CHAPTER 15

Upper Klamath River Obsidian Use Frequencies: Distance-To-Source and Additional Variables

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The Southern Cascades of south-central Oregon and northeast California, like the Klamath Basin and Modoc Plateau to the east and the Central Cascades to the north, provide many discrete sources of obsidian toolstone. The archaeological sites of the Upper Klamath River Drainage System lie just west, northwest, and southwest of these sources, providing a unique opportunity to test assumptions concerning obsidian acquisitions and use. Commonly in this area and throughout the world anthropologists presume that a community will use the obsidian sources closest to them, and if a source is relatively close to the community or core territory, individuals will acquire the obsidian through direct travel to the source (Heizer 1949, 1974). If the sources used by a community exist at a greater distance, roughly greater than 20 km, the community will use trade or exchange to obtain obsidian (Erlandson et al 2011; Kroeber 1925). However, distance may not be the only variable to influence the sources used and the mechanism of conveyance (Hughes 2011). The variables may include toolstone quality, time, tool class, culture contact, cultural boundaries or related constraints, and cultural preferences. Another commonly held assumption has been that over time, the sources acquired and their mechanism of conveyance may change based upon the level of cultural organization and complexity (Hughes 2011). It is assumed that early cultures were organized as small bands moving widely over a considerable territory, acquiring obsidian incidentally as they moved through a rather large territory hunting and gathering (Binford 1979). As groups of hunter-gatherers became larger and less mobile, perhaps regularly moving through a smaller territory their direct access to a variety of obsidian sources would be more restricted and less casual in the course of a seasonal round (Ericson 1982). By the Late Prehistoric Period when communities were tied to particular villages most if not all of the year, their acquisition of obsidian would require more planning and the likelihood of direct travel to a source or sources would not be possible or be severely restricted. Therefore, over time one would expect the use of fewer sources if several were available reasonably close. In this area, the Late Paleo-Indian Period sites would be predicted to use the greatest variety of sources. In the Archaic Period, communities would be predicted to have a somewhat smaller range of mobility, resulting in more restricted access to obsidian, thus use of fewer sources. The Late Prehistoric Period sites should have the least variety. The first step in assessing whether or not the assumptions concerning distance and time are valid for the Upper Klamath River Drainage System requires sourcing of obsidian artifacts. Therefore, a small sample study of obsidian distribution and frequency of obsidian sources was completed, and the results indicate the assumptions related to the acquisition of obsidian due to distance and time may not be valid for this area.

The use of obsidian for tools within the area of the Upper Klamath River Drainage System occurs throughout a period of at least 9000 years (Anderson and Cole 1964; Cole nd; Cressman and Olien 1962; Cressman and Wells 1961; Leonhardy 1967; Mack 1983, 1991, 1995, 2004, 2005, 2007; Newman and Cressman 1959; Nilsson et al. 1989; Wallace and Taylor 1952). In the last 35 years, a small sample of obsidian artifacts and debitage

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(n=470) from 50 of 176 known archaeological sites and 7 isolates within the Upper Klamath River Drainage System have been sourced using X-Ray Fluorescence (XRF) analysis (Hughes 1986; Jensen 1987; Mack 1983, 2005, 2007, 2008; Nilsson 1988; Nilsson et al. 1989; Oetting et al 1996; Schaefer 1995). Using distance and geology, it is reasonable to expect that the inhabitants of archaeological communities of the Upper Klamath River, which are located just west of the Klamath Basin and northwest of the Medicine Lake Highlands, had access to several obsidian source locations throughout the last 9000 years. Only one source location (Glass Mountain within the Medicine Lake Highlands) was not available until sometime after A.D. 900 (Donnelly-Nolan et al. 1990). Though small, the results of the analyses point to some unexpected use frequencies of the potentially available obsidian source locations of the region, which encompasses part of south-central Oregon and northeast California. Even though the usual measure of "distance-to-source" would lead one to expect some greater variation in use of source locations, the frequency of one source in all the obsidian assemblages tested regardless of their location within the Upper Klamath River drainage dominates. The source is the Medicine Lake Highlands, in particular, the locality of Grasshopper Flat/Lost Iron Wells/Red Switchback (GF/LW/RS). Neither chronology, assemblage location, nor the functions of the obsidian artifacts in this area change the dominance of Medicine Lake Highland obsidian significantly (Mack 2011).

