL3262	291-02-S1	TU 28	Level 5	DEB	Cowhead Lake *	4.3 ± 0.1	NM ± NM	--

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Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3262	291-02-S2	TU 28	Level 5	DEB	Blue Mountain *	1.9 ± 0.1	NM ± NM	--
35KL3262	295-02-S1	TU 29	Level 2	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	295-02-S2	TU 29	Level 2	DEB	Grasshopper Group *	5.3 ± 0.1	NM ± NM	--
35KL3262	295-03	TU 29	Level 2	PRE	Blue Mountain *	1.6 ± 0.1	NM ± NM	--
35KL3262	297-02-S1	TU 29	Level 4	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	299-02-S1	TU 30	Level 1	DEB	Cowhead Lake *	6.9 ± 0.1	NM ± NM	--
35KL3262	299-02-S2	TU 30	Level 1	DEB	Blue Mountain *	4.1 ± 0.1	NM ± NM	--
35KL3262	300-02-S1	TU 30	Level 1	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3262	300-02-S2	TU 30	Level 1	DEB	Blue Mountain *	2.3 ± 0.1	NM ± NM	--
35KL3262	301-02-S1	TU 30	Level 3	DEB	Cowhead Lake *	4.3 ± 0.1	NM ± NM	--
35KL3262	301-02-S2	TU 30	Level 3	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3262	302-02-S1	TU 30	Level 4	DEB	Blue Mountain *	2.1 ± 0.0	NM ± NM	--
35KL3262	303-02-S1	TU 30	Level 5	DEB	Cowhead Lake *	4.2 ± 0.1	NM ± NM	--
35KL3262	303-02-S2	TU 30	Level 5	DEB	Cowhead Lake *	4.3 ± 0.1	NM ± NM	--
35KL3262	303-02-S3	TU 30	Level 5	DEB	Sugar Hill *	4.2 ± 0.1	NM ± NM	--
35KL3493	1-01	SP 6	0-17	DEB	Surveyor Spring *	9.0 ± 0.1	NM ± NM	--
35KL3300	1-01	SC 1	Surface	DEB	Blue Mountain *	3.2 ± 0.1	NM ± NM	--
35KL3300	2-01	SC 2	Surface	PPT	Spodue Mountain	5.8 ± 0.1	NM ± NM	--
35KL3300	3-01	SC 3	Surface	DEB	Spodue Mountain *	4.4 ± 0.1	NM ± NM	--
35KL3300	4-01	SC 4	Surface	DEB	Spodue Mountain *	NA ± NA	NM ± NM	REC; UNR (NVH?)
35KL3300	5-01	SC 5	Surface	DEB	Blue Mountain	2.4 ± 0.1	NM ± NM	--
35KL3300	6-01	SC 6	Surface	DEB	Blue Mountain	1.7 ± 0.1	NM ± NM	--
35KL3300	7-01	SC 7	Surface	FLT	Cowhead Lake *	6.1 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3300	9-01	SC 9	Surface	DEB	GF/LIW/RS *	4.9 ± 0.1	NM ± NM	--
35KL3300	10-01	SC 10	Surface	DEB	Cowhead Lake *	4.9 ± 0.0	NM ± NM	--
35KL3300	11-01	SC 11	Surface	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3300	12-01	SC 12	Surface	DEB	Silver Lake/Sycan Marsh *	NA ± NA	NM ± NM	REC; UNR (crystalline)
35KL3300	15-01-S1	QTU 2	Level 2	DEB	Blue Mountain *	1.5 ± 0.1	NM ± NM	--
35KL3446	2-01	QTU 6	Level 1	FLT	Blue Mountain	2.1 ± 0.1	NM ± NM	Same rim on all surfaces
35KL3446	3-01	QTU 6	Level 3	BLA	Blue Mountain *	1.7 ± 0.1	NM ± NM	--
35KL3446	4-01-1	QTU 9	Level 1	PPT	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3446	4-01-S1	QTU 9	Level 1	DEB	Blue Mountain *	1.7 ± 0.0	NM ± NM	DFV
35KL3446	4-01-S2	QTU 9	Level 1	DEB	Glass Mountain *	1.6 ± 0.1	NM ± NM	--
35KL3446	5-01-S1	QTU 9	Level 2	DEB	Blue Mountain *	2.9 ± 0.1	NM ± NM	--
35KL3446	6-01-1	QTU 9	Level 3	FLT	Sugar Hill *	2.2 ± 0.1	NM ± NM	--
35KL3446	6-01-S1	QTU 9	Level 3	DEB	Blue Mountain *	1.4 ± 0.1	NM ± NM	--
35KL3446	9-01-1	QTU 11	Level 3	COR	Blue Mountain *	1.4 ± 0.1	NM ± NM	--
35KL3495	1-01	SC 1	Surface	DEB	Cougar Butte *	6.2 ± 0.1	NM ± NM	DFV
35KL3495	2-01	SC 2	Surface	PPT	Cowhead Lake *	6.5 ± 0.1	NM ± NM	Same rim on all surfaces
35KL3495	3-01	SC 3	Surface	DEB	Not Obsidian	NM ± NM	NM ± NM	Not cut
35KL3495	4-01	SC 4	Surface	DEB	Cowhead Lake *	1.6 ± 0.0	4.8 ± 0.1	Smaller rim on BRE
35KL3495	6-01	SC 6	Surface	PRE	Tucker HIll *	3.5 ± 0.1	NM ± NM	Same rim on all surfaces
35KL3495	8-01	SC 8	Surface	DEB	Buck Mountain *	6.5 ± 0.1	NM ± NM	DFV (crystalline)
35KL3495	9-01	SC 9	Surface	DEB	East Medicine Lake *	4.7 ± 0.1	NM ± NM	--
35KL3495	10-01	SC 10	Surface	COR	Cowhead Lake	5.6 ± 0.1	NM ± NM	--
35KL3495	11-01	SC 11	Surface	DEB	Cougar Butte *	5.8 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3495	12-01	SC 12	Surface	DEB	Cowhead Lake *	2.0 ± 0.0	5.5 ± 0.1	Smaller rim on BRE
35KL3495	13-01	SC 13	Surface	COR	Unknown FGV B	NA ± NA	NM ± NM	UNR (crystalline)
35KL3495	14-01	SC 14	Surface	FLT	Blue Mountain	2.5 ± 0.1	NM ± NM	--
35KL3447	3-01	SC 3	Surface	COR	Unknown FGV	NM ± NM	NM ± NM	Not cut
35KL3447	4-01	SC 4	Surface	DEB	East Medicine Lake *	2.9 ± 0.1	NM ± NM	--
35KL3447	5-01	SC 5	Surface	DEB	Blue Mountain *	3.2 ± 0.1	NM ± NM	DFV (crystalline)
35KL3447	6-01	SC 6	Surface	BLA	Blue Mountain	2.0 ± 0.1	NM ± NM	--
35KL3447	7-01	SC 7	Surface	DEB	Blue Mountain *	4.2 ± 0.1	NM ± NM	--
35KL3447	8-01	SC 8	Surface	DEB	Blue Mountain *	1.5 ± 0.1	NM ± NM	--
35KL3447	9-01	SC 9	Surface	DEB	East Medicine Lake *	5.9 ± 0.1	NM ± NM	DFV
35KL3447	10-01	SC 10	Surface	BLA	East Medicine Lake *	5.3 ± 0.1	NM ± NM	--
35KL3447	11-01	SC 11	Surface	FLT	East Medicine Lake *	6.5 ± 0.1	NM ± NM	DFV
35KL3447	12-01	SC 12	Surface	DEB	Grasshopper Group *	4.8 ± 0.0	NM ± NM	--
35KL3447	14-01	SC 14	Surface	DEB	East Medicine Lake *	2.0 ± 0.1	5.0 ± 0.1	Smaller rim on dorsal margin
35KL3447	17-01	QTU 8	Level 1	COR	Silver Lake/Sycan Marsh	2.5 ± 0.1	NM ± NM	Same rim on all surfaces
35KL3447	17-02	QTU 8	Level 1	DEB	East Medicine Lake *	2.3 ± 0.1	NM ± NM	--
35KL3447	18-01	QTU 9	Level 1	DEB	Glass Mountain *	2.0 ± 0.1	NM ± NM	--
35KL3447	18-01-1	QTU 9	Level 1	PPT	East Medicine Lake *	2.1 ± 0.1	NM ± NM	--
35KL3447	24-01	SC 1004	Surface	KNI	Spodue Mountain	1.8 ± 0.1	2.6 ± 0.1	Smaller rim on BRE & dorsal surfaces
35KL3447	34-01	SC 1014	Surface	BLA	Blue Mountain *	1.9 ± 0.1	NM ± NM	Same rim on all surfaces
35KL3449	1-01	SC 1	Surface	FLT	Unknown FGV	NM ± NM	NM ± NM	Not cut
35KL3449	3-01	SC 3	Surface	PPT	Blue Mountain	2.1 ± 0.1	NM ± NM	--
35KL3449	4-01	SC 4	Surface	BUR	Cowhead Lake *	6.5 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

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Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3449	5-01	SC 5	Surface	SCR	East Medicine Lake	5.5 ± 0.1	NM ± NM	--
35KL3449	6-01	SC 6	Surface	DRL	Tucker Hill	4.1 ± 0.1	NM ± NM	--
35KL3449	8-01	SC 8	Surface	BLA	Cowhead Lake	2.4 ± 0.1	NM ± NM	--
35KL3449	11-01	SC 11	Surface	PPT	Cowhead Lake *	4.6 ± 0.1	NM ± NM	--
35KL3449	17-01	SC 17	Surface	FLT	Cowhead Lake	2.6 ± 0.1	NM ± NM	--
35KL3449	20-01	SC 20	Surface	PRE	Cowhead Lake	2.8 ± 0.1	NM ± NM	--
35KL3449	21-01	SC 21	Surface	DEB	Unknown FGV *	NM ± NM	NM ± NM	Not cut
35KL3449	22-01	SC 22	Surface	DEB	Glass Mountain *	NA ± NA	NM ± NM	REC; UNR, OPA
35KL3449	24-01	SC 24	Surface	COR	Grasshopper Group	5.4 ± 0.1	NM ± NM	--
35KL3449	25-01	SC 25	Surface	DEB	Drews Creek/Butcher Flat	2.4 ± 0.1	NM ± NM	--
35KL3449	26-01	SC 26	Surface	DEB	Blue Mountain *	2.9 ± 0.1	NM ± NM	--
35KL3449	27-01	SC 27	Surface	DEB	Grasshopper Group	4.8 ± 0.1	NM ± NM	--
35KL3449	28-01	SC 28	Surface	DEB	Cowhead Lake *	6.5 ± 0.1	NM ± NM	--
35KL3449	29-01	SC 29	Surface	DEB	GF/LIW/RS	3.1 ± 0.1	NM ± NM	--
35KL3449	30-01	SC 30	Surface	DEB	Blue Mountain *	2.5 ± 0.1	NM ± NM	NVH on BRE
35KL3449	34-01	SC 34	Surface	FLT	Unknown FGV	NM ± NM	NM ± NM	Not cut
35KL3449	35-01	SC 35	Surface	COR	Blue Mountain	NA ± NA	NM ± NM	Ventral basal scar is approx 3.5 microns
35KL3449	36-01	SC 36	Surface	FLT	Cowhead Lake	2.8 ± 0.1	NM ± NM	--
35KL3449	37-01-S1	QTU 1	Surface	DEB	Sugar Hill *	7.6 ± 0.1	NM ± NM	--
35KL3449	41-01	SC 37	Surface	PPT	Tucker Hill *	6.2 ± 0.1	NM ± NM	--
35KL3449	44-01	SC 40	Surface	PRE	Blue Mountain *	3.4 ± 0.1	NM ± NM	--
35KL3449	45-01	SC 41	Surface	PPT	Buck Mountain *	1.6 ± 0.1	3.1 ± 0.1	Smaller rim on BRE
35KL3449	48-01-S1	QTU 3	Level 1	DEB	Silver Lake/Sycan Marsh *	3.6 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammerstone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Northwest Research Obsidian Studies Laboratory

Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3449	49-01-S1	QTU 3	Level 2	DEB	Grasshopper Group *	4.9 ± 0.1	NM ± NM	--
35KL3449	50-01	QTU 4	Level 5	DEB	Unknown FGV	NM ± NM	NM ± NM	Not cut
35KL3449	52-01	QTU 4	Level 7	DEB	East Medicine Lake *	5.1 ± 0.1	NM ± NM	--
35KL3449	56-01	TU 1	Surface	DEB	Glass Mountain *	2.8 ± 0.1	NM ± NM	--
35KL3449	57-03-2	TU 1	Level 1	COR	Cowhead Lake	3.1 ± 0.1	NM ± NM	--
35KL3449	57-03-4	TU 1	Level 1	FLT	Cowhead Lake	2.8 ± 0.1	NM ± NM	--
35KL3449	58-02-1	TU 1	Level 2	PPT	Cowhead Lake *	2.6 ± 0.1	NM ± NM	Platform is BEV, UNR
35KL3449	59-02-1	TU 1	Level 3	FLT	Buck Mountain	2.3 ± 0.1	NM ± NM	--
35KL3449	59-02-S1	TU 1	Level 3	DEB	Blue Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3449	59-03	TU 1	Level 3	PPT	Spodue Mountain *	2.2 ± 0.1	NM ± NM	Dorsal margin is BEV, UNR
35KL3449	63-01-S1	TU 2	Surface	DEB	Buck Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3449	64-04-11	TU 2	Level 1	FLT	Spodue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3449	65-02-1	TU 2	Level 2	FLT	Cowhead Lake	2.0 ± 0.1	NM ± NM	--
35KL3449	65-02-2	TU 2	Level 2	FLT	Blue Mountain	2.4 ± 0.1	NM ± NM	--
35KL3449	65-02-S1	TU 2	Level 2	DEB	Blue Mountain *	1.6 ± 0.1	NM ± NM	--
35KL3449	66-02-1	TU 2	Level 3	FLT	Blue Mountain	1.7 ± 0.1	NM ± NM	NVH on BRE
35KL3449	74-03-1	TU 3	Level 3	FLT	Cowhead Lake *	5.2 ± 0.1	NM ± NM	--
35KL3449	75-04-S1	TU 3	Level 4	DEB	Cowhead Lake *	3.1 ± 0.1	NM ± NM	--
35KL3449	79-03-S1	TU 3	Level 8	DEB	Buck Mountain *	6.3 ± 0.0	NM ± NM	--
35KL3449	89-02-1	TU 4	Level 8	PPT	Grasshopper Group *	6.1 ± 0.1	NM ± NM	Dorsal surface is UNR
35KL3449	90-02	TU 4	Level 9	PPT	Spodue Mountain	6.1 ± 0.1	NM ± NM	--
35KL3449	90-03-S1	TU 4	Level 9	DEB	East Medicine Lake *	4.9 ± 0.1	NM ± NM	--
35KL3448	2-01	QTU 3	Level 1	DEB	Blue Mountain *	2.0 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3448	3 01-S1	QTU 4	Surface	DEB	Blue Mountain *	2.3 ± 0.1	NM ± NM	--
35KL3448	4 01-S1	QTU 4	Level 1	DEB	Blue Mountain *	3.5 ± 0.1	NM ± NM	--
35KL3448	5-01	QTU 4	Level 3	DEB	Blue Mountain *	2.7 ± 0.1	NM ± NM	--
35KL3472	3-01	SC 3	Surface	DEB	Blue Mountain *	4.6 ± 0.0	NM ± NM	REC
35KL3472	5-01	SC 5	Surface	DEB	Blue Mountain *	2.6 ± 0.1	NM ± NM	NVH on BRE
35KL3472	7-01	SC 7	Surface	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3472	13-01	QTU 3	Level 2	DEB	Glass Mountain *	3.2 ± 0.1	NM ± NM	--
35KL3307	4-01	SC 4	Surface	DEB	Glass Mountain *	1.8 ± 0.1	NM ± NM	--
35KL3307	5-01	SC 5	Surface	PPT	Tucker HIll *	4.0 ± 0.1	NM ± NM	--
35KL3307	11-01	SC 11	Surface	DEB	Cowhead Lake *	3.6 ± 0.1	NM ± NM	--
35KL3307	12-01	SC 12	Surface	DEB	Cougar Butte *	5.1 ± 0.1	NM ± NM	--
35KL3307	15-01	SC 15	Surface	DEB	Cowhead Lake	1.5 ± 0.1	NM ± NM	--
35KL3307	16-01	SC 16	Surface	DEB	Blue Mountain	1.8 ± 0.0	NM ± NM	--
35KL3307	17-01	SC 17	Surface	DEB	Buck Mountain *	2.9 ± 0.1	NM ± NM	--
35KL3307	18-01	SC 18	Surface	FLT	Buck Mountain *	2.2 ± 0.1	NM ± NM	DFV
35KL3307	19-01	SC 19	Surface	FLT	Buck Mountain	5.0 ± 0.1	6.0 ± 0.1	Smaller rim on ventral surface
35KL3307	20-01	SC 20	Surface	DEB	East Medicine Lake *	NA ± NA	NM ± NM	REC; UNR, DFV
35KL3451	1-01	SC 1	Surface	FLT	Cowhead Lake	3.1 ± 0.1	NM ± NM	Same rim on all surfaces
35KL3451	2-01	SC 2	Surface	DEB	Buck Mountain *	NA ± NA	NM ± NM	UNR, WEA
35KL3451	3-01	SC 3	Surface	DEB	Spodue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3451	4-01	SC 4	Surface	DEB	Cowhead Lake *	2.9 ± 0.1	NM ± NM	--
35KL3451	5-01	SC 5	Surface	DEB	Cougar Butte *	3.3 ± 0.1	NM ± NM	--
35KL3443	4-01	QTU 1	Level 2	PRE	Blue Mountain	5.0 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

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Table B-1. Obsidian Hydration Results and Sample Provenience: Sites Associated with the Ruby Pipeline Project, Oregon

Site	Catalog No.	Unit	Depth	Artifact Type[A]	Artifact Source	Hydration Rims		Comments[B]
						Rim 1	Rim 2	
35KL3277	1-01	SC 1	Surface	DEB	Blue Mountain *	1.6 ± 0.1	2.7 ± 0.1	Smaller rim on BRE
35KL3277	2-01	SC 2	Surface	DEB	Not Obsidian	NM ± NM	NM ± NM	Not cut
35KL3277	3-01	SC 3	Surface	DEB	Blue Mountain *	2.2 ± 0.1	NM ± NM	--
35KL3277	4-01	SC 4	Surface	DEB	Blue Mountain *	3.1 ± 0.1	NM ± NM	DFV
35KL3277	5-01	SC 5	Surface	DEB	Blue Mountain *	1.4 ± 0.1	NM ± NM	REC
35KL3277	7-01	SC 7	Surface	DEB	Cougar Butte *	2.5 ± 0.1	NM ± NM	--
35KL3277	8-01	SC 8	Surface	DEB	Blue Mountain *	2.1 ± 0.1	NM ± NM	--
35KL3277	9-01	SC 9	Surface	DEB	Blue Mountain *	3.0 ± 0.1	NM ± NM	--
35KL3277	10-01	SC 10	Surface	DEB	Blue Mountain	1.6 ± 0.1	NM ± NM	--
35KL3277	12-01	QTU 2	Level 1	DEB	Blue Mountain *	3.3 ± 0.1	NM ± NM	--

[A] ADZ = Adz; BIF = Biface; BLA = Blank; BUR = Burin; CHO = Chopper; COR = Core; COS = Cooking Stone; CRE = Crescent; DEB = Debitage; DRL = Drill; FLT = Flake Tool; HAM = Hammer-stone; KNI = Knife; MAN = Manuport; PEB = Pebble Tool; PPT = Projectile Point; PRE = Preform; SCR = Scraper; TRM = Tested Raw Material; UNI = Uniface; WFL = Worked Flake.

[B] See text for explanation of comment abbreviations

NA = Not Available (attempted hydration analysis but unmeasurable rim); NM = Not Measured; * = Small sample

Abbreviations and Definitions Used in the Comments Column

All hydration rim measurements are recorded in microns.
When two or more individual cuts are placed on an artifact, the separate locations are designated Cut A, Cut B, etc.
Hydration rims found on internal fissures in the glass are designated as “fissure”.
Dorsal, ventral, surface, and microns are sometimes abbreviated in the comments column as d, v, surf, and mic.

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.

Appendix C

Geographic Distribution of Obsidian and FGV Sources for Selected Ruby Pipeline Project Sites

APPENDIX C: GEOGRAPHIC DISTRIBUTION OF OBSIDIAN AND FGV SOURCES FOR SELECTED RUBY PIPELINE PROJECT SITES

The maps in Appendix C depict the geographic distribution of identified obsidian and fine-grained volcanic (FGV) toolstone sources for all project sites in which 20 or more artifacts were geochemically characterized (see Table C-1 and Figure C-1). Individual sites are presented in an east to west order with a single site featured for each map. A filled triangle indicates that the obsidian source is present at the site an unfilled triangle shows that the source was not found among the characterized obsidian artifacts. Similarly, a filled diamond indicates that the FGV source is present at the site an unfilled diamond shows that the source was not found among the characterized FGV artifacts.

The obsidian and FGV source locations depicted in the maps are somewhat generalized and some of the obsidian sources, particularly those associated with voluminous Great Basin ashflow eruptions, are widely dispersed over the landscape. In particular, glass from the Massacre Lake/Guano Valley geochemical source is found over a very extensive area of northwestern Nevada and southeastern Oregon. When artifacts from this source are present at a site, the broader areal distribution of locales at which source obsidian has been found is shown on the map.

Table C-1. Ruby Pipeline sites in which 20 or more artifacts were geochemically analyzed.

