

CHAPTER 12

Glass Buttes, Oregon: 14,000 Years of Continuous Use

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For at least fourteen millennia Glass Buttes, one of the largest obsidian sources in Oregon, has been a source of high quality toolstone for Native American flintknappers. In the last century non-native historic and modern flintknappers as well as rock hounds have also used this resource for its abundant, colorful and high quality obsidian. This paper will discuss the quantity and quality of Glass Buttes obsidian, archaeological work that has been done there, the prehistoric and modern use of the resource, new archaeological findings, and the Bureau of Land Management protection plan for this valuable resource.

Obsidian was a commodity and trade item used extensively by Native American and First Nations people of North America. In the United States, the state of Oregon has in excess of 100 geochemical obsidian sources, more than anywhere else on the continent (Northwest Research Obsidian Studies Laboratory 2012) (Figure 12-1). The ancient use of these obsidian resources has added to a rich archaeological record throughout Oregon, the Pacific Northwest and Great Basin. Over the last thirty years, the use of x-ray fluorescence (XRF) characterization methods has enabled researchers to understand the movement of obsidian tools and toolstone across the landscape (Skinner 1983; Hughes 1983; Carlson 1994). Blood residue extraction, another recently developed technique (Neuman 1990; Williams 1990; Fagan 2011), aids research in understanding game hunting strategies used by ancient hunters and how they have changed over time. The Glass Buttes Source Complex, with



Figure 12-1. Oregon obsidian sources with Glass Buttes Source Complex circled.

its nine geochemical varieties identified by Craig Skinner (Ambroz et al. 2001; Northwest Research Obsidian Studies Laboratory 2012), is one of, if not the largest obsidian source in Oregon (Figures 12-2 and 12-3). Glass Buttes has a rich archaeological record that has provided, using XRF and blood residue extraction, new information to our understanding of this very important resource.

Glass Buttes lies within the ethnographic range of the Northern Paiute people and was an important resource for Native People for thousands of years (Mack 1975; Loy 2001; Lebow 1990). Due to its abundant high quality and often-colorful obsidian, Glass Buttes is still used today as a toolstone source by modern flintknappers as well as a material

source for geologists and rock hounds. Modern use of Glass Buttes has impacted this important resource but it continues to be highly significant as a subject of geological and archaeological research as well as a Mecca for rock hounds and practitioners of traditional arts and technologies.

Geologic Setting

Glass Buttes is located primarily in south-central Oregon's Lake County, along U.S. Route 20 between the cities of Bend and Burns. It is situated in the High Lava Plains, on the northern edge of the Great Basin, and is in the Bureau of Land Management (BLM) Prineville District (Figure 12-1). Five million year old Glass Buttes, a large rhyolitic volcanic center, is generally between 900 m to more than 1800 m in elevation and is dominated by Little Glass Butte, and Glass Butte at 1945 m elevation (Mack 1975; Churchill 1991:1; Orr et al. 1992; Loy 2001). Ancient lakebeds, lava ridges, cinder cones, and intermittent springs typify the area (Mack 1975). Obsidian at Glass Buttes is found in an area of approximately 746 km² (Northwest Research Obsidian Studies Laboratory 2012), and occurs as surface float pebbles and cobbles and primary geologic sub-surface veins (Skinner 1983; Churchill 1991:1). This obsidian occurs in a variety of colors including: translucent and banded black, red, mahogany, gold sheen, silver sheen, gray-green banded, rainbow and banded or mottled multi-color combinations (Skinner 1983). Sub-surface obsidian in some areas is available in very large blocks or boulders, some weighing 45 kg or more (Figure 12-4).

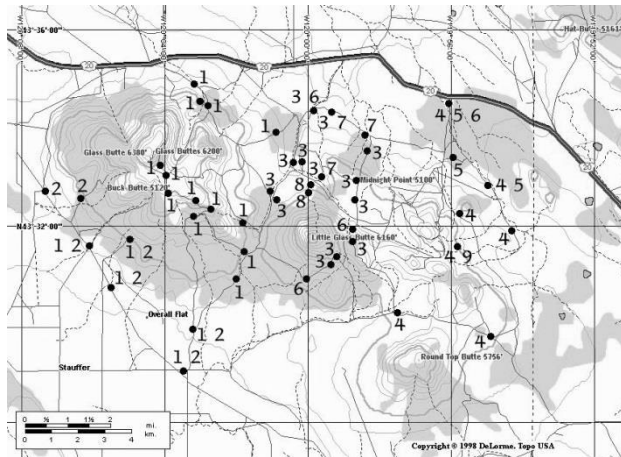


Figure 12-2. Glass Buttes main geochemical varieties 1-9 source locations.