For this study, the Upper Klamath River Drainage System is defined as the Upper Klamath River and its tributaries from Keno, Oregon on the east to Interstate 5 on the northern edge of Shasta Valley in northern California on the west (Figure 15-1). The northern boundary is roughly Highway 66 in the vicinity of the Jenny Creek drainage east to Hayden Mountain, where it bends northward to cross the middle course of Spencer Creek. The southern boundary is south of the California-Oregon border and includes the headwaters of Shovel Creek, Rock Creek, Bogus Creek, and the Shasta River, a major tributary of the Klamath River, which flows into the Klamath just west of Interstate 5 and includes the only major tributary valley in the study area. To the east of the study area the Klamath River flows through a small portion of the western Klamath Basin; to the west,

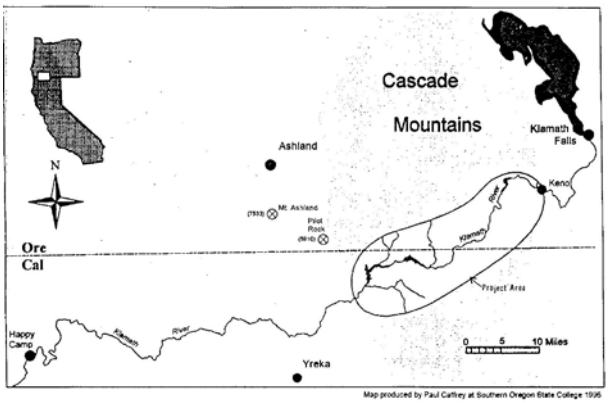

Figure 15-1. Upper Klamath River drainage system project area.

the river begins to cut through the Klamath Mountains of northern California. Thus the research area for this obsidian study is the stretch of the Klamath River and its tributaries, which cut through the Cascades Mountains, both the High Cascades and the Western Cascades (Figure 15-1). The boundaries of the Upper Klamath were originally conceived based upon geology and areas where archaeological survey and test excavations produced scientifically documented obsidian artifacts either from sites or as isolated finds since 1952 (Mack 1990).

The obsidian recovered for the study comes from slightly over 49 archaeological sites and 7 isolated finds. The sites include village sites, large and small campsites, and lithic scatters, which are the result of various types of activity or special use. Archaeological research indicates human use and habitation of the Upper Klamath River drainage begins at least 9000 years ago (Mack 1991). During the earliest pre-contact period, the canyon's inhabitants likely travelled throughout the Upper Klamath River drainage from regions surrounding the canyon, while continuing to use surrounding areas as well. During the Archaic Period, the area's inhabitants exploited the varied resources of the canyon on a seasonal basis, occupying the canyon and outlying areas during the times at which the canyon's resources were at their peak and then moving seasonally into other areas. The settlement pattern of the canyon shifted during the Late Prehistoric or Pacific Period with the development of housepit villages upon the terraces and benches of the river and along major tributaries. These housepits represented a year-a-round occupation,

though this does not necessarily mean that entire families would remain in the village all year (Mack 1990). Many of the people living in the villages left during various points in the year to hunt, gather, and trade, often in the surrounding uplands. For example, the upland immediately to the south of the canyon requires only a half-hour or less to reach from the river terraces and benches below, not necessitating major relocations of families. The uplands to the north also take less than an hour to reach by foot from the river terraces and benches.

