CHAPTER 11

Ancient Trade Routes for Obsidian Cliffs and Newberry Volcano Toolstone in the Pacific Northwest

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Obsidian has been recognized throughout the world as an important trade commodity in societies dependent on lithic tools, in regions as diverse as the Mediterranean, Micronesia, Asia, and the Americas (Ammerman 1985; Ayres et al. 1997; Baugh and Nelson 1987; Braswell 2003; Carlson 1994; Glascock 2003; Glascock et al. 2006; Grier 2003; Kuzmin and Glascock 2007; Kuzmin et al. 2008; Santley 1984). In the Pacific Northwest of North America, obsidian and other goods were distributed via a far-reaching trade network, involving the Columbia and Fraser river systems and the intervening coastal zone from southern British Columbia to Oregon (Anastasio 1972; Carlson 1994; Hayden and Schulting 1997; Ray 1939; Stern 1998). Hayden and Schulting (1997) note commonalities in exotic materials, crafted prestige items, marine shell ornaments, and sculpted bone and stone artifacts throughout a "Plateau Interaction Sphere," distributed between important economic centers, including principal exchange nodes at The Dalles on the lower Columbia River and at the Thompson-Fraser river confluence in southern British Columbia. Taking a coastal perspective, Ames and Maschner (1999:170) similarly note a southern Northwest Coast "obsidian exchange network" that includes lands bordering the Salish Sea (Gulf of Georgia-Strait of Juan de Fuca-Puget Sound), and extending south to the lower Columbia River region. In addition to economic connections, they note a number of distinctive cultural traits shared throughout this region, including cranial re-shaping, anthropomorphic stone bowls, common artistic motifs in carved pumice, antler, and clay, whale bone and zoomorphic clubs, and other artifacts (also see Connolly 1992; Duff 1956; Wingert 1952).

Charting the geography of exchange networks has been facilitated by the use of x-ray fluorescence and other techniques which provide inexpensive and non-destructive means of identifying diagnostic trace element profiles of both subject artifacts and their geologic sources. As a result, geochemical "fingerprinting" of artifact obsidian has become standard practice in archaeological studies, and, especially in regions where obsidian is abundant, extensive source data have been compiled.

Carlson (1994) has noted that a significant proportion of artifact obsidian from sites in southern British Columbia has been traced to Oregon sources (Figure 11-1). Artifact obsidian at these sites derive predominantly from source localities near the headwaters of Oregon's Deschutes and John Day Rivers, including Obsidian Cliffs, Newberry Volcano, Glass Buttes, and a "John Day" source that is likely the widely distributed geochemical type most commonly

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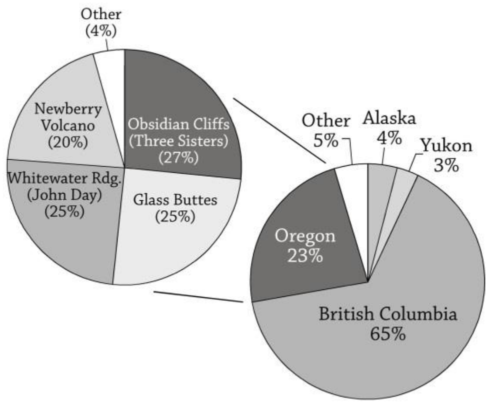

Figure 11-1. Proportion of British Columbia obsidian artifacts by source area (after Carlson 1994).

identified in Oregon as Whitewater Ridge (Skinner 2008). Hughes and Connolly (1999) have previously shown that obsidian systematically quarried from one of these sources—the Newberry Volcano obsidian flows in central Oregon—was used most extensively in the Deschutes River basin to the north, and commonly distributed in trade farther north along the spine of the Cascade Range and then throughout the region bordering the Salish Sea. The present research, similar in scope and design to the earlier Newberry Volcano study, is aimed at mapping the geographic distribution of obsidian quarried from the culturally important Obsidian Cliffs source. We find that, apart from a slightly more westerly bias, material from the Obsidian Cliffs exhibits similar geographic, and possibly temporal, distributions as the Newberry obsidian, suggesting that both were parts of the same economic network, primarily employed by consumers to the north.