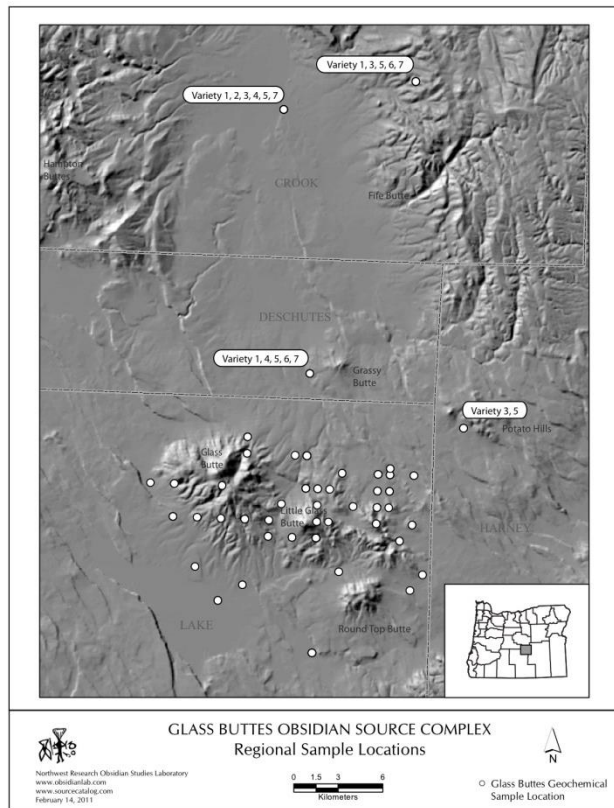


Figure 12-3. Glass Buttes extended geochemical obsidian source variety locations.



Figure 12-4. Large quarried obsidian.

Geochemical studies of source obsidian by Ambroz (1997), Ambroz et al. (2001), and Northwest Research Obsidian Studies Laboratory (unpublished research, 2012) has identified nine geochemical varieties at a number of primary and secondary source locations within the Glass Buttes Complex and in the basins to the north and south of Glass Buttes. These sources are found primarily in northeast Lake County (Figure 12-2), with Glass Buttes geochemical varieties 1, 2, 3, 4, 5, 6 and 7 occurring in two locales in southeast Crook County, geochemical varieties 1, 4, 5, 6 and 7 occurring in southeast Deschutes County, and geochemical varieties 3 and 7 occurring in northwest Harney County (Figure 12-3).

Mining and Geothermal Exploration

Glass Buttes is within an area geologically mapped for its mercury mining and geothermal exploration potential (Johnson and Ciancanelli 1984; Loy 2001). Mercury mining, perlite mining evaluation and geothermal exploration have taken place in the Glass Buttes area. The Oregon Department of Environmental Quality (DEQ) reports that mercury-bearing cinnabar was first discovered at Glass Buttes in 1933, and small-scale mining and exploration was carried out until 1957. From 1957 through 1970, the Jackson Mountain Mining Company conducted larger mining operations, producing 500 flasks of mercury between 1967 and 1970 (Oregon Department of Environmental Quality 2012). Remnants of the mining operations and tailing piles can still be seen to the east of Glass Buttes, but these areas should be avoided as mercury contamination in the mining areas renders them unsafe to visit. These areas were slated by the DEQ for environmental cleanup in 2001, but action has yet to be undertaken by the BLM (Oregon Department of Environmental Quality 2012).

According to the University of Nevada Reno's Great Basin Center for Geothermal Research, Magma Energy was the first company to explore Glass Buttes for its geothermal potential. "Exploration activity in and around Magma's 3607 ha (8,914 acre) property (lease at Glass Buttes) began in 1974 and continued through the early 1980's. Work included numerous drilled temperature gradient holes, geologic mapping, an electrical resistivity survey and a soil-mercury survey. Initial work was sponsored by the Oregon

Department of Geology and Mineral Industries and later by the geothermal lease holders Vulcan Geothermal Group and Phillips." (Great Basin Center for Geothermal Energy 2012).

In 1975, Mack conducted a cultural resources inventory for the BLM (Mack 1975). A geothermal plant has not yet been built at Glass Buttes. However, in 2010 ORMAT Nevada conducted further geothermal exploration adjacent to Magma's Glass Buttes project with a \$4.5 million dollar grant from the U.S. Department of Energy (Great Basin Center for Geothermal Energy 2012). At the time of this writing no further information on the ORMAT geothermal project was available.

The Supreme Perlite Mining Company laid mining claims within the Glass Buttes area in 1988. Between 1988 and 1989, four test pits were excavated and exploratory drilling took place within a 40-acre designated area, south of U.S. Route 20 and east of Glass Butte. In 1990 a cultural resource survey was conducted by Churchill (1991). Subsequent development for perlite mining has not been undertaken (Supreme Perlite Mining Company, personal communication 2012).

In the mid-1960s a single, private obsidian-mining claim was established at Glass Buttes. Several individuals have held the "grandfathered" claim since the claim was made, and is still in effect to date.

Previous Research

A number of archaeological projects have taken place in the Glass Buttes area (Mack 1975; Crowley-Thomas 1983a, b; Griffin and Soper 1984; Soper and Griffin 1984; Enneberg 1987; Churchill and Jenkins 1989; Churchill 1991; Sharp et al. 1998; Skinner and Thatcher 2003; Jenkins 2005; Jenkins and Connolly 2006). The four largest archaeological projects of the Glass Buttes area are surveys by Mack (1975) and Churchill (1991), obsidian studies carried out as part of the FGV Western Fiber Build Project (Skinner and Thatcher 2003; Sharp et al. 1998), and the Jenkins and Connolly (2006) testing and evaluation project.

Churchill's survey, conducted in 1990, covered 480 acres for the Supreme Perlite Mining Company's proposed mine, as previously discussed. Churchill (1991) recorded 14 archaeological sites and two isolated artifact finds. The 14 archaeological sites contained a number of

bifaces, unifaces, cores, and a hammerstone. Of the two isolate finds, one is a projectile point fragment that resembles an Elko Eared series point; the other is a biface (Churchill 1991:2:1-4).