The initial obsidian analysis focused upon formed artifacts, particularly projectile points. Richard Hughes completed the first X-Ray Fluorescence analysis done on obsidian artifacts from sites along the Upper Klamath River in 1977 (Mack 1979). Beginning in the late 1980s, in addition to formed artifacts, core fragments, worked flakes, utilized flakes, and debitage were also included in the sourced samples. The end result is a higher proportion of formed artifacts, especially projectile points, in the sample of sourced artifacts from the study area. Richard Hughes (1986, 1987, 1988, 1994a, 1994b, 1995, 1996a, 1996b 1997, 1998, 1999a, 1999b, 1999c, 2001, 2006a, 2006b, 2014) completed the vast majority of the X-Ray Fluorescence analyses from 1977 to 2006. However, Northwest Research Obsidian Studies Laboratory analyzed a few specimens in 1996 (Skinner et al. 1996). Slightly more than half of the assemblages sourced date to the Late Prehistoric Period, based upon associated radiocarbon dates, obsidian hydration, and the presence of time-sensitive projectile points (Desert Side-notched, Tuluwnt Series, and Rose Spring Series). Slightly less than half represent the earlier Archaic Period occupation of the area also based upon associated radiocarbon dates, obsidian hydration, and time-sensitive artifacts (Clilipudi Corner-Notched, Elko Series, Siskiyou Side-Notched, McKee Uniface, Houx Series, and Northern Side-notched). As surface collections can only be dated by time-sensitive artifacts, projectile points are the primary artifact type sourced from those collections.

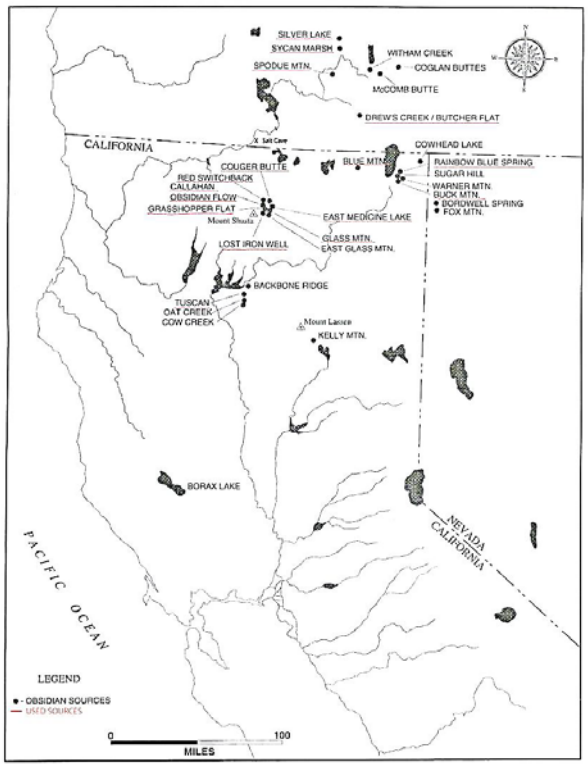

Figure 15-2. Locations of obsidian sources in study area.

Results of XRF Analysis

The results of the X-Ray Fluorescence analyses reveal the obsidian artifacts within the study area come from 13 distinct sources or source groups (Figure 15-2). Of these 13 sources, six are located in the Medicine Lake Highlands (Figure 15-2). The remaining seven sources are located in areas northeast, east, and south of the canyon. Sources within the Medicine Lake Highlands vary in distance from roughly 55 to 74 km to the southeast of the Upper Klamath River, measured from the location of Salt Cave (Schaefer 1995). The distances to the sources would vary somewhat depending upon whether the point of measurement is upriver or downriver of Salt Cave and whether the point of measurement is north of the river or south of the river. The specific sources from the Medicine Lake Highlands represented in order of frequency are:

1. Grasshopper Flat/Lost Iron Well/Red Switchback: 54-69 km southeast; n=361
2. East Medicine Lake-two localities (Yellowjacket and Stony Rhyolite): 75 km southeast; n=23
3. Callahan Obsidian Flow: 55 km southeast; n=22
4. Glass Mountain: 71 km southeast; n=6
5. Cougar Butte: 69 km southeast; n=2

6. Railroad Grade: 58 km southeast; n=2
7. Generally sourced to the Medicine Lake Highlands: 54-75 km southeast; n=10 (Skinner et al 1996)

Of these six, the obsidian from Grasshopper Flat/Lost Iron Wells/Red Switchback was most common, at 86 percent of the specimens from the Medicine Lake Highland sources. Three percent sourced more generally to the highlands. In the earliest analysis reported by Hughes (Mack 1979), artifacts were sourced to the Medicine Lake Highlands generally, but these specimens were reanalyzed by Hughes in 1999 and identified to the Grasshopper Flat/Lost Iron Well/Red Switchback location within the Medicine Lake Highlands. The X-Ray Fluorescence analyses reported by Skinner, Davis, and Thatcher in 1996 uses different source groupings for the Medicine Lake Highlands sources. Therefore, some of these sourced specimens are grouped into a general category for the purposes of this study. East Medicine Lake and Callahan each represent five percent of the total number of specimens sourced to the Medicine Lake Highlands. Glass Mountain, Cougar Butte, and Railroad Grade all have a small representation in the sample, one percent or less for each.