PROJECT SITE (EAST TO WEST)	LONGITUDE	LATITUDE	NUMBER OF GEOCHEMICALLY CHARACTERIZED ARTIFACTS	FIGURE
35LK1231	-119.98	42.00	999	C-2
35LK3931	-120.02	42.03	47	C-3
35LK3842	-120.06	42.05	81	C-4
35LK3327	-120.07	42.06	59	C-5
35LK4140	-120.11	42.11	49	C-6
35LK3337	-120.13	42.12	116	C-7
35LK3891	-120.14	42.13	20	C-8
35LK3989	-120.43	42.09	20	C-9
35LK3896	-120.44	42.09	37	C-10
35LK4173	-120.48	42.04	49	C-11
35LK4134	-120.49	42.02	55	C-12
35LK4130	-120.51	42.02	83	C-13
35LK4068	-120.56	42.01	38	C-14
35LK3920	-120.64	42.01	212	C-15
35LK4221	-120.77	42.01	51	C-16
35KL3262	-121.07	42.00	330	C-17
35KL3449	-121.15	42.01	48	C-18

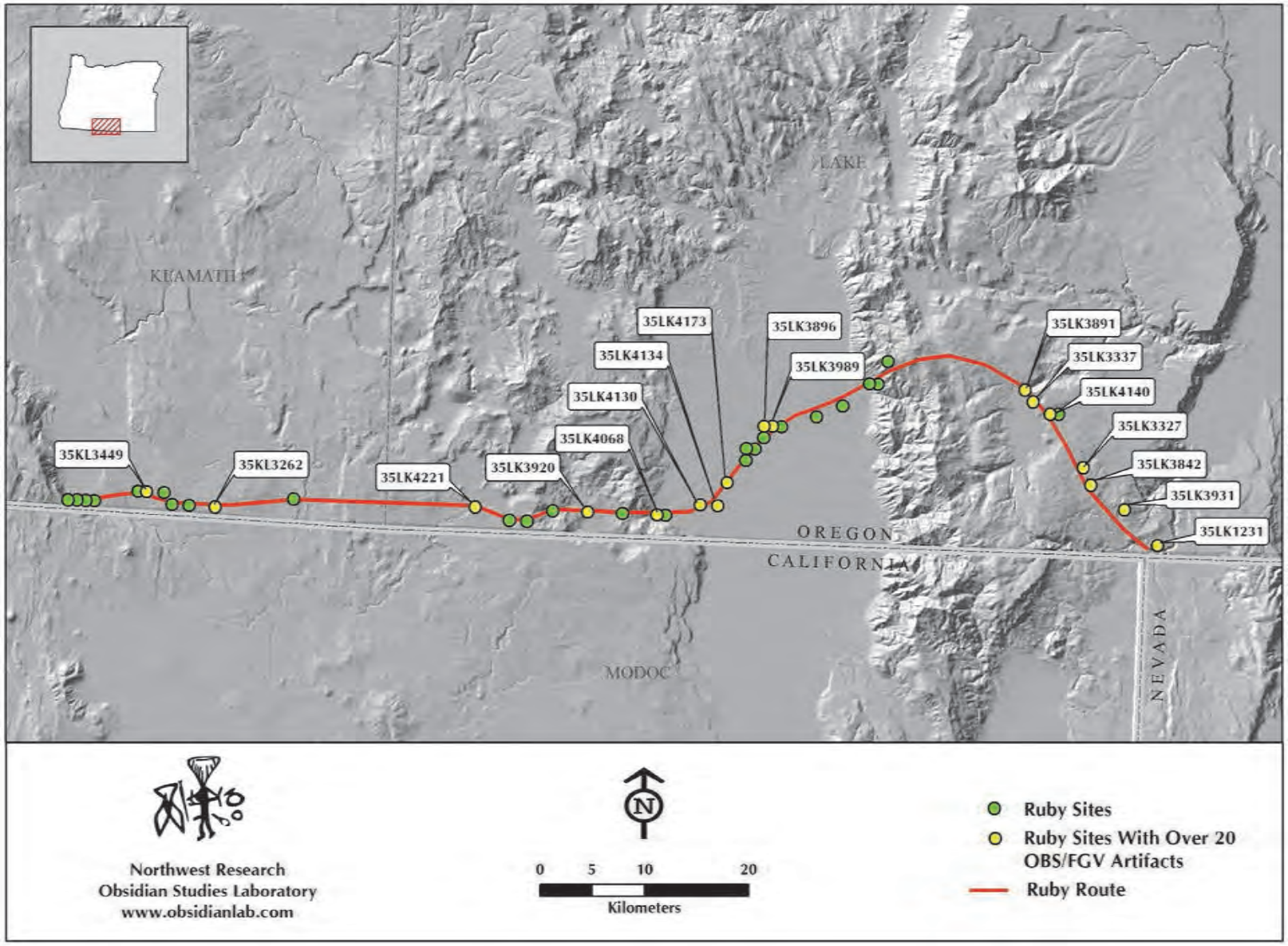

Figure C-1. Ruby Pipeline sites at which 20 or more artifacts were geochemically characterized.

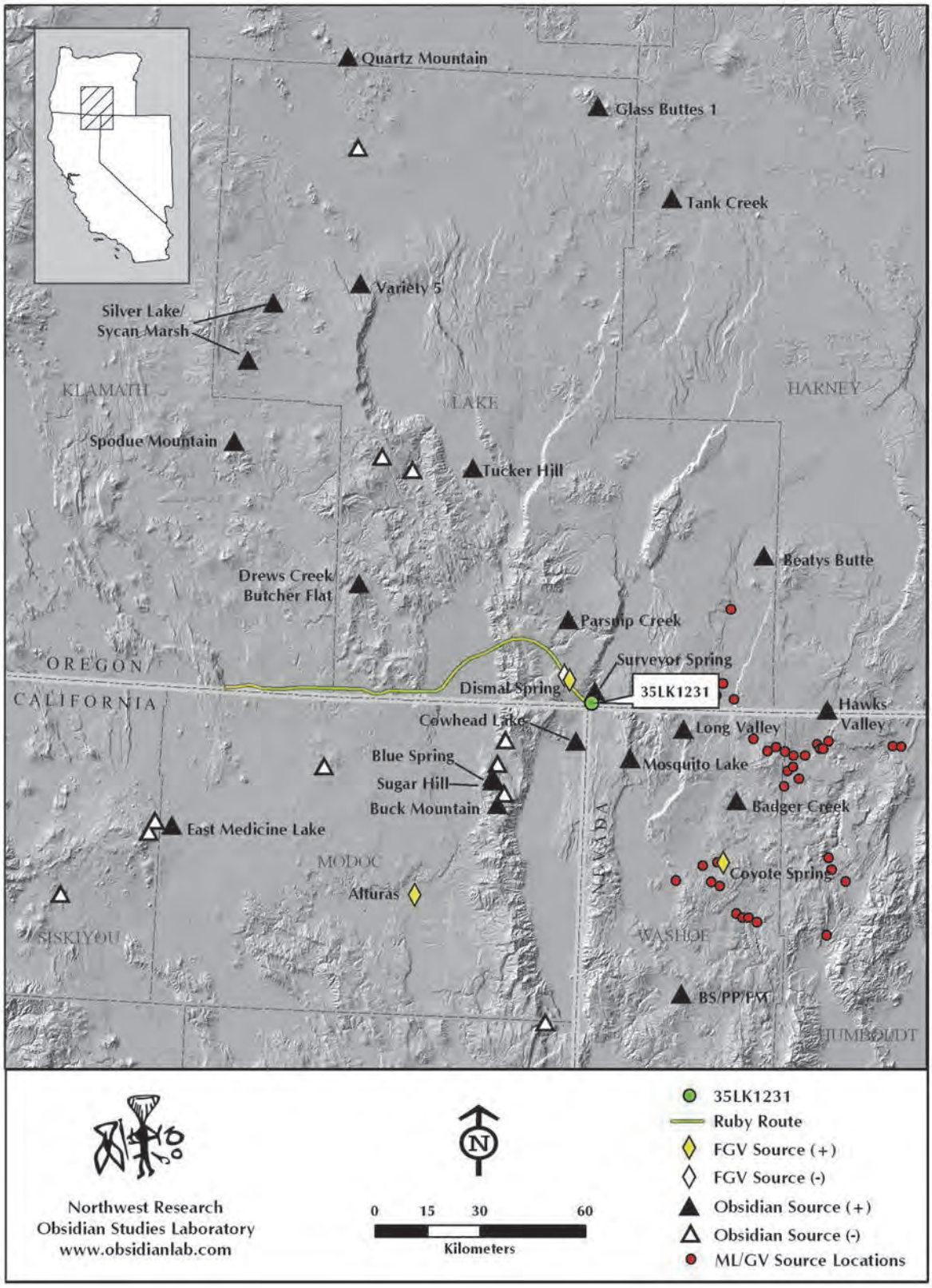

Figure C-2. Geographic distribution of obsidian and FGV artifact sources identified at 35LK1231.

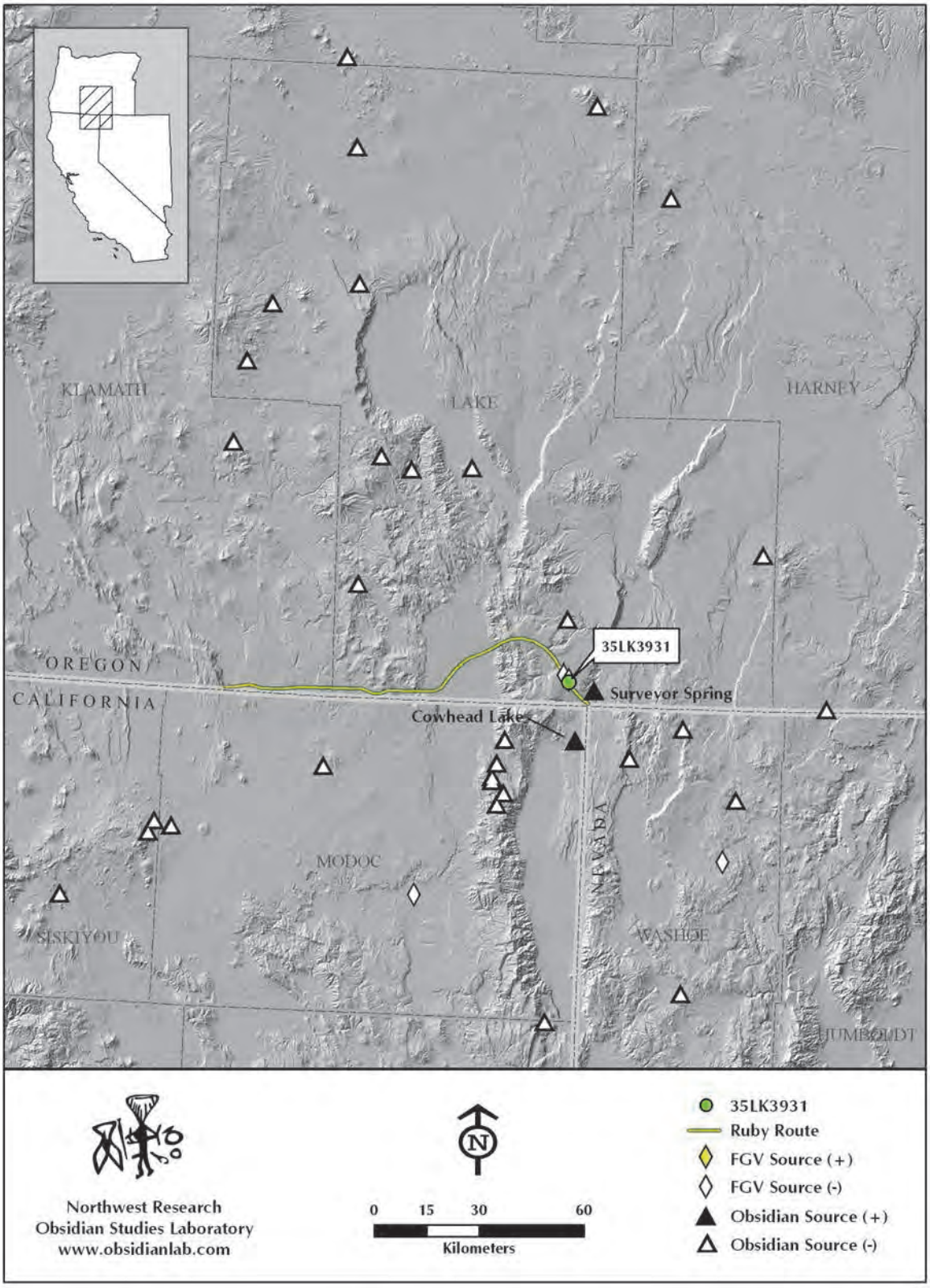

Figure C-3. Geographic distribution of obsidian and FGV artifact sources identified at 35LK3931.