Jenkins and Connolly's 2006 testing and evaluation project, was conducted under an Oregon Department of Transportation contract for the FTV Western Fiber Build Project, a fiber optics communications line survey paralleling U.S. Route 20. Work included excavation of 197 test probes and three 1-x-1-m test units at five sites. Four of the sites were small lithic scatters, but the fifth was a huge 800-x-200-m area of dense and discreet chipping stations containing thousands of flakes, early stage biface fragments and 40-60 cm deep deposits. Early stage reduction of quarry blanks and flake "rough outs" were the major activities at all five sites using locally obtained obsidian cobbles of Glass Buttes varieties 1 and 2. Obsidian XRF sourcing of 74 specimens that included six tools, an unmodified cobble, and 67 flakes, indicated most were derived from Glass Buttes varieties 1, 2 and 3. Two of the specimens, both bifaces, were made of Silver Lake/Sycan Marsh and Brooks Canyon obsidian. The Silver Lake/Sycan Marsh obsidian source is located about 95 km to the southwest, and the Brooks Canyon obsidian source is located 11 km west of Glass Buttes. The only specimen recovered with chronologically diagnostic attributes, was an Elko Corner-notched projectile point base fragment made of Glass Buttes 1 obsidian. Although no radiocarbon dates were obtained, obsidian hydration analysis of 100 samples of obsidian suggests that these sites were used over a long period of time, extending from a few hundred years ago and back several thousand years into the terminal Pleistocene (Jenkins and Connolly 2006: 57-62). The scope of this project, including subsurface testing and obsidian characterization and hydration analysis, makes it one of the more comprehensive projects that have been conducted at Glass Buttes to date.

Mack (1975) conducted the largest survey of the Glass Buttes area to date under a contract with the Bureau of Land Management for proposed geothermal leasing, as previously discussed. Covering a 30-square-kilometer area around Glass Buttes, the survey identified and documented 131 archaeological sites and 15 isolated artifact finds. Mack describes the archaeological sites as campsites, large and small knapping stations,

hunting blinds, rock walls and quarries (Mack 1975:7; Churchill 1991:1:8). Projectile point types recovered during this survey range in age from approximately 13,000 B.P. to 900 B.P. based on standard chronological assignment of the types and indicate continuous human use of the area for that period (Mack 1975:46). These projectile point types as listed by Mack include: a fluted Clovis point, Western Stemmed and foliate points, Northern Side-Notched, Pinto, Humboldt, Elko, and Rose Spring series points (Mack 1975: 78-84).

Re-Evaluation of Artifacts From the 1975 Mack Survey

In 1975, Mack collected and identified 77 tools that include 48 projectile points, one crescent, three drills, one graver, seven scrapers, five stemmed knives, eight bifacial knives, and four unifacial knives. Seventy-three are made from obsidian or fine grain volcanic material (FGV), and four are made from cryptocrystalline silicate material (CCS). At the time of the 1975 Mack survey XRF geochemical sourcing of obsidian was in its infancy and was not a consideration. Blood residue extraction and analysis from stone tools was also in its early stages and not readily available to researchers. Both of these research tools are now commonly used for archaeological analysis.

In 2011, analysis was conducted on 41 of the obsidian and FGV projectile points, on loan from the University of Oregon Museum of Natural and Cultural History. These artifacts are listed in Table 12-1 and have been assigned numbers from 1 to 41 for the purposes of the analysis and discussion below (Figure 12-5). The artifacts were selected based on their chronological type associations and technological criteria, including attributes diagnostic of stone tool manufacture, use and rejuvenation (Flenniken 1981; Flenniken and Raymond 1986; Titmus and Woods 1986; Stueber 2010). Technological analysis indicated that the damage, breakage patterns and flake scar patterns were consistent with projectile points that exhibit damage due to use impact fractures and/or characteristics of rejuvenation to extend use-life. Blood residue extraction and analysis was conducted by Archaeological Investigations Northwest, Inc. (AINW). XRF geochemical sourcing was conducted on 40 of the same projectile points by Northwest Research Obsidian

Table 12-1. Obsidian source and blood residue results for selected projectile points recovered at Glass Buttes by Mack (1975).