The non-Medicine Lake Highland glasses are in order of frequency:

1. Spodue Mountain: 58-87 km northeast; n=18
2. Warner Mountains-two localities (Buck Mountain and Blue Spring): 156 km east; n=9
3. Silver Lake/Sycan Marsh: 119-133.5 km; n= 9
4. Drews Creek/Butcher Flat: 113.5 km northeast; n=4
5. Blue Mountain: 96.5 km east; n=2
6. Massacre Lake/Guano Valley: 135-214 km southeast and east; n=1
7. Tuscan: 117 km south; n=1

Spodue Mountain's frequency is equivalent to 3.8 percent of the sample. Though the Spodue Mountain source is approximately 87 km northeast of the Upper Klamath River, nodules of this obsidian have been redeposited in the Sprague River and Williamson River, which are much closer to the Upper Klamath River (Hughes and Mikkelsen 1985, Hughes 1886b:311-312). Thus Spodue Mountain obsidian could be obtained within 55 km of Salt Cave on the Klamath. Silver Lake/Sycan Marsh and the Warner Mountains sources are 2.1 percent, and the remainder of the source localities, Drews Creek, Blue Mountain, Massacre Lake/Guano Valley, and Tucsan are one percent or less.

Though the frequency of each obsidian source location is not completely unexpected based upon the distance between the source location and the Upper Klamath, there are some surprises. Of the 470 sourced specimens, clearly Medicine Lake Highlands' glasses dominate with 90 percent of the total. Of these, it is not surprising the majority come from Grasshopper Flat/Lost Iron Wells/Red Switchback sources located on the western side of the highlands. The Red Switchback locale is one of the four closest source locales to the Upper Klamath River at 55 km. But there are three other source locations also roughly 55 km from the measuring point on the Upper Klamath River: Callahan Obsidian Flow, Railroad Grade, and Spodue Mountain. The low frequency of specimens from the Callahan Obsidian Flow (4 percent) is surprising because it is in the northwest corner of the highlands, directly south of the Red Switchback locale. Only two specimens (less than 1 percent) source to Railroad Grade on the north edge of the highlands, which may be explained by the source's poor quality even though it is one of the closest sources. Spodue Mountain obsidian accounts for slightly more than four percent of the obsidian in the study area even though it is found within the Sprague River and Williamson River as a secondary deposit, which is also within 55 km of the measuring point of Salt Caves on the Upper Klamath River.

Distance- to- source also does not explain the fact that some of the more distant sources both from the Medicine Lake Highland and the non-Medicine Lake Highland sources have higher percentages of frequency than closer sources. Comparing sources, which are roughly 72 km from the Upper Klamath one notes a slightly higher frequency of the East Medicine Lake source (six percent), the most distant of the Medicine Lake Highland sources. The frequency of Glass Mountain and Cougar Butte, located in the Medicine Lake Highlands, are both represented by one percent or less. Glass Mountain is a recent

extrusion of obsidian and has not been available until the most recent part of the Late Prehistoric, which probably explains its low frequency in Upper Klamath archaeology sites.