The Newberry Volcano Obsidian Quarries: A Review

Newberry Caldera is at the center of the massive Newberry shield volcano. Located about 40 miles east of the Cascade Range crest, it marks the hydrologic divide between the Columbia River Plateau to the north and the Great Basin to the south. The caldera saw regular residential use in the early Holocene, most notably at the Paulina Lake site (Connolly 1999). About 7600 years ago the caldera was buried by nearly a meter of airfall tephra from the eruption of Mt. Mazama, a major Cascade Range Volcano; this event was soon followed by extensive eruptive activity within the Newberry Caldera itself. These events dramatically changed the landscape in the caldera neighborhood, creating a biotic desert that would have significantly diminished its biotic values for hunter-gatherer communities. On the other hand, among these eruptive events were numerous obsidian flows, including the geochemically indistinguishable Interlake, Central Pumice Cone, Game Hut, and East Lake flows. These were extruded between ca. 7000 and 3000 years ago, and together make up the Newberry Volcano geochemical type (Connolly and Hughes 1999; Hughes 1988; Laidley and McKay 1971; Skinner 1983).

Other chemically distinguishable obsidian flows are present in the caldera, including the Buried Flow (exposed prior to ca. 7600 years ago but rendered largely inaccessible by subsequent volcanic activity), and the Big Obsidian Flow, which erupted about 1300 years ago (Friedman 1977; Linneman 1990; MacLeod et al. 1995; MacLeod and Sherrod 1988). Obsidian from neither of these sources commonly occurs beyond the immediate vicinity of Newberry Volcano (Hughes and Connolly 1999), which suggests that these obsidians, most accessible in early Holocene times and during the most recent millennium, respectively, experienced fundamentally different economic circumstances than the Newberry Volcano geochemical type. Many sites have been identified within the caldera, and most—particularly those of middle and late Holocene age—are quarry stations or satellite lithic workshops dominated by early and middle stages of lithic reduction and the production of large bifacial blanks (Ozbun 1991).

Although the caldera apparently saw some residential use in the early Holocene, there is no evidence for sustained occupations during middle and late Holocene times, when activities in the caldera appear to have been focused almost exclusively on toolstone procurement and the production of quarry blanks for transport away from the quarry source (Connolly 1999). The extent of lithic reduction activities in the caldera is indicated by massive quantities of lithic reduction debris, especially notable in light of a general absence of domestic features and a paucity of evidence for hunting, harvesting, food processing, and other subsistence activities. The tool assemblage is dominated by large quarry blanks and preforms, with only modest occurrences of other tool classes (Figure 11-2). This contrast suggests that obsidian toolstone procurement in the caldera during middle Holocene and later times was not simply an activity embedded into a complex of hunter-gatherer routines, but a targeted activity on a scale that suggests a commercial enterprise.

Questions relating to the trajectory of Newberry Volcano obsidian beyond the caldera were addressed by Hughes and Connolly (1999), with the development of a contour map illustrating the distribution of Newberry Volcano obsidian (Figure 11-3). Contour values were generated by using the proportion of Newberry Volcano obsidian to all sourced specimens from each site where it was present. Ten-percent contour intervals were used, with the lower limit set at 20%, since the decreasing frequency of data points at the outer limits of the map made the contouring increasingly unreliable. Beyond the 20% contour interval, occurrences are simply represented by dots.

The results show a strongly directional distribution of Newberry obsidian to the north, traveling primarily through the Deschutes River basin. Some Newberry obsidian continued north, possibly along the spine of the Cascades, and into the Salish Sea (Puget Sound-Gulf of Georgia) region. This movement was no doubt facilitated by proximity of the Newberry source to the regional trading center at The Dalles, which provided a distribution point throughout the larger Columbia Plateau or southern Northwest Coast interaction spheres. By contrast, there is little suggestion that Newberry obsidian was conveyed in any quantity to the south.