No.	Site or Isolate and Catalog No.	Projectile Point Type	Break Type or Evidence of Repair	Obsidian Source	Distance From Source	Blood Residue
1	35LK326/1	Clovis	bending	Witham Creek	120 km	
2	35HA81/5	Crescent		Buck Spring	40 km	
3	35LK318/4	Western Stemmed	bending, burin	Chickahominy	32 km	Bear
4	35LK318/3	Western Stemmed	bending	Bear Creek	160 km	
5	Isolate 3	Western Stemmed	rejuvenation	Glass Buttes 4		
6	35LK92/1	Western Stemmed	bending	Wagontire	24 km	Bear
7	35LK322/1	Cascade	bending	Glass Buttes 3		Deer, Rabbit
8	35LK278/1	Cascade	rejuvenation	Big Stick	32 km	Bovine, Rabbit
9	35LK345/1	Cascade	rejuvenation	Cougar Mtn.	80 km	Camel
10	Isolate 10	Cascade	rejuvenation	Tough Butte	64 km	
11	35LK384/1	Cascade	bending, facial burin	Tank Creek	40 km	
12	35LK374/1	Cascade	rejuvenation, bending	MLGV*	144 km	
13	35LK365/1	Humboldt	bending	Glass Buttes 1		
14	35LK322/3	Humboldt	bending	Glass Buttes 3		
15	35LK293/3	Northern Side- Notched	rejuvenation	Venator FGV*	136 km	
16	35LK311/1	Northern Side- Notched	bending	Riley	32 km	Bovine, Deer
17	35HA77/1A	Elko series	rejuvenation, bending	Buck Spring	40 km	Chicken
18	35LK307/1	Rose Spring	rejuvenation, bending	Carlton (Bald Butte)	32 km	
19	35LK384/2	Elko	bending	Glass Buttes 9		
20	Isolate 4	Gatecliff Split Stem	bending	Riley	32 km	
21	35LK385/3	Elko	rejuvenation	Tank Creek	40 km	
22	35HA77/1B	Rose Spring	bending	Round Top Butte	40 km	
23	Isolate 9	Elko	bending	Burns	64 km	
24	35LK315/1	Elko	bending	Glass Buttes 3		
25	35HA82/1	Fragment	bending	Glass Buttes 4		
26	35LK306/1	Elko	bending	Glass Buttes 3		
27	35LK306/2	Elko	bending	Glass Buttes 3		
28	35LK299/2	Elko	bending	Chickahominy	32 km	
29	35LK366/1	Gatecliff Split Stem	bending, facial burin	Buck Spring	40 km	Rabbit
30	35LK305/3	Fragment	bending	Glass Buttes 7		Chicken
31	35LK359/1	Western Stemmed	bending	Glass Buttes 1		
32	35LK314/1	Distal Fragment	bending, facial burin	Rimrock Spring	40 km	
33	35LK383/1	Distal Fragment	rejuvenation, bending	Cougar Mtn.	80 km	Camel
34	35LK317/2	Medial fragment	bending	Spodue Mtn.	90 km	
35	Isolate 14	Fragment	bending	Riley	32 km	
36	35LK284/2	Fragment	bending	Glass Buttes 1		
37	35LK313/1	Fragment	bending	Variety 5	32 km	
38	Isolate 12	Fragment	bending	Tank Creek	40 km	
39	35HA80/1	Rose Spring	bending	Buck Spring	40 km	
40	35LK301/1	Rose Spring	bending	Carlton (Bald Butte)	32 km	
41	35HA95/4	Rose Spring	bending	Whitewater Ridge	115 km	

* MLGV=Massacre Lake/Guano Valley; FGV=Fine Grained Volcanic

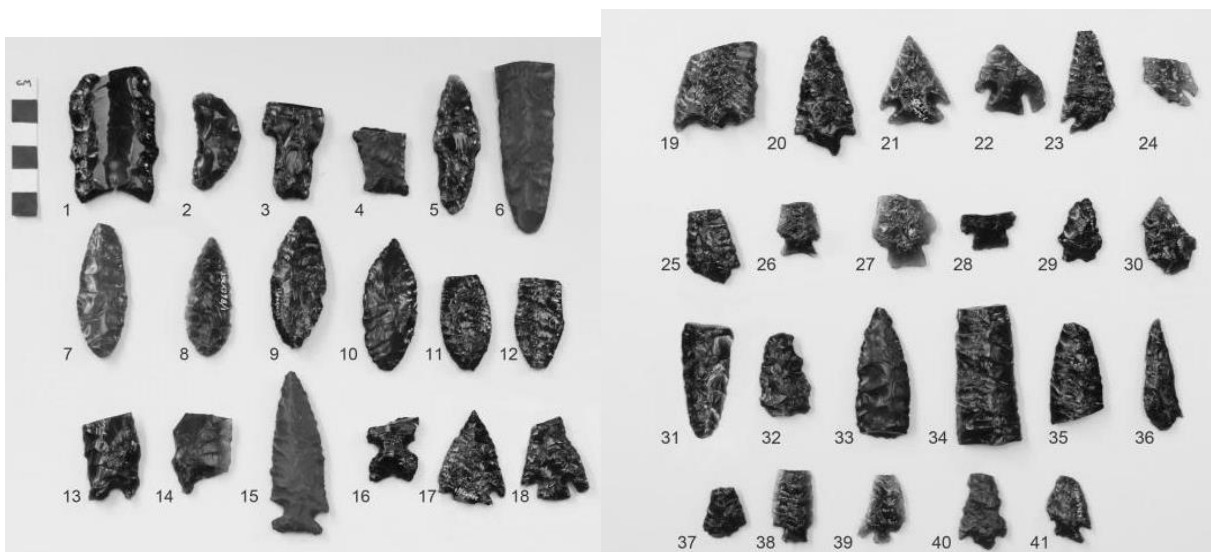


Figure 12-5. Projectile points recovered at Glass Buttes by Mack (1975) and selected for obsidian source and blood residue analysis.

Studies Laboratory. No obsidian hydration studies were performed for this project. Geochemical sourcing and obsidian hydration for the Clovis point recovered during the 1975 Mack survey (Artifact 1) was conducted in 2002 by Northwest Research Obsidian Studies Laboratory (Rondeau 2007a).

Results for the geochemical characterization and blood residue analyses provide great insight into the use of Glass Buttes by prehistoric hunter-gatherers. Obsidian tools found at Glass Buttes represent 19 distant sources: Witham Creek, Buck Spring, Chickahominy, Bear Creek, Wagontire, Big Stick, Cougar Mountain, Tough Butte, Tank Creek, Massacre Lake/Guano Valley, Venator Fine-Grained Volcanic, Riley, Carlon (Bald Butte), Variety 5, Tank Creek, Round Top Butte, Burns, Rimrock Spring, Spodue Mountain, and Glass Buttes geochemical varieties 1,3,4,7, and 9 (Table 12-1 and Figures 12-5 and 12-6).

