APPENDICES

A-1. Glossary Of Technical Terms

A horizon: usually dark, organic-rich soil layer forming the topsoil immediately under modern vegetation, especially grasslands and meadows

alpine: specific sense refers to the vegetation community of the highest elevations, characterized by an absence of trees and dominated by sparse, low plant growth, or none at all; general meaning refers to the higher elevations of mountain masses

alpine glacier: one that exists due to snow accumulation from local mountain massifs, as distinct from cordilleran glaciers

anthropogenic: of human origin or cause

assemblage: a sample of artifacts collected for the purpose of archeological analysis or study

B horizon: weathered subsoil layer, forming iron and other mineral-rich accumulations in dense forests

basalt: a fine-grained, dark, opaque rock formed from the extrusion of magma at the earth surface; low in silica content

biface II: early stage in form in the manufacture of biface tools, resulting from cleaning and rough shaping into a generalized form, such that a variety of final tools could be made from the "blank"

bipolar: a technique for reducing small nodules of stone by placing the nodule on a stone anvil and applying direct force with a hammerstone

calibrated years: the age of a radiocarbon sample after it is adjusted to more accurately reflect calendar years, which are different than radiocarbon years

chert: a fine-grained rock type, similar to flint, that is high in silica; breaks with a conchoidal fracture; SiO_2

cordilleran glacier: a large glacier formed by the coalescence of many smaller glaciers formed in mountain cordillera

debitage: describes the accumulation of chipped stone debris created when tool stone is cleaned and tested, and when tools are manufactured

decortication flake: flake removed from the outer, weathered surface of a larger piece of stone; the dorsal surface comprises the weathered surface of the original, unflaked nodule

electron microprobe analysis: a way to measure the presence and quantity of major elements bound up within the matrix of glass fragments; creates a chemical fingerprint for glasses from different volcanic eruptions

flake: a thin piece of stone removed from a larger piece of stone through mechanical fracture induced by applying force, such as through hammering

glacial cirque: a usually deep mountain basin carved by erosion from an alpine glacier

Holocene: the non-glacial time period that followed disappearance of the cordilleran glacier; the present is considered part of the Holocene

lithic: of or referring to stone or mineral matter

lithic scatter: a generic archeological site type characterized by the dominance of stone tools, debitage, or other lithic artifact categories

loess: a deposit of fine, wind-blown (transported) silt-sized particles

metasediment: a generic term used to describe an array of metamorphosed sedimentary rocks, such as siltstone, claystone, slate, shale

nunatak: a mass of earth or rock that protrudes above the surface of a glacier; in the North Cascades, some mountain summits are nunataks

obsidian: rock of volcanic origin composed of predominately glass (SiO_2)

Olcott: an archeological term variously applied to certain leaf-shaped projectile (usually spear) points, or to a cultural pattern characterized by the presence of leaf-shaped points

paleoecology: study of the environments and natural history of time periods earlier than the present

pass: a low spot or saddle in a ridge line or mountain terrain that is utilized as a passage by people or animals

petrographic analysis: a way of identifying and quantifying the mineral composition of rocks, so as to identify the rock type

radiocarbon date: an age estimate of an organic (carbon-containing) material, based on the constant rate of decay of carbon isotopes

saddle: a low spot or dip in a ridge line or mountain terrain, not known to be used as a pass

shatter: angular, blocky fragments of stone produced during the flaking process

stade: a time period characterized by a glacial advance or glacial activity

subalpine: high elevation vegetation zone characterized a patchy mix of forest surrounded by meadows; a transition zone between the alpine zone above, and the montane forest zone below

tephra: volcanic ash, composed mostly of glass

tool stone: a lithic material that is or was utilized by indigenous populations

vitrophyre: a variety of obsidian characterized by the presence of larger crystals (phenocrysts) embedded in the glassy groundmass

X-ray fluorescence analysis (XRF): a technique used to measure the quantity of trace elements found in glassy rock types; creates a chemical fingerprint that is used to identify different volcanic glass deposits

A-2. Results of Obsidian X-Ray Fluorescence Analyses

*Appendix A-2 Results of XRF Analyses, North Cascades National Park, Washington, and British Columbia,Canada**