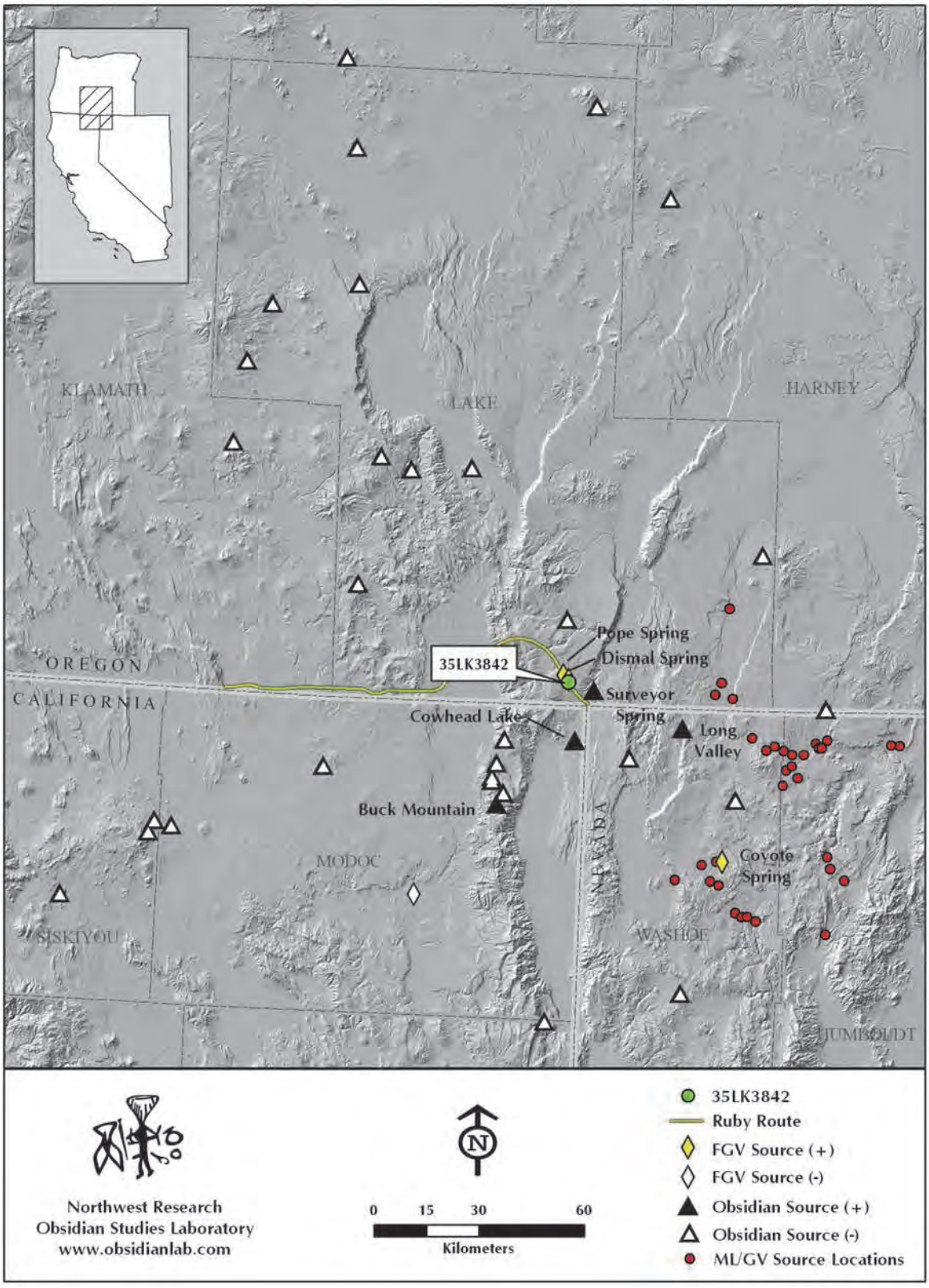

Figure C-4. Geographic distribution of obsidian and FGV artifact sources identified at 35LK3842.

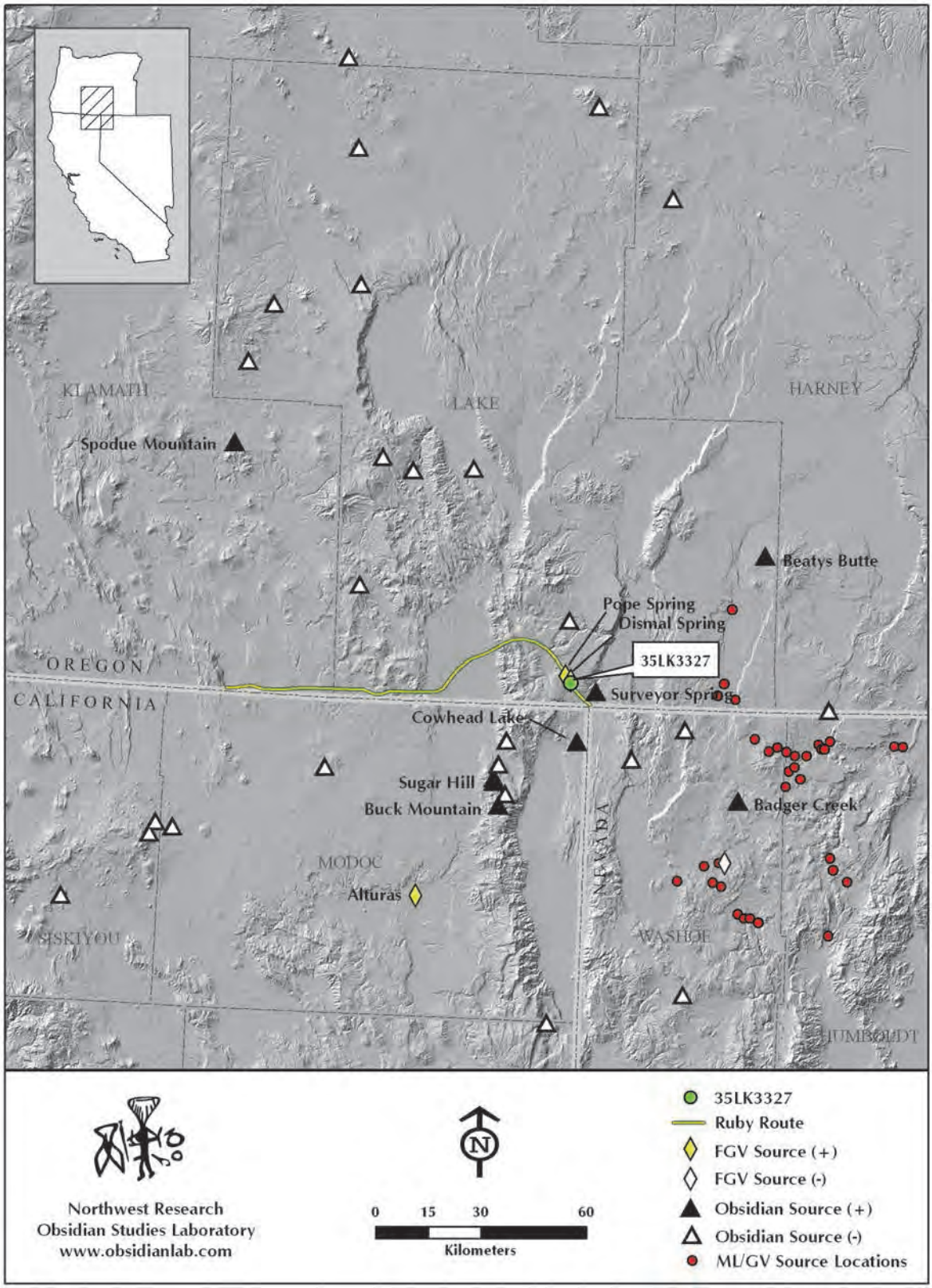

Figure C-5. Geographic distribution of obsidian and FGV artifact sources identified at 35LK3327.

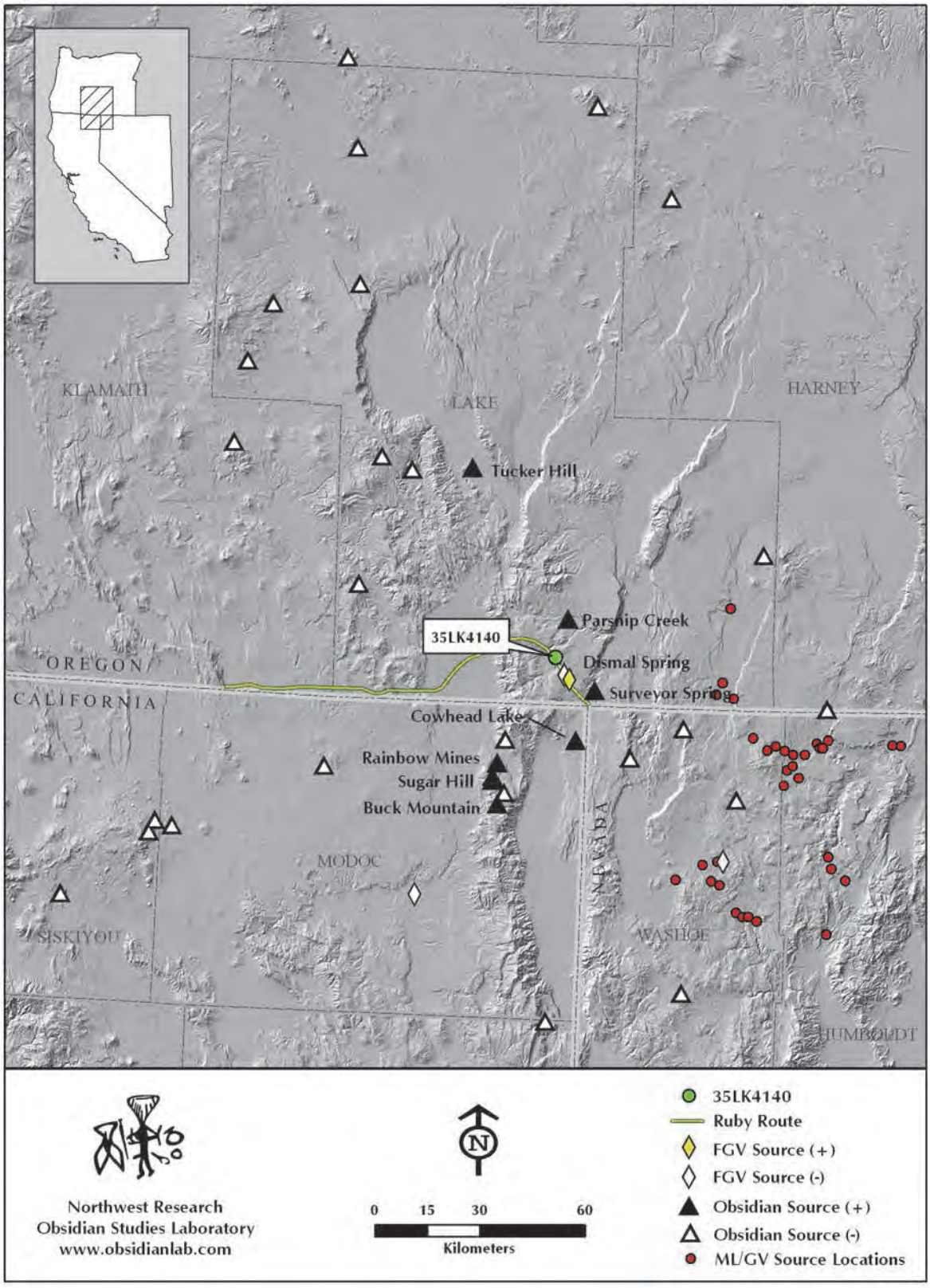

Figure C-6. Geographic distribution of obsidian and FGV artifact sources identified at 35LK4140.