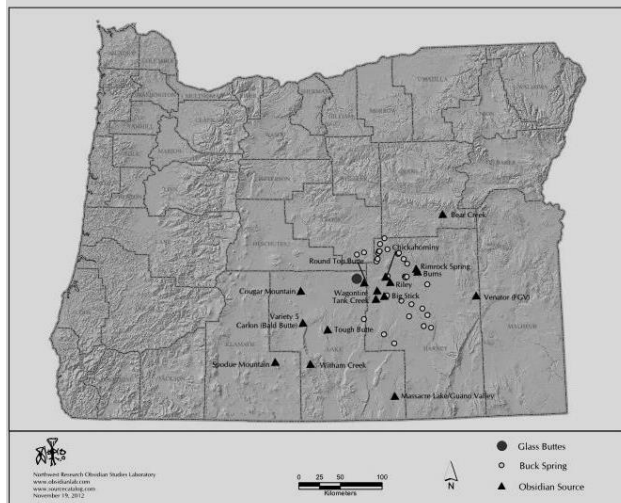


Figure 12-6. Obsidian and FGV source locations for the Mack 1975 artifacts.

Blood residue extraction and analysis was conducted on 41 artifacts (Figure 12-5) recovered during the 1975 Mack survey. The artifacts were tested using antisera from 18 species including human. Ten of the artifacts tested positive for blood residues, with three of the 10 artifacts each testing positive for blood residues from two types of animals. The species identified in the positive results include: bear, bovine (bison), camel, chicken (grouse, turkey, quail) deer (white tail deer, mule deer, elk) and rabbit. These results and the corresponding artifacts are shown in Table 12-1

and Figure 12-5. A foliate Cascade point with rejuvenation evidence at the distal portion (Artifact 9), and the distal fragment of a dart point (Artifact 33), both tested positive for camel blood residue. These positive results suggest that these two projectile points were used to hunt North American camels, which became extinct at the end of the Pleistocene. Archaeological sites at Fossil Lake (Minor and Spencer 1977) and Paisley Caves (Jenkins et al. 2012), Oregon, and in southwestern Canada (Kooyman et al. 2012), among other places in western North America, have produced evidence for the existence of this extinct species in association with human activity.

The artifacts collected during the 1975 Mack survey included five Western Stemmed points. Current research at sites containing Western Stemmed points indicates that they are contemporaneous with Clovis points and preceded the period of Clovis technology (Fagan 1988, 1996; Jenkins et al. 2012; O’Grady et al. 2012). The analyses of 41 artifacts from the 1975 Mack survey collection represent a time span from the terminal Pleistocene to the late Holocene, and provide a clear picture that Glass Buttes was a destination for the inhabitants of the region for millennia. These analyses show that a large portion of the artifacts can be traced to 19 distant obsidian sources (Figure 12-6). Two additional distant obsidian sources, Silver Lake/Sycan Marsh and Brooks Canyon, were identified by Jenkins and Connolly (2006) for artifacts they found at Glass Buttes.

Twenty five percent of the Mack survey artifacts had positive results from the blood residue analysis giving an indication of the variety of fauna that was being hunted in the area during this long period of use. In spite of all the available obsidian in the larger region, 13 sources within a 50 km radius (Figure 12-1), the range of chronological types (Figure 12-5 and Table 12-1) and number of artifacts from distant obsidian sources as well as the blood residue evidence, indicate that Glass Buttes was a preferred obsidian source with locally available game hunting opportunities.

Paleoindians Use of Glass Buttes

Paisley Caves

The Paisley Caves, located in the Summer Lake Basin of south-central Oregon, have been

established through rigorous scientific investigation as having the oldest human DNA in North America. These dates, obtained from human coprolites, range in age from approximately 1,242 cal B.P. to 14,600 cal B.P., with the oldest dates being 1,600 years older than Clovis. The Paisley Caves have also produced Western Stemmed projectile points dated as old, or older than, Clovis. The well stratified deposits in Paisley Caves have yielded a wealth of other archaeological materials including sinew and plant fiber threads, leather, basketry, cordage, rope, and wooden pegs, as well as butchered animal bones (including camel) (Jenkins 2008; Gilbert et al 2009; Jenkins et al. 2012). The Paisley Caves are approximately 95 km southwest of Glass Buttes and have yielded seven flakes of Glass Buttes obsidian, most of them from deeply stratified deposits. One flake of Glass Buttes 3 was found in Level 33, approximately two to three meters from a large mammal bone, possibly horse or camel, that dates to 14,404 cal. yrs B.P. Another flake of Glass Buttes 2, from Level 39, is three meters away from a specimen with a date of 13,772 cal. B.P. (Dennis Jenkins personal communication). These data indicate that Pre-Clovis peoples made their way from Glass Buttes to the Paisley Caves.

Clovis

At the time of Churchill's 1990 survey (Churchill 1991) the only fluted Clovis projectile point (Bradley et al. 2010) that had been found at Glass Buttes was during the Mack (1975) survey. Since that time, two additional Clovis artifacts have been found at Glass Buttes. In addition, obsidian Clovis artifacts from other sites have been sourced to Glass Buttes.