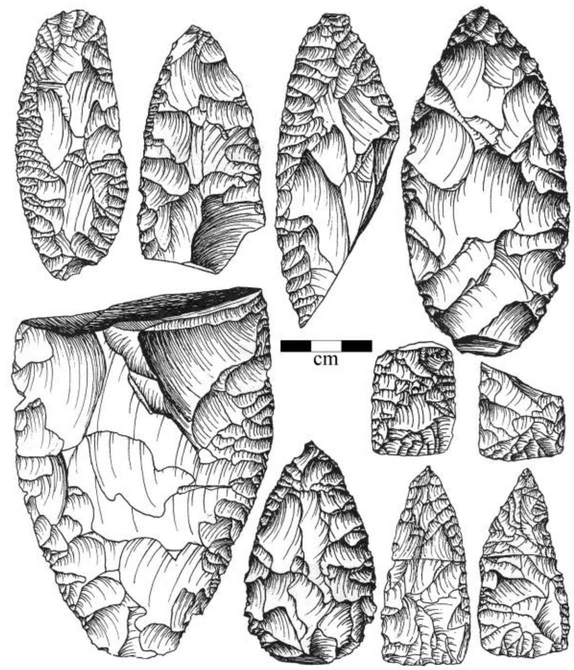

Figure 11-2. Newberry quarry bifaces from sites 35DS219 and 35DS34 (from Connolly 1999).

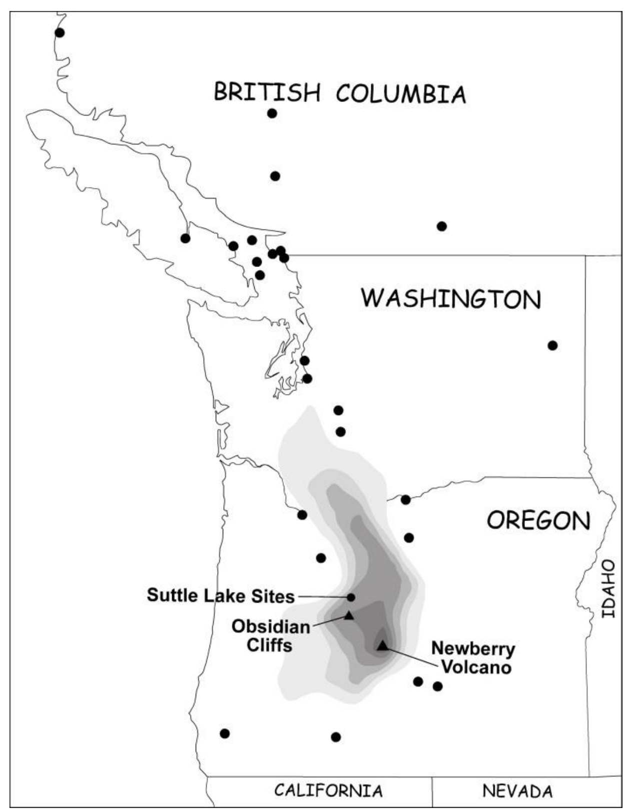

Figure 11-3. Distribution of Newberry Volcano obsidian beyond the Newberry Caldera, and the relative positions of the Obsidian Cliffs quarry and the Suttle Lake/Lake Creek site complex.

The Obsidian Cliffs Quarry

More recently, we had the opportunity to examine a complex of sites at the northeast shore of Suttle Lake, located on the east flank of the Cascade Range about 55 miles northwest of Newberry Caldera. Like the Newberry sites, those at Suttle Lake exhibited the features of quarry-related lithic reduction workshops, with dense lithic reduction debris and a tool assemblage dominated by mid-stage bifaces (Figure 11-4). However, the obsidian reduction debris was derived exclusively from Obsidian Cliffs, an important source located on the

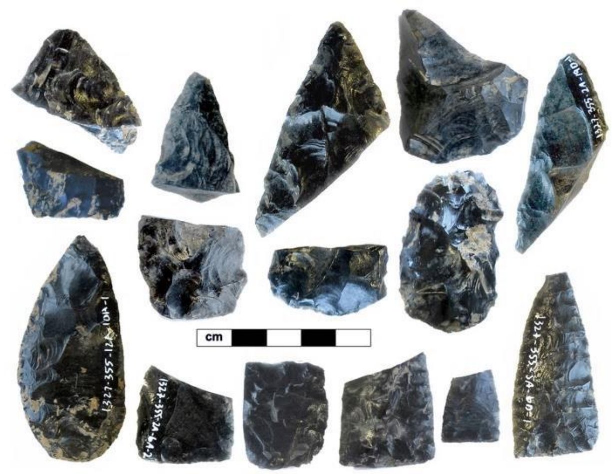

Figure 11-4. Bifaces of Obsidian Cliffs obsidian from the Suttle Lake/Lake Creek site.

west flank of the North Sister mountain peak in the High Cascades about 15 miles south of Suttle Lake.