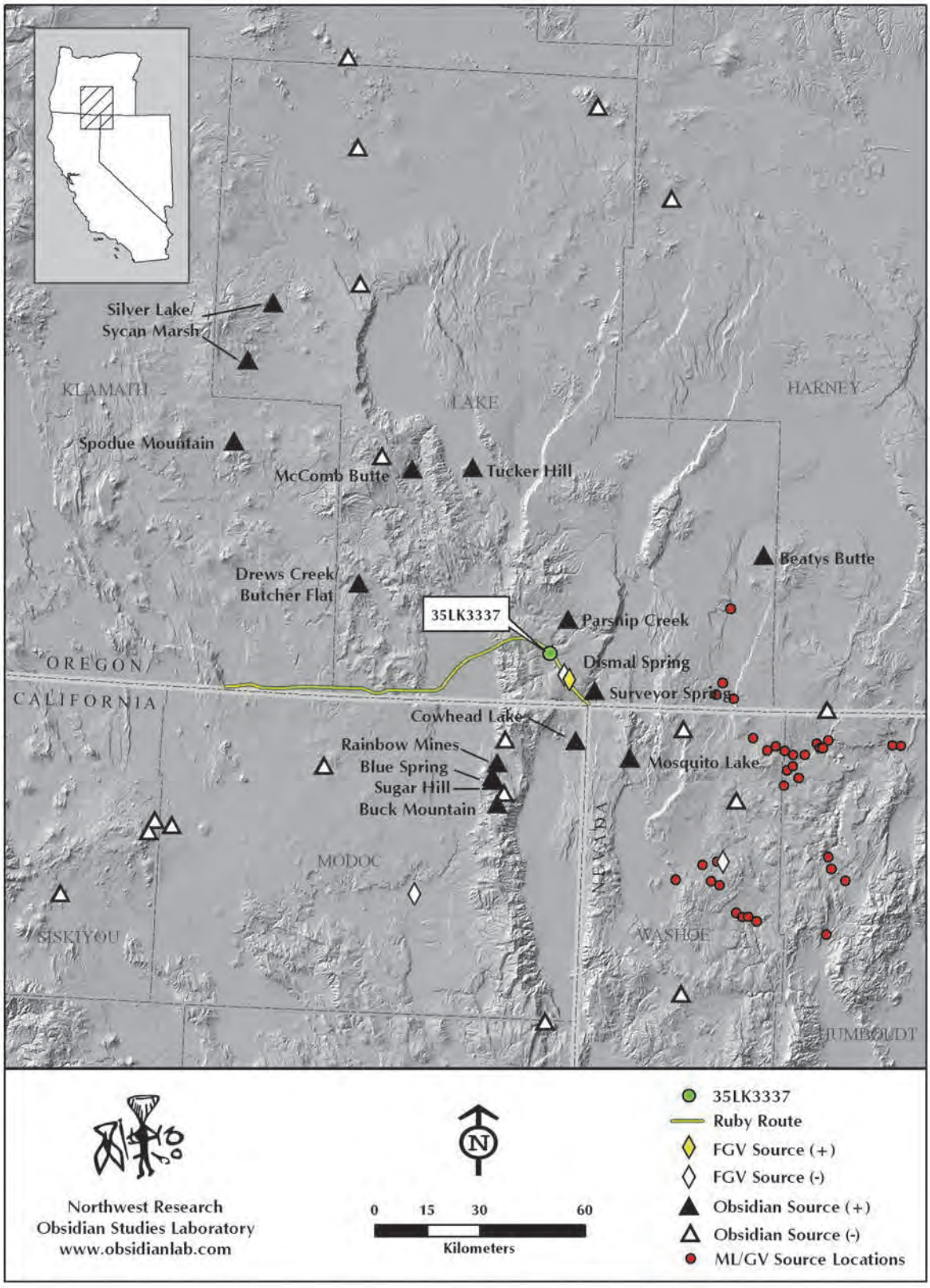

Figure C-7. Geographic distribution of obsidian and FGV artifact sources identified at 35LK3337.

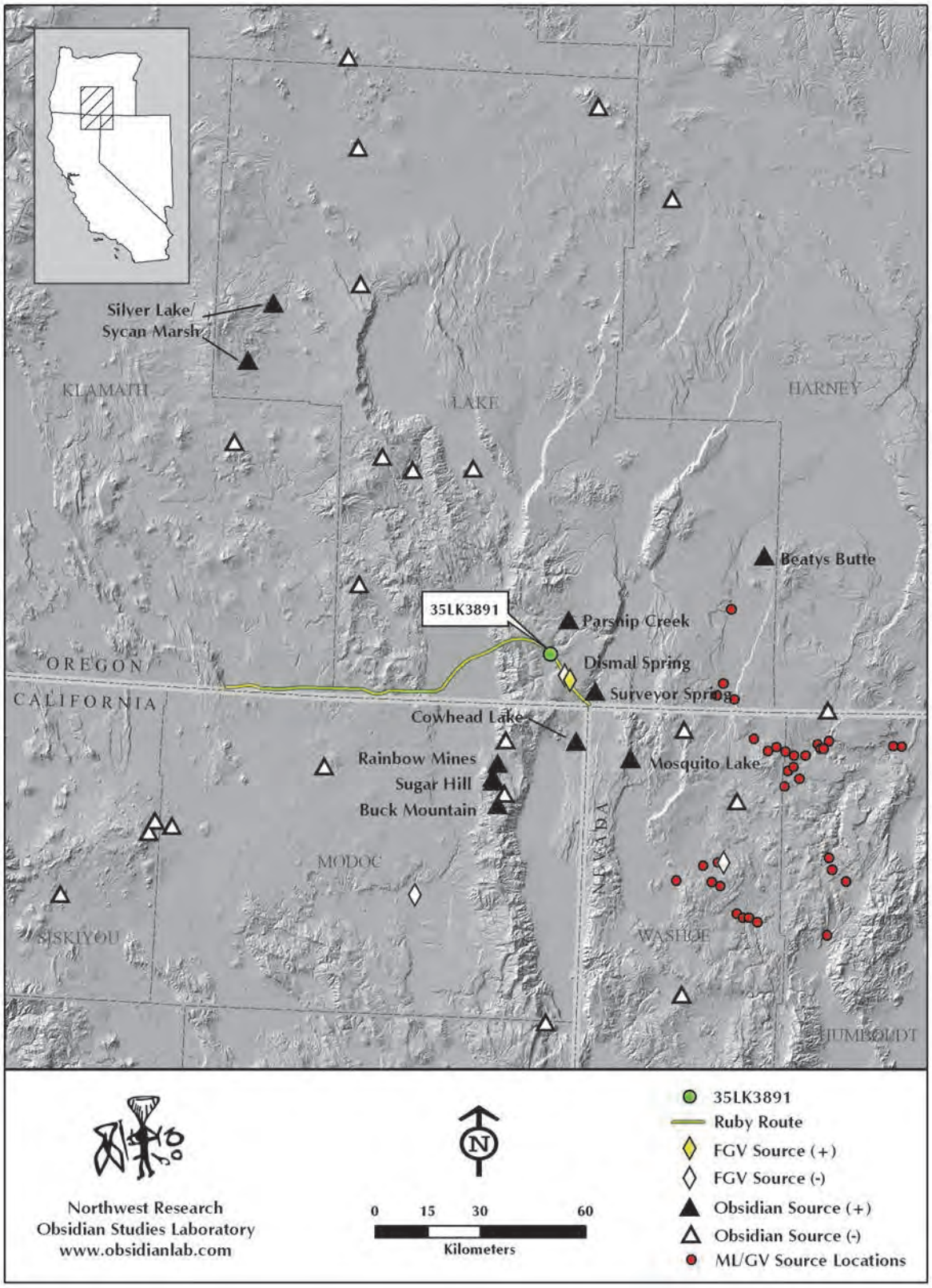

Figure C-8. Geographic distribution of obsidian and FGV artifact sources identified at 35LK3891.

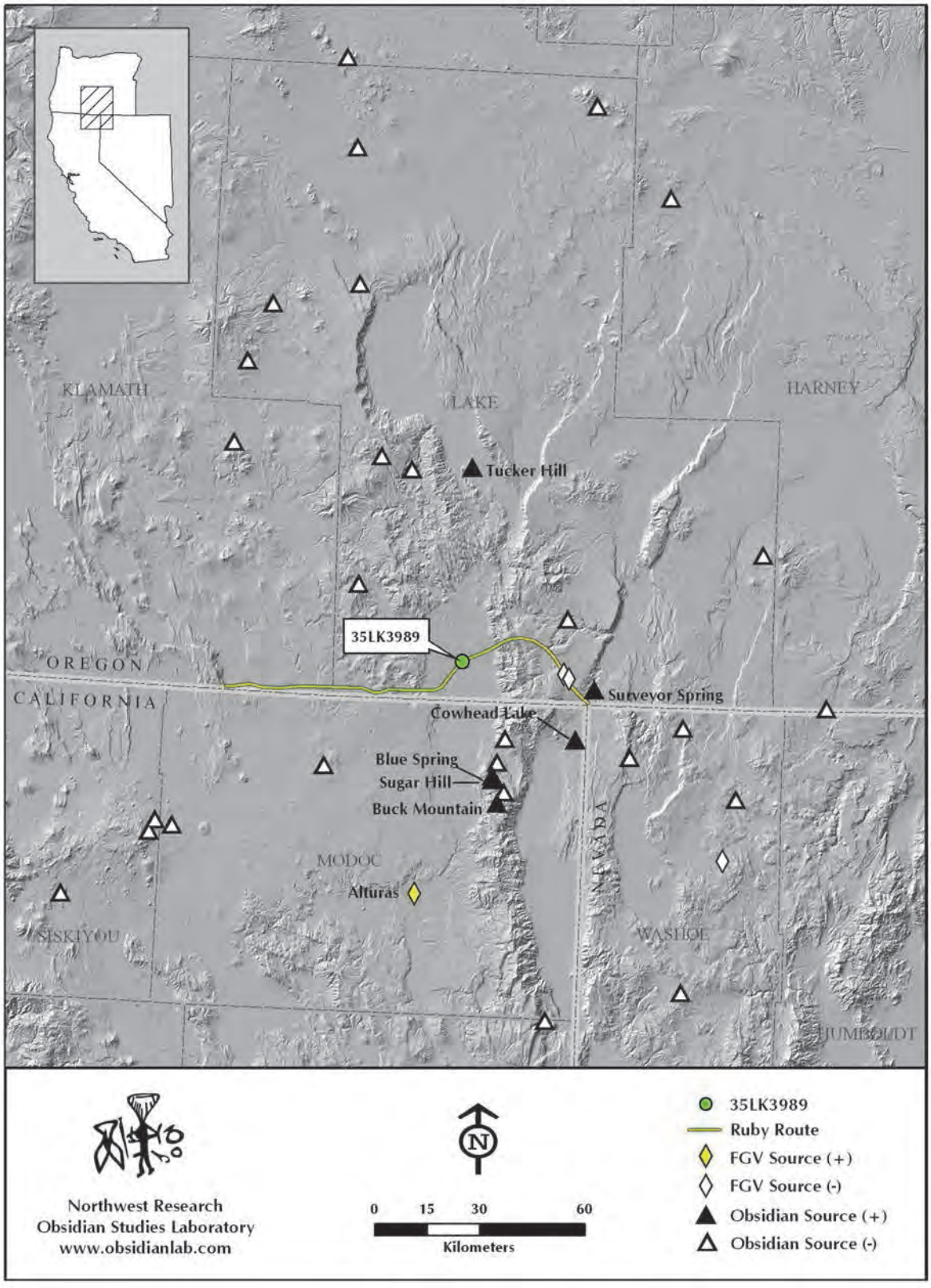

Figure C-9. Geographic distribution of obsidian and FGV artifact sources identified at 35LK3989.