In 2002, XRF geochemical sourcing conducted on the 1975 Mack survey Clovis point identified Witham Creek as the obsidian source (Rondeau 2007a). The Witham Creek source is located approximately 120 km south, as the crow flies, from Glass Buttes, but a much farther trek for a Clovis-armed traveler (Figure 12-7).

Recently, two more obsidian Clovis artifacts have been found at Glass Buttes. The Sand Flat Clovis, a point fragment, was found to the east of Little Glass Butte, and was sourced to Sugar Hill in northern California, about 160 km to the south (Figure 12-8) (Rondeau 2007b). The second

artifact, a fluted Clovis preform, was found south of Glass Butte at Round Top Butte, and was correlated with Big Stick, about 32 km to the east (Scott Thomas personal communication; Rondeau 2007b).



Figure 12-7. Clovis point recovered during the 1975 Mack survey.



Figure 12-8. Sand Flat Clovis.

There are 39 Clovis artifacts made from Glass Buttes obsidian, now identified, from various sites. The Cottage Grove Clovis, found in the Willamette Valley near Cottage Grove, Oregon, was in the collection of the man that reported its find and who died in the 1920s (Minor 1985:35). This complete Clovis artifact has flute flakes covering its entire length on both faces and is made from Glass Buttes 3 obsidian (Ozbun et al. 1997; Connolly et al. 1994; Ozbun and Stueber 2001). This Clovis point was found approximately 240 km west of Glass Buttes (Figure 12-9).

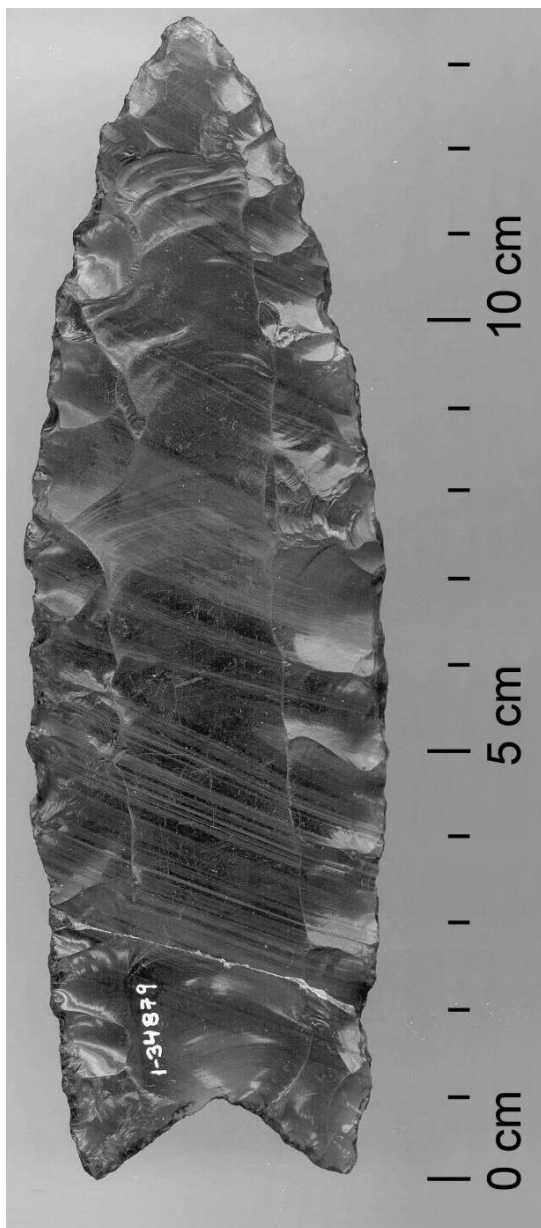


Figure 12-9. Cottage Grove Clovis.

The Ilse site Clovis, a base fragment which sources to Glass Buttes 1, was found at Rimrock Lake, northeast Harney County, about 24 km to the east of Glass Buttes (O’Grady and Thomas 2011). The Sheep Mountain site Clovis, a base fragment, sourced to Glass Buttes 1, was found 24 km east of Glass Buttes (O’Grady et al. 2009). An obsidian Clovis point and two associated Clovis artifacts sourced to Glass Buttes 4 were found at the Cal Schmidt site in Harney County (Spencer and Schmidt 1989).

The Dietz Clovis site, located in the northwestern portion of Alkali Basin, Lake County, Oregon, is the largest Clovis site in the Pacific Northwest, and has been studied and reported by a number of researchers (Fagan 1988, 1990, 1996; Pinson 2011; O’Grady, et al. 2012). Earlier obsidian sourcing assigned three of the Clovis artifacts, a point and two flute flakes, to Glass Buttes, and also indicated that 30 artifacts, 17 Clovis points and 13 fluted preforms and flute flakes, were from the Buck Mountain obsidian source in northern California (Fagan 1996). Recent re-evaluation of the putative Buck Mountain Clovis artifacts by O’Grady and the Northwest Research Obsidian Studies Laboratory (2012) has resulted in a reassignment of the source as Glass Buttes geochemical varieties 3 and 6. Thus, based on the recent XRF analysis, 33 of the Dietz Clovis artifacts are now sourced to Glass Buttes (O’Grady, et al. 2012). This abundance of evidence clearly establishes Glass Buttes as an important toolstone source for Clovis toolmakers.