Obsidian Cliffs obsidian has been found at many archaeological sites, particularly in western and central Oregon, and it is clear that this was a major toolstone source throughout the post-glacial period (Skinner 1995; Skinner and Winkler 1991, 1994; Musil and O'Neill 1997). It has been noted at the Paulina Lake site (within Newberry Caldera) in components dating between 11,000 and 7000 years ago (Connolly 1999), and at the 10,000 year old 45KT1362 site in central Washington (Galm and Gough 2000), and at Cascadia Cave in the South Santiam River drainage, where 96% of characterized obsidian from the nearly 9000 year-long occupation sequence is from Obsidian Cliffs (Baxter 1986, 2007). Numerous archaeological sites of the High Cascades near Obsidian Cliffs appear to be lithic reduction stations related to quarrying activity (Fagan et al. 1992; Jenkins 1988; Jenkins and Churchill 1988; Minor and Toepel 1984; Winthrop and Gray 1985).

Based on reported occurrences of Obsidian Cliffs material in the Oregon Cascades, it appears that Obsidian Cliffs material, like the Newberry Volcano obsidian, was primarily carried northward. Skinner and Winkler (1994) report that Obsidian Cliffs material represents about 85% of obsidian at sites on Willamette National Forest lands in the McKenzie River subbasin west of the Cascade crest, and 72% of obsidian in the Clackamas and Santiam sub-basins to the north (cf. Kelly 2001, 2003). This proportion decreases dramatically to the south; although Obsidian Cliffs is located near the head of the Middle Fork Willamette subbasin, toolstone from this source is just 34% of identified obsidian in the Middle Fork basin. In the Umpqua Basin to the immediate south, just 8% of identified obsidian is from Obsidian Cliffs (Skinner and Winkler 1994).

To more systematically evaluate the distribution dynamics of this widely used obsidian, we produced a comprehensive map. For this effort, we relied primarily on the obsidian sourcing data bank of co-author Craig Skinner's Northwest Research Obsidian Studies Lab, as well as a small amount of published data from other sources. We identified a total of 550 distinct sites in Oregon, Washington, and British Columbia from which at least one artifact of Obsidian Cliffs material was identified.

As with the Newberry data, a distribution and density contour map was then generated, in a two step process, using the percentage of Obsidian Cliffs material identified in each assemblage where it was present. We elected to limit our mapping universe to sites from which 20 or more obsidian specimens had been sourced. As a result, our final sample used for contouring was reduced from 550 to 188 sites. We used Surfer mapping software to produce a contour map with 5% contour intervals, using site latitude and longitude for X and Y coordinates. The lowest contour value was set at 20%, as the decreasing frequency of data points at the outer limits of the map made the contouring increasingly unreliable. Occurrences beyond the 20% contour were simply represented by dots to indicate presence (Figure 11-5).

As expected, the Obsidian Cliffs obsidian shows a strong northerly bias, nearly matching that previously mapped for the Newberry Volcano source, and reinforcing attention to the Cascade uplands as a possible transport corridor. Apart from a small amount of Obsidian Cliffs material that travels down along the crest of the Cascade Range and into the upper North Umpqua River drainage, there is little movement south. By contrast, most Obsidian Cliffs material travels north along the spine of the Cascades, and is commonly found in the Willamette Valley to the west and northwest. In the southern and Central Willamette Valley, Obsidian Cliffs glass could also have been procured from local secondary deposits of McKenzie and Willamette river gravels. It apparently follows main river systems draining the western Cascades,

