Appendix I
Obsidian Source Analysis
X-Ray Fluorescence Analysis of Artifact Obsidian from Marmes Rockshelter (45-FR-50), Franklin County, Washington

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Twenty obsidian artifacts from Marmes Rockshelter (45-FR-50), Franklin County, Washington, were submitted for energy dispersive X-ray fluorescence trace element provenience analysis. The samples were prepared and analyzed at the Northwest Research Obsidian Studies Laboratory under the accession number 2000-11.

Analytical Methods

X-Ray Fluorescence Analysis. Nondestructive trace element analysis of the samples was completed using a Spectrace 5000 energy dispersive X-ray fluorescence spectrometer. The system is equipped with a Si(Li) detector with a resolution of 155 eV FHWM for 5.9 keV X-rays (at 1000 counts per second) in an area 30 mm². Signals from the spectrometer are amplified and filtered by a time variant pulse processor and sent to a 100 MHZ Wilkinson type analog-to-digital converter. The X-ray tube employed is a Bremsstrahlung type, with a rhodium target, and 5 mil Be window. The tube is driven by a 50 kV 1 mA high voltage power supply, providing a voltage range of 4 to 50 kV.

The diagnostic trace element values used to characterize the samples are compared directly to those for known obsidian sources reported in the literature and with unpublished trace element data collected through analysis of geologic source samples (Skinner 2000). Artifacts are correlated to a parent obsidian source or chemical source group if diagnostic trace element values fall within about two standard deviations of the analytical uncertainty of the known upper and lower limits of chemical variability recorded for the source. Occasionally, visual attributes are used to corroborate the source assignments although sources are never assigned solely on the basis of megascopic characteristics.

Additional details about specific analytical methods and procedures used for the 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.

Results

Three geochemical obsidian sources were identified among the 20 artifacts that were characterized by X-ray fluorescence analysis (Table 1). The locations of the site and the identified obsidian sources are shown in Figure 1. Analytical results are presented in Table A-1 in the Appendix and are summarized in Table 2 and Figure 2. Descriptive information about all identified obsidian sources is outlined in Table 2.

Table 1. Results of trace element analysis of artifacts.

<table>
<thead>
<tr>
<th>Geologic Source</th>
<th>N</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indian Creek</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>Timber Butte</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Whitewater Ridge</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>20</td>
<td>100</td>
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</tbody>
</table>
Table 2. Descriptions of obsidian sources identified in the current investigation. Summaries include results of unpublished field and geochemical source research conducted by Northwest Research.

<table>
<thead>
<tr>
<th>Geologic Source</th>
<th>Location</th>
<th>Description</th>
<th>References</th>
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</thead>
<tbody>
<tr>
<td>Indian Creek</td>
<td>Dooley Mountain, Northeast Oregon</td>
<td>Also known as the Dooley Mountain or Wallowa source, this geochemical source is one of three varieties associated with the Dooley Mountain rhyolite complex. The Indian Creek source is known primarily from outcrops located on the southern slopes of Dooley Mountain. The Indian Creek glass is by far the best-represented of the Dooley mountain sources among characterized archaeological sites in the source region. Prehistoric use of relatively small quantities of Indian Creek obsidian is well-documented at numerous sites in southeastern Washington and at sites throughout northeast and north-central Oregon.</td>
<td>Gilluly 1937, McDonald 1985, 1986, Reid 1997, Sappington 1981b, Whitson 1988</td>
</tr>
<tr>
<td>Timber Butte</td>
<td>Gem and Boise counties, western Idaho</td>
<td>Situated approximately 30 mi (48 km) north of Boise, Idaho, geologic obsidian from this source is found at many scattered localities in the Timber Butte vicinity. During the prehistoric period, the Timber Butte source was the most intensively used western Idaho obsidian source. Obsidian from this source has been identified at archaeological sites throughout Idaho and northeastern Oregon and southeastern Washington.</td>
<td>Arnold 1984, Bailey 1992, Holmer 1997, Matson et al. 1983, Sappington 1981a, 1981b, 1981c, 1982, 1984, Yohe 1996</td>
</tr>
<tr>
<td>Whitewater Ridge</td>
<td>Malheur National Forest, Grant County, Oregon</td>
<td>High quality obsidian correlated with the Whitewater Ridge source group is known from many different widely distributed source localities found along the southern margins and hills immediately south of Bear Valley. Obsidian from this highly variable geochemical source has also been known as the Little Bear Creek, Seneca, Whitewater Spring, Foster Spring, John Day, and Bear Valley sources. Prehistoric use of the Whitewater Ridge source was very extensive, perhaps more so than any other source in northeast Oregon. Artifacts from the source have been found throughout the Malheur National Forest and are common at many north-central Oregon sites in the John Day and Lower Deschutes river basins. Glass from Whitewater Ridge has been identified as far north as North Cascades National Park in Washington, as far west as the Oregon Cascades, as far south as the Malheur Lake Basin, and has possibly been identified in British Columbia, Canada.</td>
<td>Ambroz 1997, Armitage 1995, Carlson 1994, D'Auria et al. 1992, Endzweig 1994, Erlanson et al. 1991, Hughes 1995a, 1995b, Sappington 1981b, Skinner 1983, 1995a, 1995b, Skinner and Thatcher 1998, Skinner et al. 1998</td>
</tr>
</tbody>
</table>
Figure 1. Locations of Marmes Rockshelter (45-FR-50) and obsidian sources identified by trace element studies.

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

Ambroz, Jessica A.

Armitage, Charles L.

Arnold, Quentin M.

Bailey, Jeff

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D'Auria, John M., Malcolm A. James, and Dorothy Godfrey-Smith

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Erlandson, Jon M., R. E. Hughes, C. E. Skinner, M. L. Moss, and J. Boughton

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Holmer, Richard N.

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Mattson, Daniel M., Ruthann Knudson, Robert L. Sappington, and Michael A. Pfeiffer


Whitson, David N.  

Yohe, Robert M. II.  
1996 *X-Ray Fluorescence and Obsidian Hydration Results from the Analysis of a Turkey-Tail Biface from the Waterhouse Collection.* *Idaho Archaeologist* 19:11–14.