Non-Paleoindian Glass Buttes Artifacts from Distant Archaeological Sites

Archaeological research in recent decades has provided evidence for the wide geographic distribution of obsidian from Glass Buttes. Glass Buttes obsidian has been found in sites from the northern California coast, throughout Oregon, southern Washington and as far north as southwest British Columbia, eastern Vancouver Island, and the Gulf Islands of British Columbia (Table 12-2 and Figure 12-10). Moore (2009) names Glass Buttes as one of the Great Basin toolstone sources and, because of its high quality material, uses it as a standard by which other obsidian sources are judged (Moore 2009). It is likely that other sites that have not had XRF characterization studies may

contain Glass Buttes obsidian artifacts (Ambrose et al. 2001). See Table 12-2 for a list of sites where Glass Buttes obsidian artifacts have been found.

Table 12-2. Sites and areas where Glass Buttes obsidian has been found with references and distance from the source.

LOCATION	REFERENCE	DISTANCE
Fort Rock Basin, OR	Skinner et al. 2004	136 km
Buffalo Flat, OR	Oetting 2004	136 km
Bone Cave, OR	Ferguson and Skinner 2005	130 km
Malheur Headwaters, OR	Cadena 2012	130 km
Ashland, & Southern Willamette Valley, OR	Ozbun and Stueber 2001	240 km
Celilo, OR	Ozbun et al. 1998	230 km
Wildcat Canyon, Lower Columbia River, OR	Carlson 1994	230 km
Meier Site, Portland Basin, OR	Sobel 2011	335 km
Broken Top Site, Portland Basin, OR	Ellis and Fagan 1993	300 km
Cathlapotle/Clahclehlah, Lower Columbia River, WA	Sobel 2001, 2011	335/280 km
Mt. Adams, WA	Hughes 1990	400 km
Judd Peak, WA	McClure 1989	400 km
Umpqua/Eden Site, OR	Skinner et al 1999	300 km
Gold Hill Site, OR	Hughes 1990	250 km
Gunther Island, CA	Hughes 1978	425 km
Vancouver Island and Lower Fraser River, BC	Carlson 1994; Arcas 1994	770 km
Departure Bay Site, BC	Carlson 1994; Arcas 1994	885 km
Park Farm Site, Pitt Meadows, BC	Carlson 1994; Wilson 2009	850 km

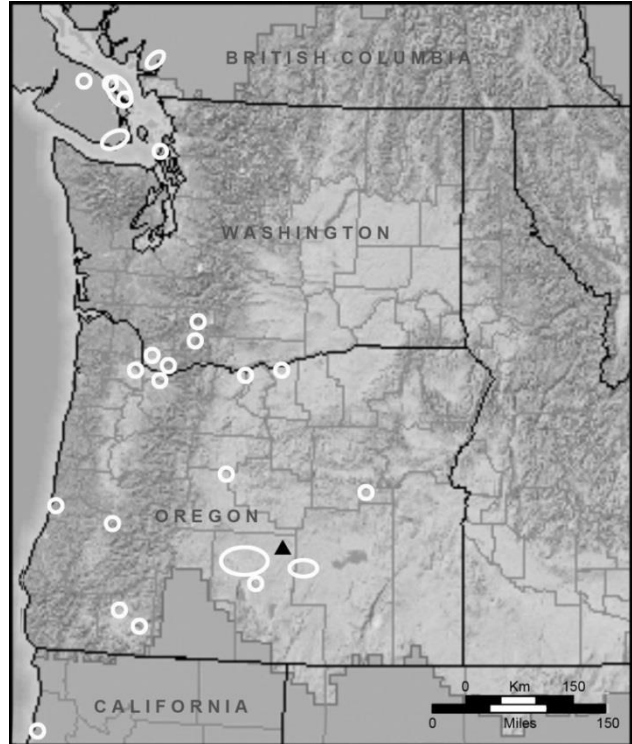


Figure 12-10. Distribution of Glass Buttes obsidian artifacts discussed in this chapter. Glass Buttes is marked with a triangle.

Historic and Modern Use

Theodore (Ted) Orcutt, or Mus-su-peta-na (Up River Boy), was a Karuk Indian born February 25, 1862 in northern California, near the Karuk Indian settlement of Weitchpec on the Klamath River. In 1876, at age 14, Ted began studying flintknapping with his Karuk uncle, Mus-sey-peu-ua-fich (Up River Coyote), who was a master flintknapper. As Ted’s skill grew he became well known as a maker of the famous wealth blades used in the White Deerskin Dance. Ted had already been flintknapping for 32 years when, in 1911, Ishi “the last Yahi” met Alfred Kroeber (Harwood 2001; Kroeber 1961).



Figure 12-11. Karuk flintknapper Ted Orcutt circa 1940.

From the 1920s through the 1940s Ted made many trips to Glass Buttes to gather large pieces of obsidian and rough out bifacial cores for wealth blades and to fill his many flintknapping orders. Forbes (1936) writes that sometime within the first three decades of the 20th century he accompanied Orcutt on quarrying forays at Glass Buttes, carrying obsidian out on packhorses. He describes watching Orcutt make large bifaces, some 76 cm (30 in) or more in length (Forbes 1936; Mack 1975; Skinner 1983; Harwood 2001) (Figure 12-12).