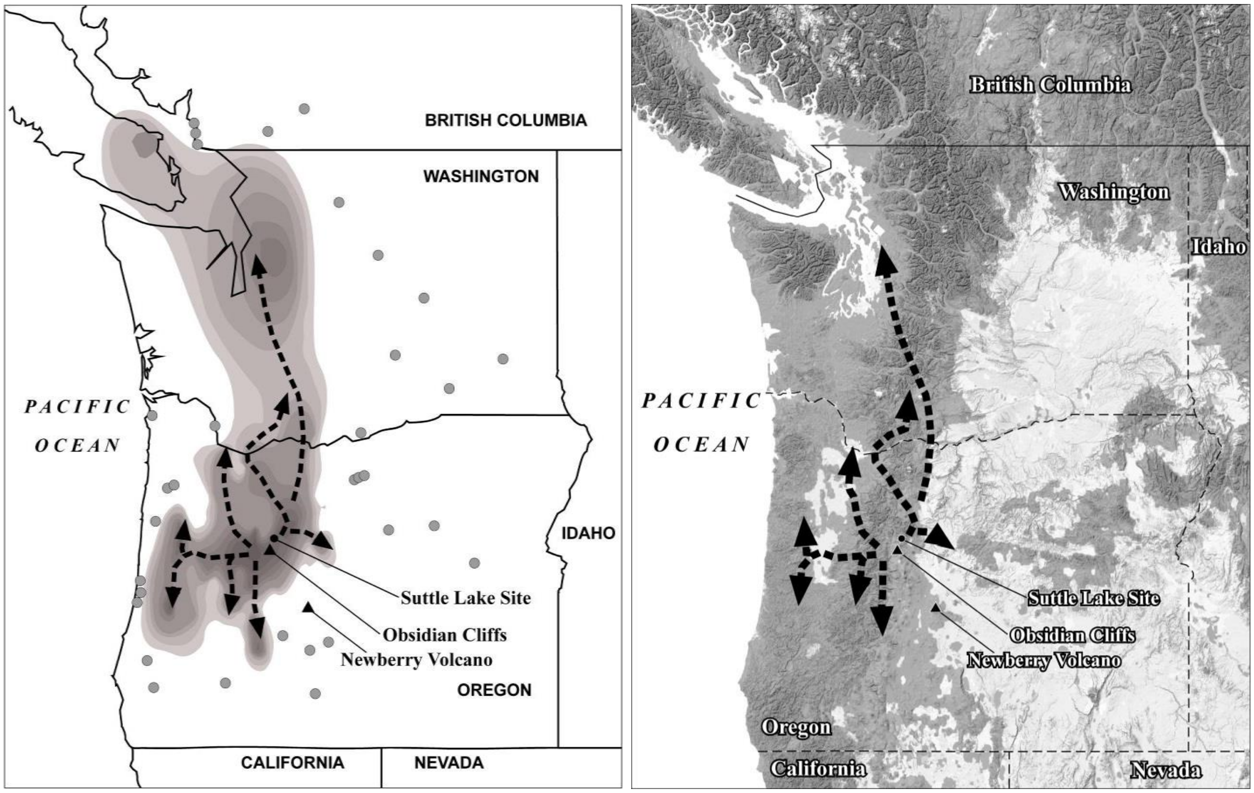

Figure 11-5. Left: Contour distribution map of Obsidian Cliffs (OC) obsidian, based on percentage of OC to all sourced specimens in 188 sites. Dots represent additional occurrences where OC obsidian accounts for less than 20% of the total sample. Right: Inferred Obsidian Cliffs distribution routes overlying a landform map (base map modified from Google maps).

probably a reflection of critical travel routes. Principal corridors include the McKenzie, Santiam, and Clackamas river systems. The appearance of Obsidian Cliffs obsidian in the northwest Umpqua Basin appears to reflect a link to the Yoncalla via their Kalapuya linguistic relatives in the Willamette Valley, rather than movement of material down the Umpqua River. Movement of material north of the Columbia River appears to follow the Cascade Range to the Puget Sound area and regions even farther north, possibly passing through trading centers at The Dalles or in the Portland Basin.

Chronology and Social Context of the Newberry and Obsidian Cliffs Quarries

Although Newberry Volcano obsidian dominates in the Deschutes Basin sites, Obsidian Cliffs material is also common, and, at a number of residential sites in the basin, is the predominant material type (Jenkins and Connolly 1994, 1996). In the western Cascades where Obsidian Cliffs obsidian is most common, Newberry Volcano obsidian regularly co-occurs with it (Skinner and Winkler 1994). This regular co-occurrence suggests that even though these two sources served slightly different geographies, both functioned as companion elements within a larger, common economic community.

Because the obsidian flows of the Newberry Volcano geochemical type are post-Mazama in age, toolstone procurement from these quarries was necessarily an activity in the post-Mazama period (middle and late Holocene). More specifically, most intensive quarrying activity appears to have occurred after ca. 4000 years ago, and prior to ca. 1000 years ago (Connolly 1999:237; Davis and Scott 1991:53) During this time there appears to have been a specialized production of bifacial implements for export from the quarries. Numerous biface caches sourced to both Newberry Volcano and Obsidian Cliffs have been identified in central Oregon and in the Cascade Range (Bennett-Rogers 1993; Marschall 2004; Scott et al. 1986; Swift

1990; Winthrop and Gray 1985). The biface caches, which feature both high numbers of bifaces and uniform production qualities, support the interpretation of obsidian as a commoditized product that was a factor in intergroup commerce, and not simply procured for local needs (Figure 11-6).