There are three sources, which fall between 97 and 122 km miles from the Upper Klamath with low frequencies, which is not surprising, but there is one distant source, which has a frequency higher than expected. The Warner Mountains obsidian source frequency is 2.1 percent; it is a distant source at roughly 156 km from the Upper Klamath study area. The Warner Mountains source locales matches in frequency Silver Lake/Sycan Marsh, which is a somewhat closer source and exceeds in frequency several other closer sources. Drews Creek, with a frequency of one percent represented by four Late Prehistoric projectile points, and Blue Mountain, with a frequency of 0.5 percent, are closer to the Upper Klamath River, at 112.5 and 96.5 km respectively. Only the two most distant sources occur at a lower frequency: Massacre Lake and Tuscan, both at approximately 0.225 percent. It should be noted that Massacre Lake obsidian cobbles can be found on the Madeline Plans, which places it at approximately 135 km from the Upper Klamath (Young 2002). The Tuscan source here refers to a multi-locational source situated along the northern and northeastern edge of the Sacramento Valley. Only one specimen is sourced to this locale, a projectile point excavated from Paradise Craggy Village just north of Yreka near the confluence of the Shasta and Klamath Rivers (Mack 2007). One must conclude that distance-to-source is not the only factor to explain the obsidian source frequencies within the Upper Klamath River Drainage, though it would seem to explain the dominance of the Grasshopper Flat/Lost Iron Wells/Red Switchback source, especially since the Red Switchback locale is one of the closest sources.

The frequency of the 13 sources used does vary somewhat based upon time. Projectile points being time-sensitive provide the easiest specimens to use for age estimates, though obsidian hydration and association with radiocarbon dates has also been used to estimate the age of many other types of sourced specimens. Of the time-sensitive projectile points sourced, there is one specimen not from the Medicine Lake Highlands which dates to the Late Paleo-Indian period, a possible Windust projectile point made from Spodue Mountain obsidian. Only eight of 65 Archaic Period projectile points (Northern Side-notched, Houx Series, McKee, Siskiyou Side-notched, Clikipudi Series, Elko Series and Excelsior) do not source to the Medicine Lake Highlands. These source to only three other locations: three from Spodue Mountain, four from Silver Lake/Sycan Marsh, and one from Tuscan. Medicine Lake Highlands' sources, Spodue Mountain, the Warner Mountains, Silver Lake/Sycan Marsh, and Drews Creek were used to make 125 Late Prehistoric or Pacific Period projectile points (Tuluwnt Series, Desert Side-notch, and Rose Spring Series) found within Upper Klamath River assemblages, of these 19 were sourced to the non-Medicine Lake Highland sources. Based upon this sample, the greatest variety of sources used occurs during the Late Prehistoric Period.

Non-projectile point artifact categories include only 20 artifacts not sourced to the Medicine Lake Highlands' sources. They include two biface fragments, a worked flake and a piece of debitage from Silver Lake/Sycan Marsh, one almost totally unworked cobble-core from the Massacre Lake/Guano Valley source, three pieces of debitage, a knife fragment, two worked bifaces, two drill midsections, and a worked flake from Spodue Mountain, three small debitage pieces and a large biface from Buck Mountain (one of the Warner Mountain source locales), and a biface fragment and worked flake from Blue Mountain. None of the used sources found in the study area represent any particular tool class in this sample. Therefore, the use of a particular source for a particular tool class does not seem to exist in the study area.

The non-projectile point artifacts of non-Medicine Lake Highlands sources almost all occur within the uplands within the Upper Klamath River Drainage, whereas 15 of the 19 Late Prehistoric Period projectile points occur in sites on the river terraces and benches, particularly village sites. Of the eight Archaic Period and one Late Paleo-Indian Period projectile points of non-Medicine Lake Highlands' obsidian, seven occur in the uplands. In contrast, artifacts dating throughout the 9000 years of occupation of the Upper Klamath made of Medicine Lake Highlands' obsidian occur both upriver and downriver of Salt Cave on the terrace and bench sites and in the upland sites, and they occur both north of the river and south of the river in equal abundance. This suggests that in the Late Prehistoric Period finished projectile points of non-

Medicine Lake Highland obsidian will be found on the river terraces and in village sites, while the few non-Medicine Lake Highland obsidian artifacts from the Archaic will primarily be found in the upland sites. These trends may change when a larger sample of artifacts from sites within the Upper Klamath River Drainage are sourced.