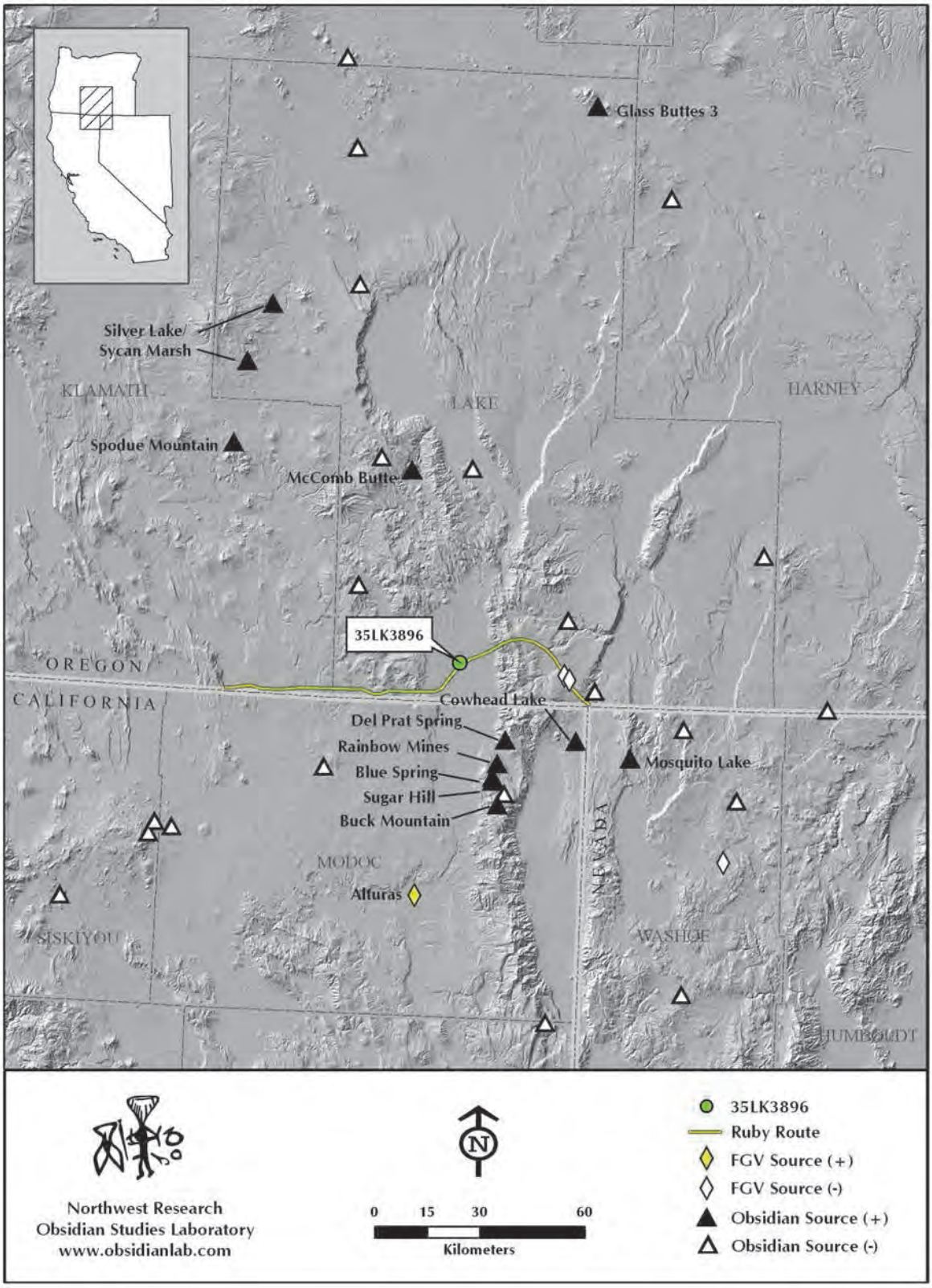

Figure C-10. Geographic distribution of obsidian and FGV artifact sources identified at 35LK3896.

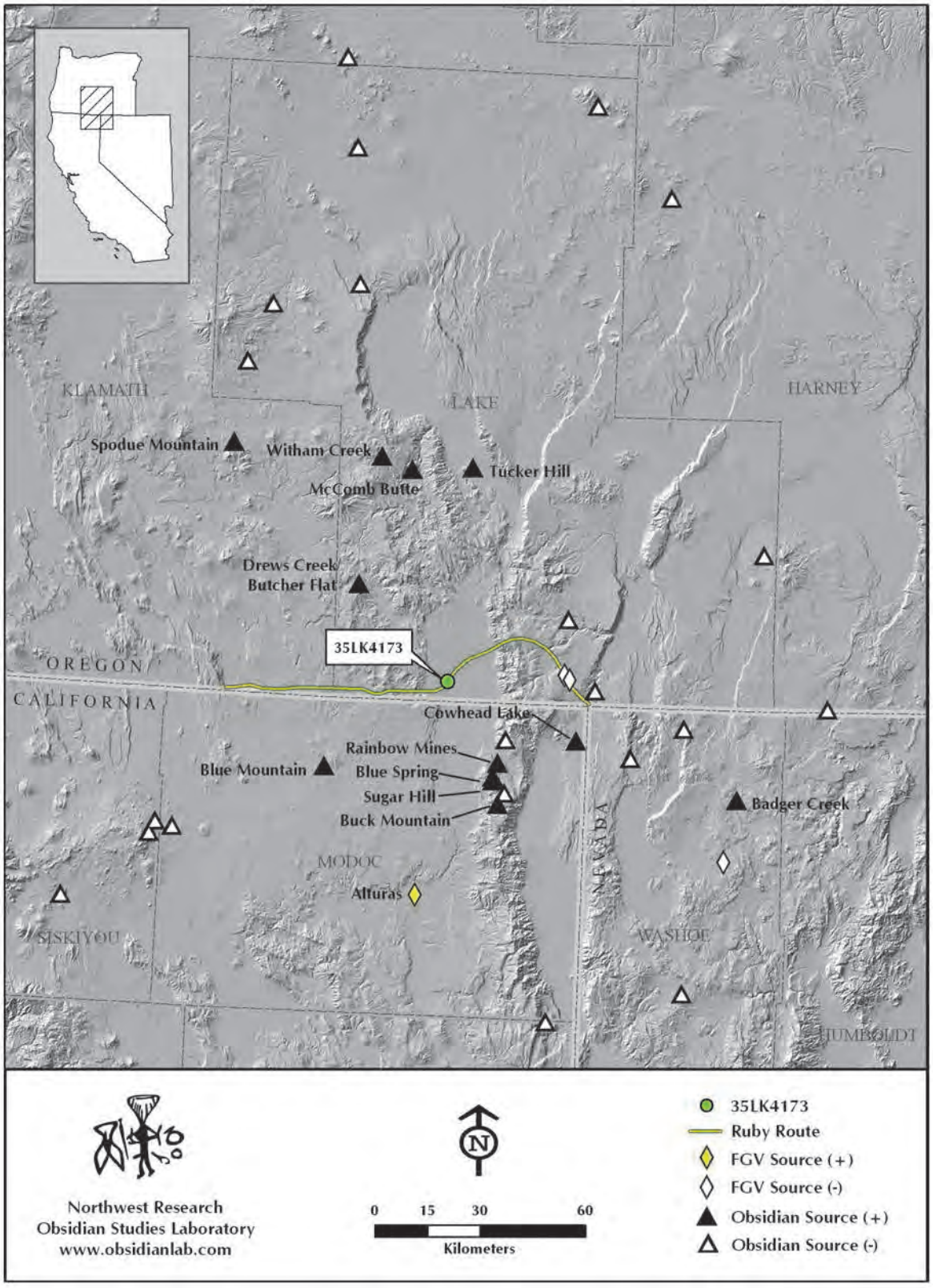

Figure C-11. Geographic distribution of obsidian and FGV artifact sources identified at 35LK4173.

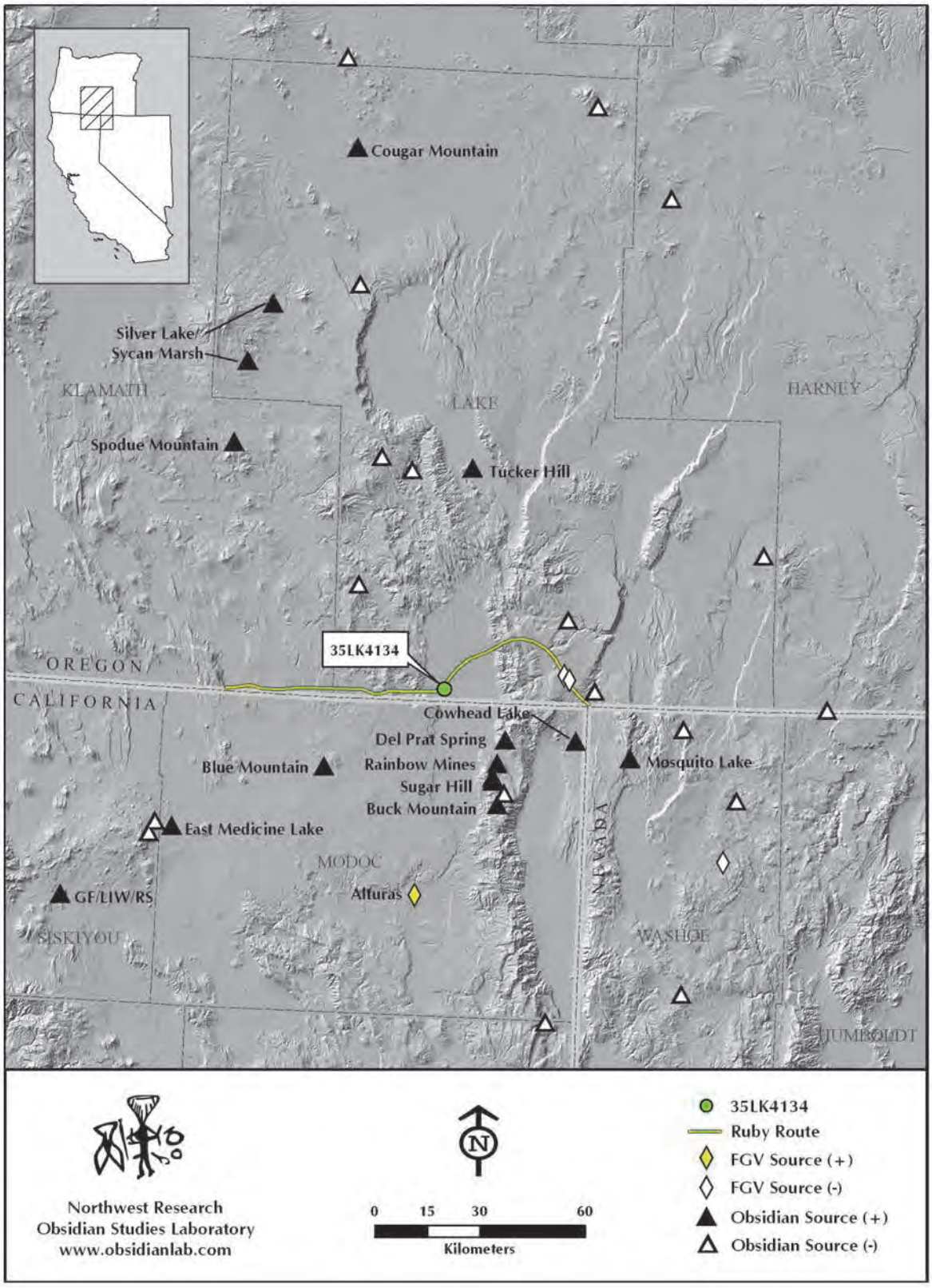

Figure C-12. Geographic distribution of obsidian and FGV artifact sources identified at 35LK4134.