In his review of trade and exchange in British Columbia, Carlson focused on obsidian because it is a trackable commodity. To be sure, obsidian is not terribly abundant at BC sites, and, not surprisingly, most obsidian in BC sites is from BC sources. However, Carlson found that nearly a quarter of traced obsidian in British Columbia sites is from Oregon sources. Of these, four are most prominently represented, including Newberry Volcano, Obsidian Cliffs (which Carlson identifies as the "Three Sisters" source), Glass Buttes, and one from the John Day area, almost certainly the source most commonly identified as Whitewater Ridge (refer to Figure 11-1).

We have drawn on data in this study from the Obsidian Cliffs and Newberry Volcano sources. We know that both sources are near the southern limits of the Columbia Basin, and near the northern edge of the Great Basin. The other two sources commonly found in British Columbia are similarly located near this important hydrologic and cultural boundary. Though we have yet to systematically examine the distribution of obsidian from these more easterly sources, we predict that they, too, will be found to be quarried most intensively by southern Columbia Plateau communities for distribution northward.

The emergent model suggests that a small number of prominent obsidian sources located near the Columbia Plateau-Northern Great Basin boundary were most intensively quarried by people to the north, serving as an important commodity in a regional exchange system that extended well into British Columbia.

In reviewing the use history of the Newbery Volcano obsidian quarries, Connolly (1999) found diminished use during the last millennium, indicating changes to the interaction sphere by which obsidian was earlier distributed. This change may correlate to settlement pattern changes documented on the southern Columbia Plateau; as noted by Endzweig (1994:12), "[t]he high density of archaeological sites recorded along the John Day River as contrasted with its limited treatment in ethnographic and historic accounts supports the impression of a population reorganization" during the last millennium. Archeological surveys have documented the presence of many housepit village clusters throughout the southern Columbia Plateau, extending along the middle and upper drainages of the Deschutes and John Day rivers (Hibbs et al.1976; Polk 1976; Endzweig 1994); for example, Jenkins and Connolly (1994) found that the Paquet Gulch site, a large village with 75 to 100 housepits not far from the Deschutes River town of Maupin, was occupied as early as ca. 2500 years ago but produced little evidence for occupation within the last ca. 1300 years. Endzweig (1994) reports that housepit sites on the upper John Day were most intensively occupied between ca. 2600 and 900 years ago; many sites continued to be regularly used after this time, but probably not as residential places. This pattern varies notably from the settlement distribution documented historically, in which residential centers where arrayed along the Columbia River corridor (Murdock 1938; Rigsby 1965; Suphan 1974). When fur trade or military parties encountered southern Columbia Plateau

Figure 11-6. Bifaces of Obsidian Cliffs obsidian from the Paul's Fire Cache site.

Sahaptins in the upper Deschutes and John Day regions during the early nineteenth century, they were generally at temporary hunting camps and accompanied by horses (Young 1899; Fremont 1887).

The apparent withdrawal from residential centers in the upper Deschutes and John Day basins during the last millennium may not have been abrupt, and may have been a response to multiple factors. Dumond and Minor (1983) see a reorientation of focus on the middle Columbia River from upstream to the downriver Chinook area after ca. 1000 BP, possibly in response to growing economic opportunities along the Columbia River corridor. Lewis and Clark marveled at the constant trade activity along the river, and Clark's remark that The Dalles vicinity was "the great mart of all this country" is well known (Thwaites 1905:4:289). The Lower Columbia area was but one important center for a region-wide Pacific Northwest/Northwest Coast exchange network. Throughout the region economic activity was controlled and managed by powerful elites, representing resource-controlling corporate households and lineages who maintained their position in part by their central role in the wide-ranging exchange economy (Ames 2006; Ames and Maschner 1999; Sobel 2006, 2012).

Another factor may have been an increasing level of hostility between southern Columbia Plateau Sahaptins and Northern Paiutes over the course of the last millennium (Kelly 1932; Murdock 1938; Ray 1938; Spier and Sapir 1930; Steward 1938; Sutton 1986; Teit 1928) that led to the abandonment of small, isolated and vulnerable hamlets in favor of larger and more secure population centers (Endzweig 1994; Jenkins and Connolly 1994; Connolly 1999).