Conclusion

With the limited current evidence these 470 specimens provide, Medicine Lake Highlands' obsidian, particularly Grasshopper Flat/Lost Iron Wells/Red Switchback, dominates whether sites are upriver or downriver of Salt Cave or north or south of the river, which meets the assumption of distance-to-source. What is surprising is its overwhelming dominance, with locales within the Medicine Lake Highlands as close to Salt Cave as the Grasshopper Flat/Lost Iron Wells locality passed over. In addition, the frequency of Warner Mountain obsidians exceeds the frequency of all non-Medicine Lake Highland sources, which are much closer to the Upper Klamath River, with the exception of Spodue Mountain. It is also equal in frequency to the Silver Lake/Sycan Marsh source, which is approximately two-thirds closer to the Upper Klamath River. Clearly some obsidian sources were more commonly used even when they came from a greater distance. The two major assumptions concerned with distance to source are not upheld by the sources used overtime. Instead of greater variety of source use in the pre-village time period (Paleo-Indian and Archaic), the greater variety occurs during the Late Prehistoric, and some sources appear to be preferred even though they are located at a greater distance. Therefore, distance alone cannot explain the frequencies of obsidian used within the Upper Klamath River Drainage. A much larger sample of artifacts from the study area will be analyzed in the next few years, which may or may not confirm the trends described here.

References Cited

Anderson, Adrien and David L. Cole
1964 *Salt Cave Dam Reservoir Archaeological Project 1963, Interim Report: Excavations at Site SC-1*. Report to Pacific Power and Light Company (COPCO Division). University of Oregon, Eugene.

Binford, Lewis R.
1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35:255-273.

Cole, David L.
n.d. *Preliminary Report: Archaeological Excavations at Keno Development*. University of Oregon, Eugene.

Cressman, Luther S. and Michael Olien
1962 *Salt Cave Dam Reservoir: Interim Report on Archaeological Project*. Report to Pacific Power and Light (COPCO Division). University of Oregon, Eugene.

Cressman, Luther S. and John Wells
1961 *Salt Cave Dam Reservoir: Interim Report on Archaeological Project 1961 Field Season*. Report to Pacific Power and Light (COPCO Division). University of Oregon, Eugene.

Donnelly-Nolan, Julie M., D.E. Champion, C.D. Miller, and D. A. Trimble
1990 Post 11,000 Year Volcanism at Medicine Lake Volcano, Cascade Range, Northern California. *Journal of Geophysical Research* 95:19,693-19,704.

Ericson, Jonathon E.
1982 Production for Obsidian Exchange in California. In *Concepts for Prehistoric Exchange*, edited by J.E. Ericson and T. K. Earle, pp 129-148. Academic Press, New York.

Erlandson, Jon M., T. Rick, Todd Braje, M. Casperson, B. Culletin, B. Fulfrost, D. Gutherie, N. Jew, D. J. Kennett, M. I. Moss, L. Reeder, C. Skinner, J. Watts, and L. Willis
2011 Paleo Indian Seafaring Maritime Technologies and Coastal Foraging on California's Channel Islands. *Science* 331: 1181-1185.

Heizer, Robert F.
1949 The Archaeology of Central California, I: The Early Horizon. *University of California Anthropological Records* 12(1).
1974 Studying the Windmiller Culture. In *Archeological Researches in Retrospect*, edited by G. R. Willey, pp. 179-206. Winthrop Publishers, Cambridge, Massachusetts.