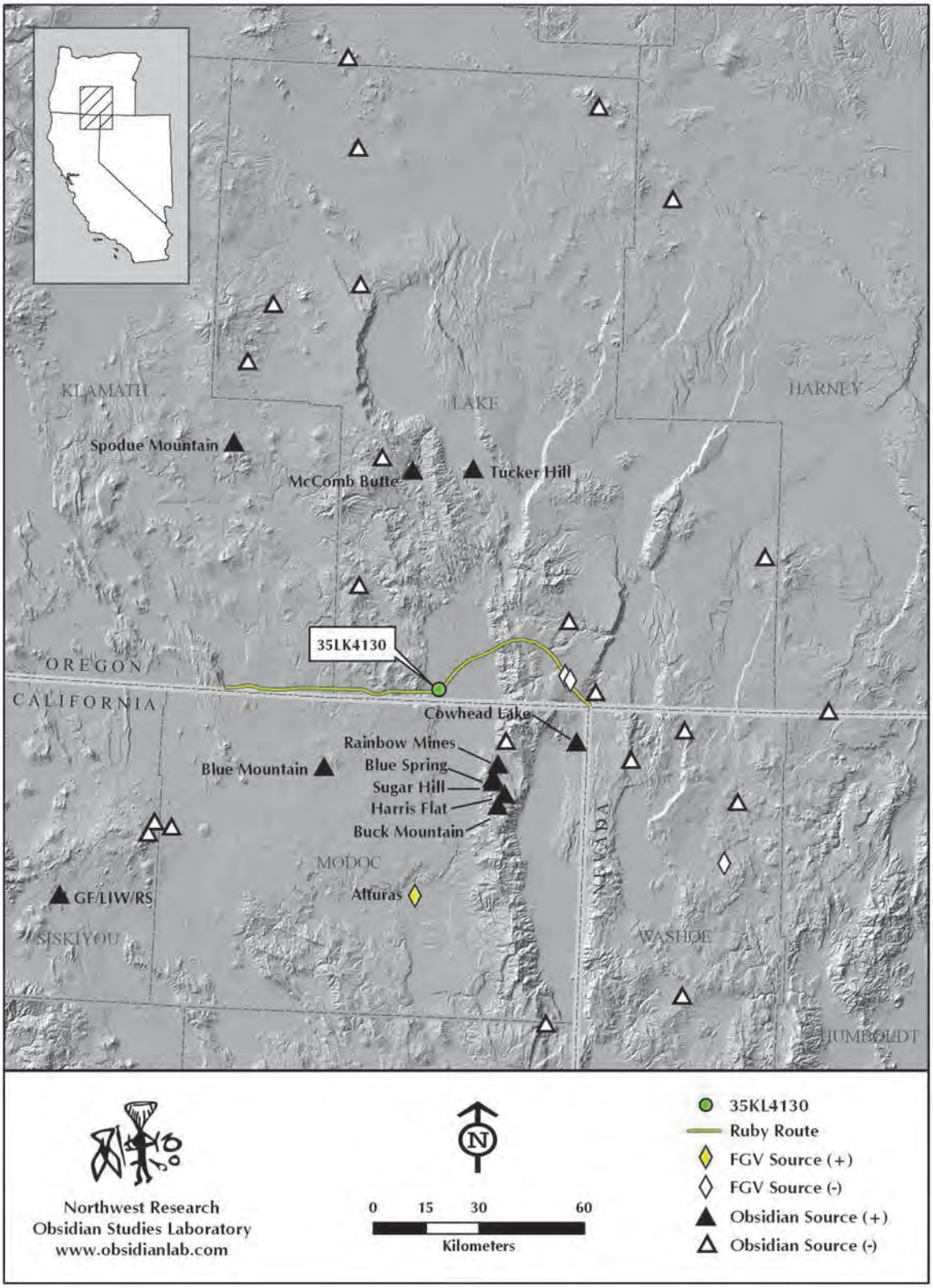

Figure C-13. Geographic distribution of obsidian and FGV artifact sources identified at 35LK4130.

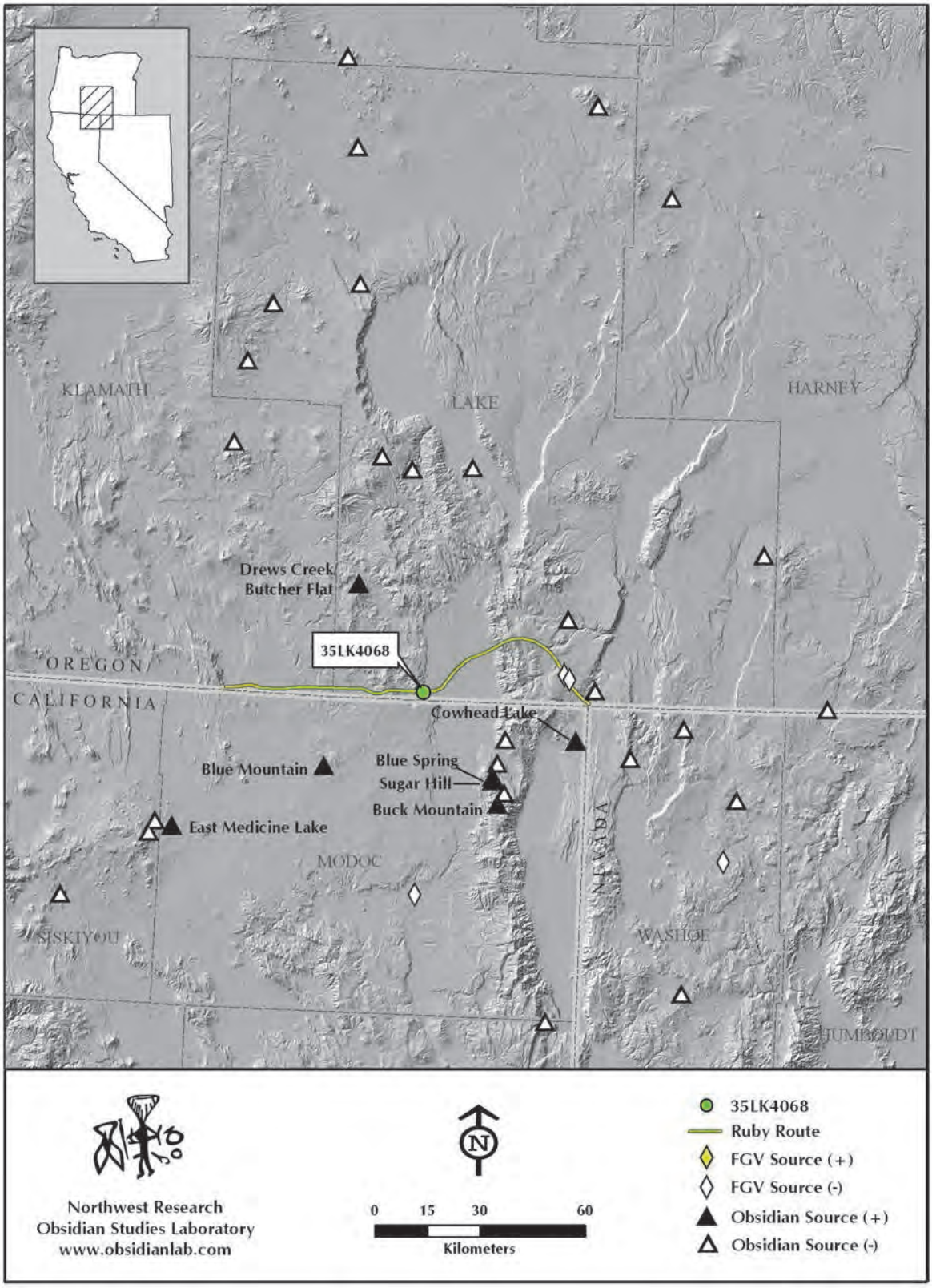

Figure C-14. Geographic distribution of obsidian and FGV artifact sources identified at 35LK4068.

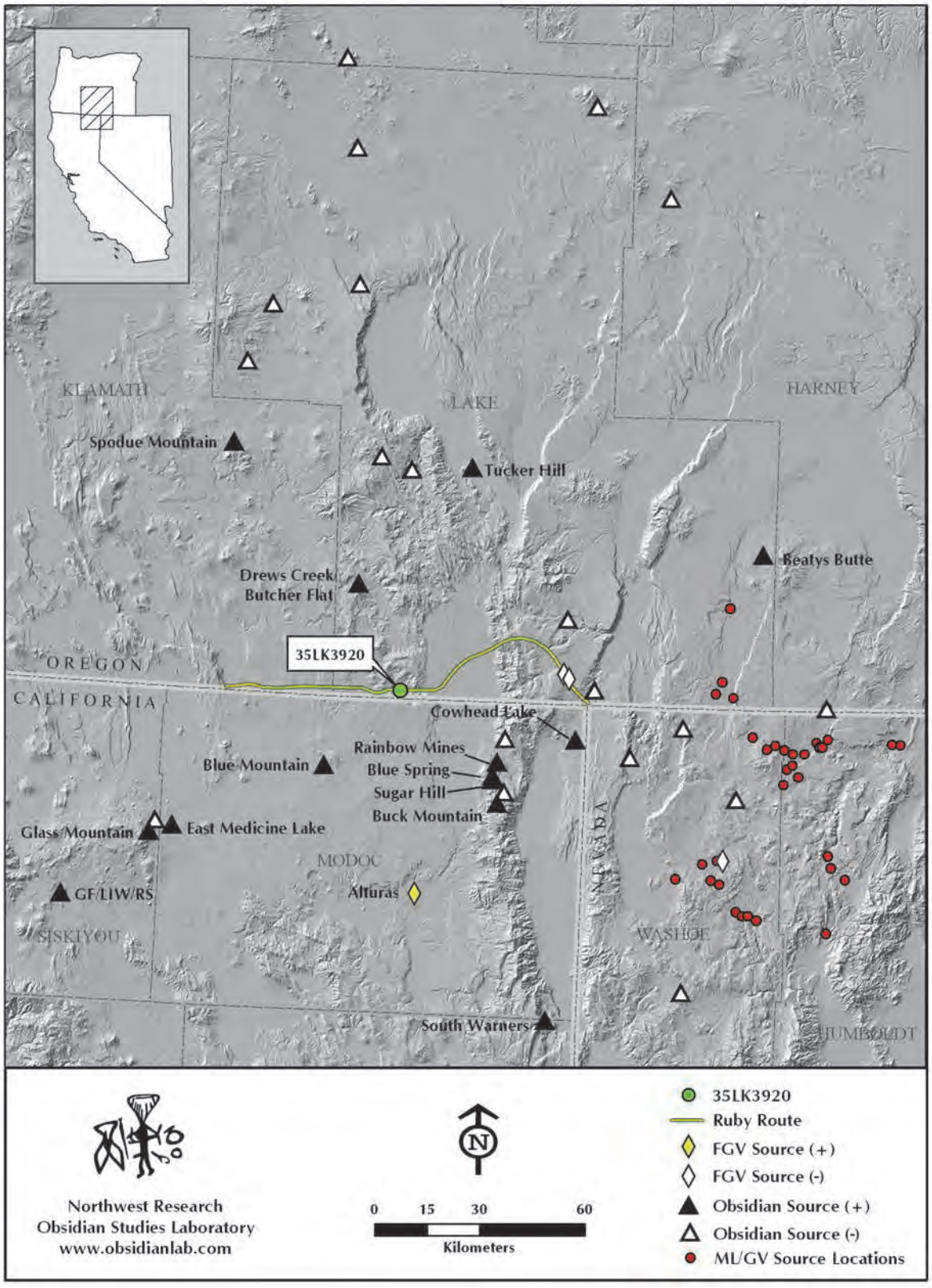

Figure C-15. Geographic distribution of obsidian and FGV artifact sources identified at 35LK3920.