Site No.	Specimen No.	Catalog No.		Trace Element Concentrations										Artifact Source
				Zn	Pb	Rb	Sr	Y	Zr	Nb	Ti	Mn	Ba	Fe203T	
45-WH-631	5	NOCA 22183A		31	16	136	93	16	109	7	682	184	578	0.36	Copper Ridge Variety B
			±	7	4	4	9	3	7	1	75	45	28	0.11	
45-WH-631	6	NOCA 22183B		55	17	143	89	17	106	6	NM	NM	NM	NM	Copper Ridge Variety B**
			±	9	5	4	9	3	7	2	74	45	NM	0.11	
45-WH-631	7	NOCA 22183C		47	29	157	102	18	117	11	NM	NM	NM	NM	Copper Ridge Variety B**
			±	8	4	4	9	3	7	1	74	45	NM	0.11	
45-WH-462	2	NOCA 10123A		52	25	147	138	13	124	11	1005	302	NM	0.62	Copper Ridge Variety B?
			±	6	3	3	7	3	7	2	96	47	NM	0.11	
45-WH-462	3	NOCA 10123B		32	21	127	101	16	112	13	779	304	NM	0.63	Copper Ridge Variety B
			±	6	2	3	7	3	7	1	96	47	NM	0.11	
45-WH-462	4	NOCA 10124		29	26	136	90	13	115	8	721	247	NM	0.5	Copper Ridge Variety B
			±	7	2	3	7	3	7	2	96	47	NM	0.11	
45-WH-462	5	NOCA 10126		29	21	123	97	15	104	8	905	346	NM	0.83	Copper Ridge Variety B
			±	6	2	3	7	3	7	1	96	47	NM	0.11	
45-WH-462	6	NOCA 10127		21	21	130	139	17	119	10	812	253	NM	0.57	Copper Ridge Variety B?
			±	7	2	3	7	3	7	1	96	47	NM	0.11	
45-WH-462	7	NOCA 10128A		31	26	136	112	16	119	10	787	277	NM	0.7	Copper Ridge Variety B
			±	6	2	3	7	3	7	2	96	47	NM	0.11	
45-WH-462	8	NOCA 10128B		30	26	141	97	14	116	12	821	232	NM	0.53	Copper Ridge Variety B
			±	6	2	3	7	3	7	2	96	47	NM	0.11	
45-WH-462	9	NOCA 10128C		29	25	141	115	14	120	13	781	261	NM	0.6	Copper Ridge Variety B
			±	6	2	3	7	3	7	1	96	47	NM	0.11	
45-WH-462	10	NOCA 10128D		21	19	132	103	15	113	7	389	146	NM	0.18	Copper Ridge Variety B
			±	7	3	3	7	3	7	2	95	47	NM	0.11	
45-WH-515	11	NOCA 12314		30	19	138	108	17	130	10	727	232	NM	0.44	Copper Ridge Variety B
			±	6	2	3	7	3	7	2	96	47	NM	0.11	
45-WH-551	11	NOCA 19508		45	14	94	75	22	182	15	749	329	837	1.06	Copper Ridge Variety A
			±	6	2	3	7	3	7	1	96	47	13	0.11	
45-WH-551	12	NOCA 19509		33	23	135	98	16	114	12	593	289	691	0.46	Copper Ridge Variety B
			±	7	2	3	7	3	7	1	96	47	13	0.11	
45-WH-551	13	NOCA 19510A		43	11	91	63	23	183	13	401	196	756	0.5	Copper Ridge Variety A
			±	7	3	3	7	3	7	2	95	47	15	0.11	
45-WH-551	14	NOCA 19510B		40	13	92	78	23	185	11	875	365	731	1.05	Copper Ridge Variety A
			±	6	2	3	7	3	7	1	96	47	13	0.11	
45-WH-551	15	NOCA 19510C		34	20	106	82	20	198	16	634	200	662	0.54	Copper Ridge Variety A
			±	7	3	3	7	3	7	2	96	47	15	0.11	
Dg-Ri-2	17	DgRi-2-1		42	25	118	108	12	110	15	557	187	727	0.66	Copper Ridge Variety B
			±	8	3	4	7	3	7	2	95	47	14	0.11	
Dg-Ri-2	18	DgRi-2-2		31	23	136	88	15	127	11	488	257	708	0.35	Copper Ridge Variety B
			±	7	3	4	7	3	7	2	96	47	15	0.11	
Chilliwack Lake Moraine, BC	1	DgRi-1 Geo 1		40	24	130	91	14	115	12	788	282	639	0.56	Copper Ridge Variety B
			±	7	3	3	7	3	7	2	96	47	13	0.11	

All trace element values reported in parts per million; ±=analytical uncertainty estimate (in ppm). Iron content reported as weight percent oxide. NA=Not available; ND=Not detected; NM=Not measured.; **=Small sample. *=Data from Skinner (1999a, 1999b, 1999c, 2003), reports submitted to R. Mierendorf, NPS.

A.3 Results of Tephra Electron Microprobe Analyses

Analysis of major elements in the glass shards performed by Dr. Franklin J. Foit, Jr., Geo-Analytical Laboratory, Department of Geology, Washington State University. Results submitted to the author in letter dated December 15, 2003, on file at North Cascades National Park Service Complex, Curation Facility, Marblemount, WA.

Glass Chemistry of Tephra (Volcanic Ash) Sample (NOCA 22171)From 45WH631, North Cascades National Park

Oxide	Percentage*
SiO_2	74.77 (0.29)
Al_2O_3	13.92 (0.15)
Fe_2O_3	1.90 (0.06)
TiO_2	0.31 (0.02)
Na_2O	4.35 (0.12)
K_2O	2.30 (0.08)
MgO	0.41 (0.04)
CaO	1.91 (0.14)
Cl	0.12 (0.02)
Total**	100
Number of shards analyzed	19
Probable Source/Age***	Mt. St. Helen's W 1460±120 A.D.

*Standard deviations given in parentheses

**Analysis normalized to 100 percent weight

***Similarity Coefficient = 0.99