Hughes, Richard E.
1986a Appendix D: X-Ray Fluorescence Data for Obsidian Specimens from CA-SIS-900. In *Archaeological Data Recovery Investigations at CA-SIS-900: A Late Prehistoric Site in Shasta Valley, California, 1989*, prepared by E. Nilsson, K.H. Banks, and G. Greenway, Mountain Archaeological Research, Redding, California, for Siskiyou County Department of Public Works, Yreka, California.
1986b Diachronic Variability in Obsidian Procurement Patterns in Northeast California and South-central Oregon. *University of California Publications in Anthropology* 17.
1987 Appendix A: X-Ray Fluorescence Data. In *Report on Historical and Archaeological Resources for the Salt Cave Hydroelectric Project, Klamath County, Oregon*, prepared by Peter M. Jensen, Jensen and Associates, Archaeological Consulting and Research, Chico, California, for The City of Klamath Falls, Oregon.
1988 Appendix G: X-Ray Fluorescence Data for Obsidian Specimens from CA-SIS-331 and CA-SIS-332. In *Archaeological Text Excavations at the Ager III Sites: CA-SIS-331, CA-SIS-332, and CA-SIS-1282, Siskiyou County, California*, prepared by Elena Nilsson for Siskiyou County Department of Public Works, Yreka, California.
1994a *Geochemical Laboratory, Letter Report 94-35.* Prepared for Joanne Mack, Pomona College, Claremont, California.
1994b *Geochemical Laboratory, Letter Report 94-52.* Prepared for Joanne Mack, Pomona College, Claremont, California.
1995 *Geochemical Laboratory, Letter Report 95-3.* Prepared for Joanne Mack, Pomona College, Claremont, California.
1996a *Geochemical Laboratory, Letter Report 96-28.* Prepared for Joanne Mack, Pomona College, Claremont, California.
1996b Appendix D: X-Ray Fluorescence Obsidian Characterization Study. In *Archaeological Inventory and Evaluation of the Orwick BLM Land Exchange Parcels, Siskiyou County, California*, prepared by Albert C. Oetting, Heritage Research Associates Report No. 198, Eugene, Oregon.
1997 *Geochemical Laboratory, Letter Report 97-15.* Prepared for Joanne Mack, Pomona College, Claremont, California.
1998 *Geochemical Laboratory, Letter Report 98-*84. Prepared for Joanne Mack, University of Notre Dame, Notre Dame, Indiana.
1999a *Geochemical Laboratory, Letter Report 99-29.* Prepared for Joanne Mack, University of Notre Dame, Notre Dame, Indiana.
1999b *Geochemical Laboratory, Letter Report 99-45*. Prepared for Joanne Mack, University of Notre Dame, Notre Dame, Indiana.
1999c *Geochemical Laboratory, Letter Report 99-53.* Prepared for Joanne Mack, University of Notre Dame, Notre Dame, Indiana.
2001 *Geochemical Laboratory, Letter Report 2001-15.* Prepared for Joanne Mack, University of Notre Dame, Notre Dame, Indiana.
2006a *Geochemical Laboratory, Letter Report 2006-89.* Prepared for Joanne Mack, University of Notre Dame, Notre Dame, Indiana.
2006b *Geochemical Laboratory, Letter Report 2006-124.* Prepared for Joanne Mack, University of Notre Dame, Notre Dame, Indiana.
2011 *Perspectives on Prehistoric Trade and Exchange in California and the Great Basin*. The University of Utah Press, Salt Lake City.
2014 *Geochemical Laboratory, Letter Report 2014-87.* Prepared for Joanne Mack, University of Notre Dame, Notre Dame, Indiana.

Hughes, Richard E. and Pat Mikkelsen
1985 *X-Ray Fluorescence Analysis of Obsidian from Five Localities Along the Sycan and Sprague Rivers, Winema National Forest, Klamath County, Oregon.* Report prepared for the Winema National Forest, Contract No. 53-04U3-ooo69, Klamath Falls, Oregon.

Jensen, Peter M.
1987 *Report on Historical and Archaeological Resources for the Salt Cave Hydroelectric Project, Klamath County, Oregon.* Jensen and Associates, Archaeological Consulting and Research, Chico, California, for The City of Klamath Falls, Oregon.

Kroeber, Alfred E.
1925 *Handbook of the Indians of California. Bureau of American Ethnography,*

Bulletin 78.

Leonhardy, Frank C.

1967 *The Archaeology of a Late Prehistoric Village in Northwestern California.* Bulletin No. 4, Museum of Natural History, University of Oregon, Eugene.

Mack, Joanne M.

1979 Archaeological Investigation in the Salt Cave Locality: Subsistence Uniformity and Cultural Diversity along the Klamath River, Oregon. Unpublished Ph.D. dissertation. Department of Anthropology, University of Oregon, Eugene.

1983 *Archaeological Investigation in the Salt Cave Locality: Subsistence Uniformity and Cultural Diversity on the Klamath River, Oregon*, University of Oregon Anthropological Papers, No. 29, Eugene.

1990 Archaeology of the Upper Klamath River. In *Living with the Land: The Indians of Southwest Oregon*, edited by N. Hannon and R. Olmo, pp. 10-25. The Proceedings of the 1989 Symposium on the Prehistory of Southwest Oregon. Southern Oregon Historical Society, Medford, Oregon.