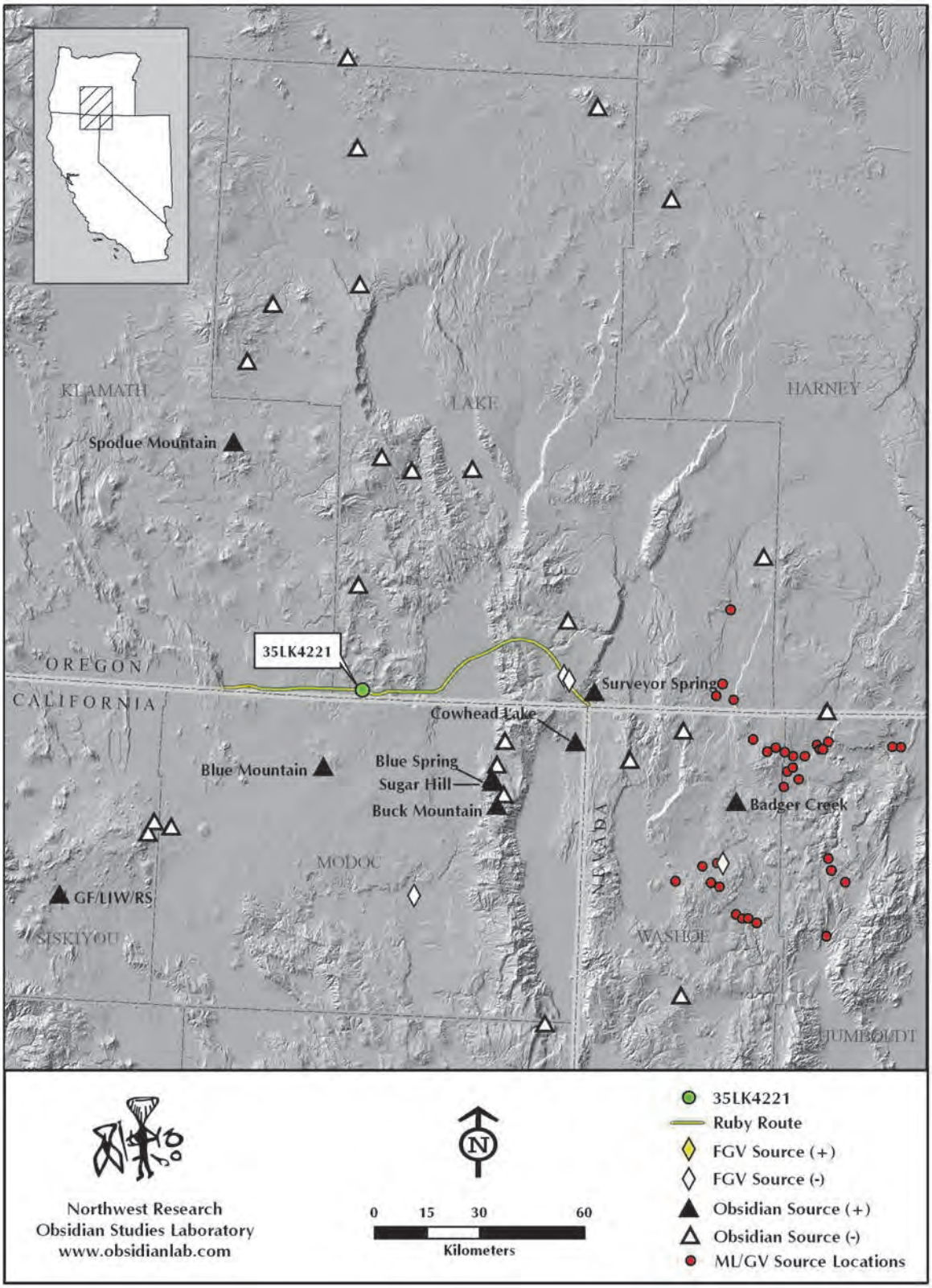

Figure C-16. Geographic distribution of obsidian and FGV artifact sources identified at 35LK4221.

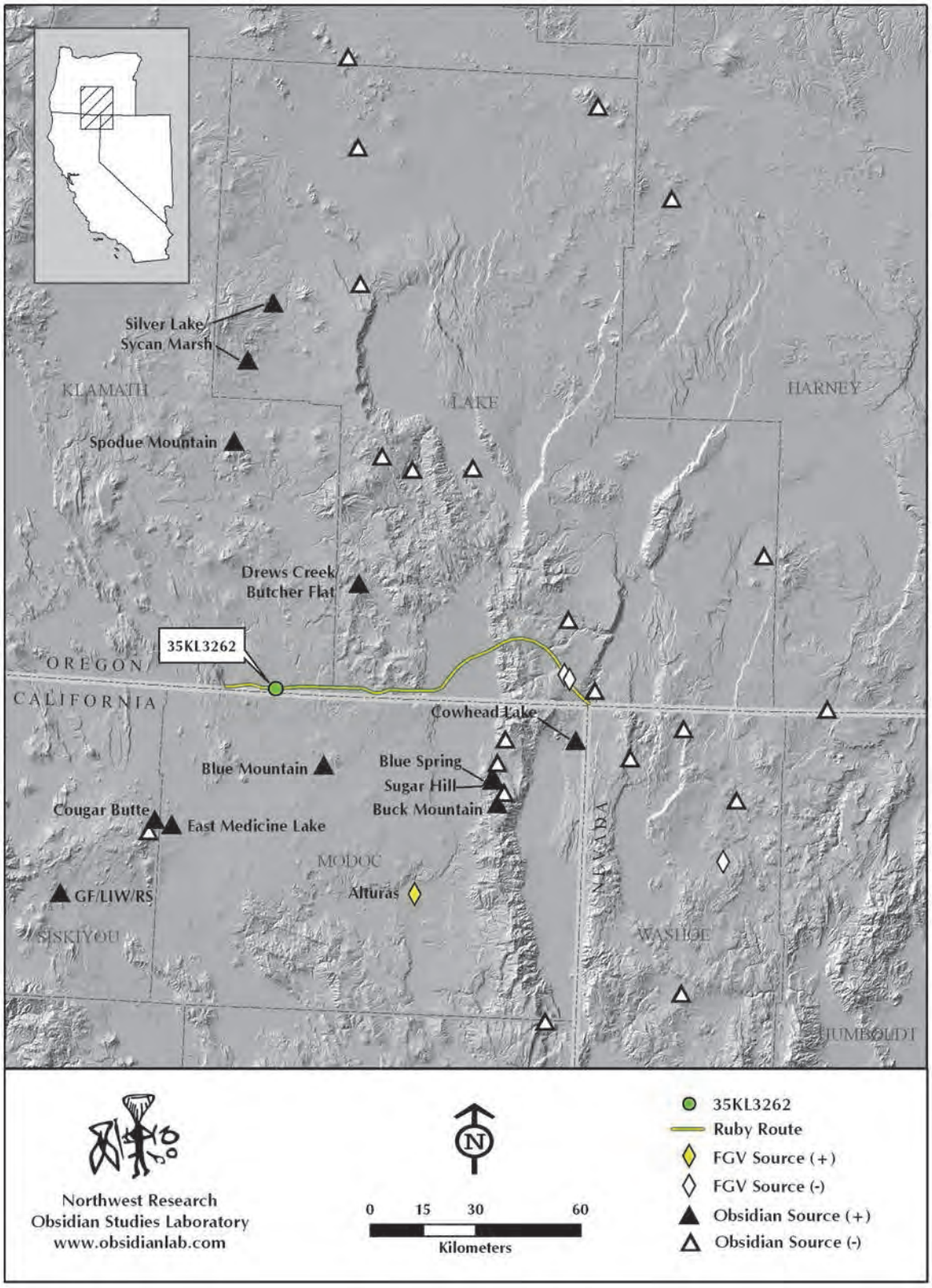

Figure C-17. Geographic distribution of obsidian and FGV artifact sources identified at 35KL3262.

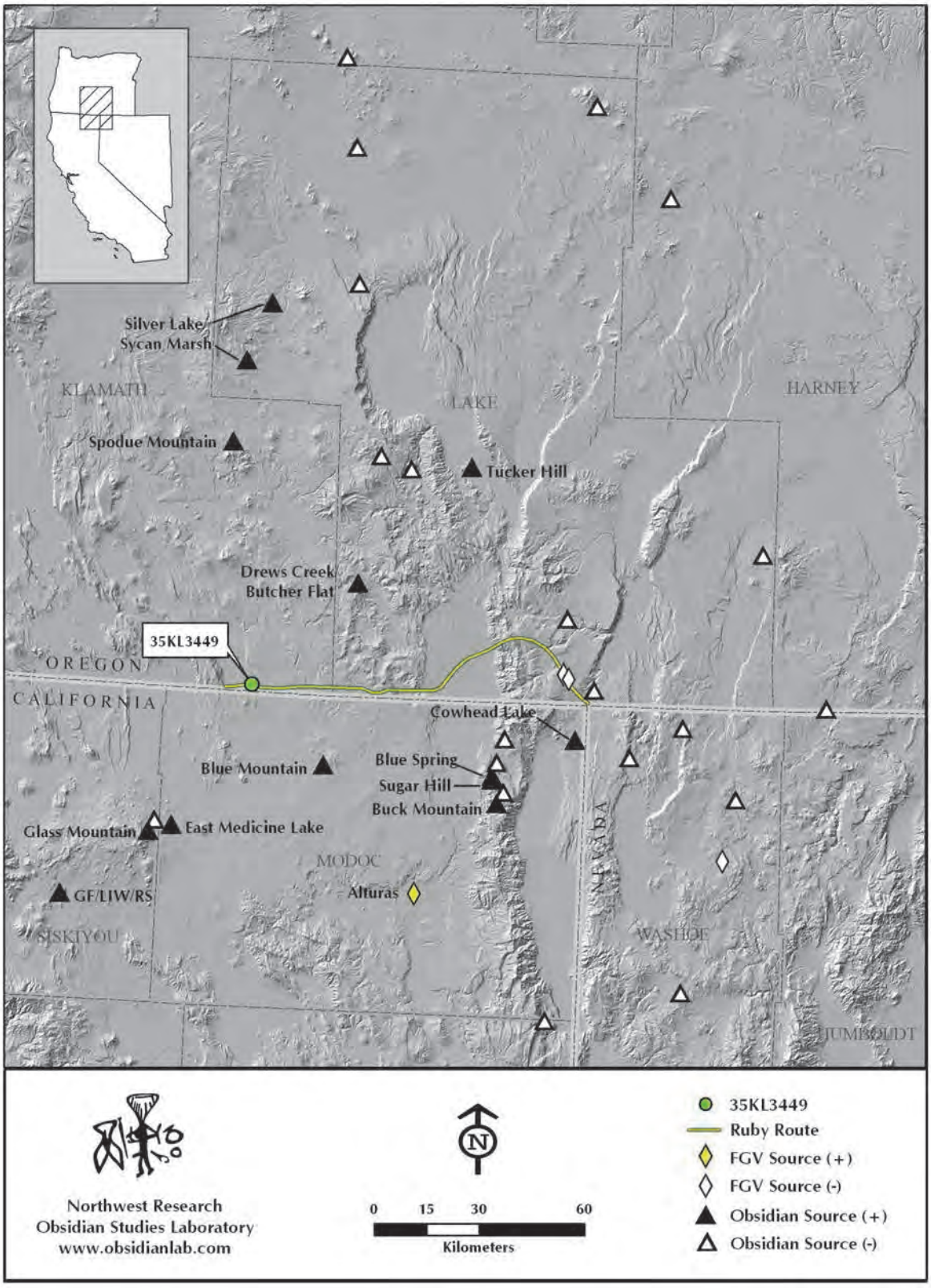

Figure C-18. Geographic distribution of obsidian and FGV artifact sources identified at 35KL3449.