Whatever the motivations, it is clear that by the time of contact what had been the major Plateau obsidian sources were firmly within lands occupied by the Northern Paiutes, who had established residential centers in the upper Deschutes, John Day, and Crooked River basins (Stewart 1939; Fowler and Liljeblad 1986; Figure 11-7). Lewis and Clark reported that, in 1805, the name given for the Deschutes River by the Columbia River Indians was "the river on which the Snake Indians live" (Thwaites 1905:3:147). While there are notable exceptions (Couture et al. 1986; Hunn 1990), the documented attitude of hostility between Plateau

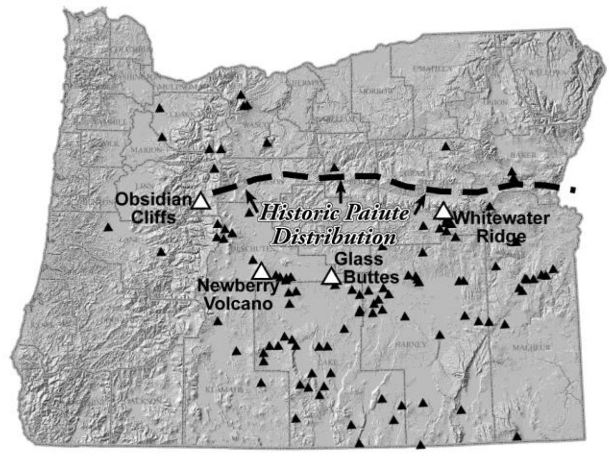

Figure 11-7. Location of the major Plateau prehistoric obsidian sources, in relation to Paiute territory at contact.

Sahaptins and their Paiute neighbors to the south must have had some impact on access to and procurement of obsidian from these sources by Plateau consumers (cf. Connolly 1999:242-243).

While access to some of the southernmost obsidian sources may have been diminished for southern Plateau folks during the last millennium, trade activity was accelerating along the Columbia River corridor (Dumond and Minor 1983; Hayden and Schulting 1997). How this change in the obsidian trade within the last millennium affected economic dynamics west of the Cascades remains largely unexplored, but one possible change is an elevated role of west-side obsidian, possibly including Obsidian Cliffs, and most notably the Inman Creek material from the Willamette Valley. Inman Creek obsidian was probably originally extruded from Western Cascades vents in the upper Middle Fork Willamette River basin, but is now widespread in Pleistocene-deposited Willamette River gravels.

A dramatic increase in the occurrence of obsidian at later Willamette Valley sites was first noted by Pettigrew (1980:66-67), who suggested that this increase may have been related to introduction of the bow and arrow, estimated to have occurred in the valley within the last ca. 2000 years. Since the Inman Creek obsidian most readily available in the Willamette River gravels occurs primarily as pebble-sized nodules, obsidian would have been of relatively limited use for the production of stone dart tips, which were typically reduced from larger bifacial preforms. The much smaller arrow points, by contrast, were frequently made on flakes, immediately making the local obsidian a significantly more valuable raw material. A manifold increase in the occurrence of projectile points in the Willamette Valley in later sites has also been noted as evidence for an increasing concern with security (Aikens et al. 2011:308-309; Jacobs et al. 1945:191-193; Zenk 1976:5-6).

From the present study, another possibility emerges for the dramatic increase of Willamette Valley obsidian in later sites. Diminished access for consumers along the Columbia River corridor to eastern Oregon obsidian sources may have enhanced its market value. One of the larger samples of sourced obsidian from the Willamette Valley is from the cluster of sites bordering the former channel of Mill Creek, in the vicinity of the modern I-5/Oregon Highway 22 interchange near Salem. The sites represent mostly continuous use throughout the past ca. 6000 years, with intense use periods between ca. 5000 and 3500 years ago and again during the last ca. 2000 years. Of 466 tested obsidian artifacts, 98% were sourced to either Obsidian Cliffs or the local Inman Creek sources. Of this number, 92% were Inman Creek obsidian, and 8% were from Obsidian Cliffs, but they were not equally distributed through time.