1991 Upper Klamath River Canyon Prehistory. In *Klamath River Canyon Prehistory and Ethnology*, by J. Mack and D. Theodoratus, M. Ashman, H. McCarthy and D. Genetti. *Cultural Resources Series No. 8*, U.S. Department of Interior, Bureau of Land Management, Oregon State Office, Portland.

1995 *Preliminary Report on the Upper Klamath River Canyon Project: Summer of 1994 Archaeological Testing, Site Evaluation, Historical Overview, and Ethnobotanical Report*. Prepared for U.S. Department of Interior, Bureau of Land Management, Klamath Falls Resource Area, Oregon and Redding Resource Area, California. Pomona College, Claremont, CA. Manuscript on file with the author.

2004 *Upper Klamath River Stateline Archaeological District*. National Register of Historical Places Nomination Form. Prepared for the National Register of Historical Places. Submitted to Bureau of Land Management, California State Office. Manuscript on file with the author.

2005 *Test Excavations at Paradise Craggy Village (CA-SIS-1066H), Upper Klamath River, Northern California*. Report for Department of Interior, Bureau of Land Management, Redding Resource Area, California. University of Notre Dame, Indiana.

2007 *Test Excavations at Geese Flying (CA-SIS-2135) and Wise Eagle (CA-SIS-2136), Upper Klamath River, Northern California.* Report for Department of Interior Bureau of Land Management, Redding Resource Area, California. University of Notre Dame, Indiana.

2008 *The Distribution of Medicine Lake Highland Obsidian in Southwestern Oregon.* Poster presented at the Society for California Archaeology, Annual Meetings,

2011 On the Role of Siskiyou Utility Ware as a Social Network Marker in Late Prehistoric Northern California and Southern Oregon. In *Perspectives on Prehistoric Trade and Exchange in California and the Great Basin*, edited by Richard E. Hughes, pp. 114-134. The University of Utah Press, Salt Lake City.

Newman, Thomas M. and Luther Cressman

1959 *Final Report on Archaeological Salvage Program in the Big Bend Project of COPCO on the Klamath River, Oregon.* Report of the Museum of Natural History, University of Oregon, to the California-Oregon Power Company, Eugene.

Nilsson, Elena

1988 *Archaeological Test Excavations at the Ager III Sites: CA-SIS-331, CA-SIS-332, CA-SIS-1281, and CA-SIS-1282, Siskiyou County*. Draft Report. Mountain Anthropological Research, Redding, California. Prepared for Siskiyou County Department of Public Works, Yreka, California.

Nilsson, Elena, K. M. Banks, and Greg Greenway

1989 *Archaeological Data Recovery Excavations at CA-SIS-900: A Late Prehistoric Site in Shasta Valley, California*. Mountain Anthropological Research, Chico, California, submitted to Siskiyou County Department of Public Works, Yreka.

Oetting, Albert C.

1996 *Archaeological Inventory and Evaluation of the Orwick BLM Land Exchange Parcels, Siskiyou County, California.* Heritage Research Associates Report No. 198, Eugene, Oregon.

Schaefer, Christopher E.
1995 *Obsidian Distribution Patterns within the Upper Klamath River Drainage.* Unpublished Senior thesis, Pomona College, California.

Skinner, Craig E., M. Kathleen Davis, and Jennifer J. Thatcher
1996 *X-Ray Fluorescence Analysis and Obsidian Hydration Measurement of Artifact Obsidian from Thirteen Medford BLM Sites, Josephine and Jackson Counties*. Northwest Research Studies Laboratory Report 96-24 Oregon. Northwest Research Obsidian Studies Laboratory, Corvallis, Oregon.

Wallace, William J. and Edith S. Taylor
1952 *Excavation of SIS-13, A Rock Shelter in Siskiyou County, California*. University of California Archaeological Survey Reports 15, Berkeley.

Young, D. Craig
2002 Secondary Obsidian Sources of the Madeline Plains: Paleolandscapes and Archaeological Implications. In *Boundary Lands: Archaeological Investigations Along the California-Great Basin Interface*, edited by K.R. McGuire, pp 75-84. Anthropological Paper No. 24, Nevada State Museum, Carson City, Nevada.