A number of obsidian hydration studies have suggested that Inman Creek obsidian hydrates at a relatively slow rate on the valley floor. Minor (1977, 1985) proposed hydration rates of $1.3\mu^2$/1000 years for the Portland Basin and $1.6\mu^2$/1000 years for the upper Willamette Valley, based on small sets of paired hydration values and radiocarbon dates. Connolly and O'Neill (2004) suggest a rate of $1.9.0\mu^2$/1000 years for Inman Creek obsidian in the upper Willamette Valley, based on Inman Creek obsidian from radiocarbon-dated contexts at the Chalker site (35LA420). This rate, which we apply to the Mill Creek sites, is slightly faster than Minor's preliminary rate, but still considerably slower than other Oregon obsidians, including Obsidian Cliffs. Based on their research on hydration rates for many eastern Oregon obsidians, Pettigrew and Hodges (1995) have found that Obsidian Cliffs and Newberry Volcano obsidians hydrate at comparable rates. Adjusting the experimentally induced hydration rate for Newberry Volcano obsidian reported by Friedman and Long (1976) and Friedman and Obradovich (1981) to the effective hydration temperature calculated for the Salem recording station, provides a hydration rate of $3.6\mu^2$/1000 years that we apply to the Obsidian Cliffs material. Calibrated ages are shown in Figure 11-8.

The use of Obsidian Cliffs material exhibits a gradual increase through time, but about 45% of obsidian from this source at Mill Creek predates ca. 1500 BP, and 55% occurs after that time. By contrast, about 84% of Inman Creek material appears to post-date ca. 1500 BP, representing a dramatic surge in the use of this local material. Looking beyond the valley, Inman Creek obsidian also appears to have assumed a position of importance in regional trade; at villages on the lower Columbia occupied only during the last millennium, the proportion of Inman Creek obsidian far exceeds that of eastern material (Sobel 2006). The implication is that Inman Creek obsidian was commoditized during the last ca. 1500 years, enhancing its value and range of distribution in the Willamette Valley/Lower Columbia region. Whether this is a function of enhanced trade opportunities in the lower Columbia Basin or of diminished access to eastern Oregon obsidians, or both, remains unresolved at present.

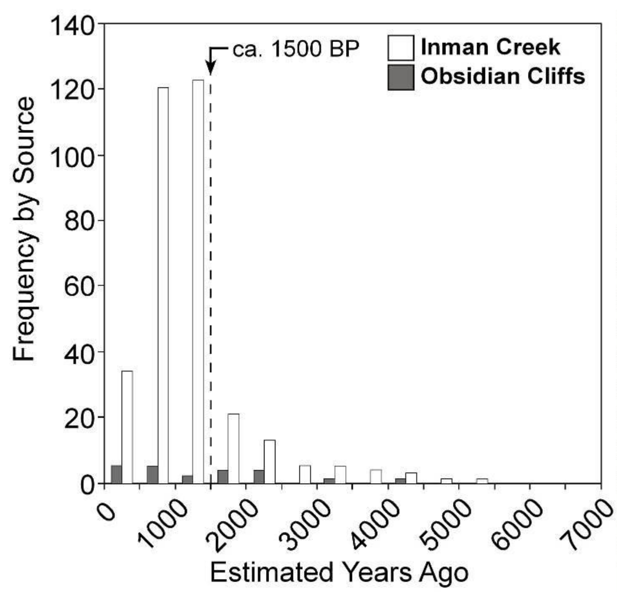

Figure 11-8. Relative proportions of Inman Creek vs. Obsidian Cliffs obsidian through time at the Mill Creek sites, central Willamette Valley.

In summary, Obsidian Cliffs, like obsidian from Newberry Volcano, was not only an important local toolstone material, but was a commoditized product systematically quarried and shaped into uniform, transportable forms and transferred to distant consumers through a regional exchange network with centers on the lower Columbia River and the Salish Sea regions. Though systematic studies have yet to be pursued, it is likely that several other eastern Oregon obsidian sources located near the southern rim of the Columbia Plateau region (most notably Glass Buttes and Whitewater Ridge) also primarily served northern consumers who participated in this exchange network. Further, it appears that during the most recent millennium, changing social dynamics may have reduced access to these eastern sources by northern consumers, while at the same time the intensity of commerce on the lower Columbia River accelerated. These factors may have served to enhance the value of the Willamette Valley's Inman Creek obsidian.

We are still some distance from fully understanding the driving forces of these regional economic patterns, but it is clear that understanding local chronologies and social dynamics depends on placing them within a much broader regional economic context.

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