Glass Buttes continues to be an important locale for obtaining high quality obsidian for the production of stone tools, as it has been for more than 14,000 years. Don Crabtree, widely acknowledged as the father of American lithic technology studies, and author of numerous articles, made collecting trips to Glass Buttes along with renowned lithic technologists Gene Titmus and J. Jeffrey Flenniken (Woods 2010). Many of the scenes in the Crabtree film series, *The Tools of Early Man*, were filmed at Glass Buttes. The first author personally accompanied the great lithic technologist and writer, Errett Callahan, on obsidian collecting trips to Glass Buttes. Since 1985, the annual Glass Buttes Spring Break Knap-in has taken place in March, with as many as 100 flintknappers attending yearly, and collecting obsidian at specific locations.

Protection

Although modern flintknappers tend to focus their knapping and quarrying activities to specific locales, as requested by the BLM, the impact is apparent. There is no specific protection plan written for Glass Buttes other than the rock hounding use policy in place on all BLM lands in the Code of Federal Regulations (CFR) under 43 CFR 8365, "Rules of Conduct" on public lands. It states that you are allowed to collect "reasonable amounts" for "non-commercial" purposes, not to exceed 113 kg (250 pounds) of raw material (not partially or completely prepared specimens) per person, per year. Sadly, some people unreasonably exploit this resource and take many hundreds of pounds at a time.

Researchers have made consistent types of recommendations regarding the archaeology of Glass Buttes over the years. Mack recommended a systemic inventory of a number of sites and test

excavations at 41 sites at Glass Buttes for the high potential for providing chronological as well as resource use and site activity patterns (Mack 1975: 49-50). Churchill (1991: 78-110) recommended 14 sites as valuable cultural resources eligible for nomination to the National Register of Historic Places (Churchill 1991).

Lebow et al., in their 1990 Cultural Resource Overview for the BLM Prineville District, recommended that the Glass Buttes area be intensively surveyed and the sites be evaluated for inclusion in the National Register of Historic Places as a district (Lebow et al.: 187-188).

In spite of damage to ancient archaeological deposits from modern use, there is still tremendous archaeological potential at Glass Buttes as seen by the work of O'Grady's and Thomas's Clovis Quest Project in locating potential Clovis workshops (Scott Thomas, personal communication 2010, 2012). Other areas for future research include more extensive survey and sub-surface testing of sites in light of the 2006 work of Jenkins and Connolly, and the possibility of identifying additional lithic technological traditions and pre-Clovis activity. Advances in XRF technology make the re-evaluation of the geochemistry of artifacts at a number of sites important for the potential to gain new information, as was done at the Dietz Site (O'Grady et al. 2012). There is still much to learn about Glass Buttes.

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References Cited

- Ambroz, Jessica A.
1997 *Characterization Of Archaeologically Significant Obsidian Sources In Oregon By Neutron Activation Analysis*. Unpublished Masters Thesis, Department of Chemistry, University of Missouri, Columbia, Missouri.
- Ambroz, Jessica A., Michael D. Glascock, and Craig E. Skinner
2001 Chemical Differentiation of Obsidian Within the Glass Buttes Complex, Oregon. *Journal of Archaeological Science* 28:741-746.
- Antiquus Archaeological Consultants Ltd.
2001 *Archaeological Monitoring for Interfor's Port Hammond Cedar Dry Kiln Replacement Project at the Port Hammond Site (Dhrp 17), Lower Fraser River, B.C., 2000 – 2001*. Report prepared for Interfor, Maple Ridge, British Columbia.
- Arcas Consulting Archaeologists LID
1994 *Archaeological Investigations at the Departure Bay Site (DhRx 16), Nanaimo, B.C.* Report prepared for The City of Nanaimo, Nanaimo, British Columbia.
- Bradley, Bruce A., Michael B. Collins, Andrew Hemmings, Marilyn Shoberg, and Jon C. Lohse
2010 *Clovis Technology*. International Monographs in Prehistory, Archaeological Series 17, Ann Arbor, Michigan.
- Cadena, Guadalupe P.
2012 *Hunter-Gatherers, Mobility, and Obsidian Procurement: A View From The Malheur Headwaters, Northeast Oregon*. Unpublished Master's thesis. University of Texas at San Antonio College of Liberal and Fine Arts Department of Anthropology, San Antonio, Texas.
- Carlson, Roy L.
1994 Trade and exchange in prehistoric British Columbia. In *Prehistoric Exchange Systems in North America*, edited by T. G. Baugh & J. E. Ericson, pp. 307-361. Plenum Press, New York.
- Churchill, Thomas E.
1991 *A Class III Cultural Resource Survey of BLM Lands Near Glass Buttes, South-Central Oregon*. Bureau of Land Management Report No. 90-05-41 Volumes 1 and 2. Lake County, Oregon.
- Churchill, Thomas E. and Paul C. Jenkins
1989 *A cultural Resource Survey of Proposed Livestock Developments on the GI Ranch*. Coastal Magnetic Search & Survey Report No. 44. Submitted to the BLM Prineville District Office, Prineville, Oregon.
- Connolly, Thomas J.
1994 Paleo Point Occurrences in the Willamette Valley, Oregon. In *Contributions to the Archaeology of Oregon, 1990-1994*, edited by Paul W. Baxter, pp. 81-88. Association of Oregon Archaeologists Occasional Papers No. 5. Eugene, Oregon.
- Crowley-Thomas, Suzanne
1983a *Glass Buttes Communication Site ROW Cultural Resource Survey Report*. BLM Prineville District Report No. 83-05-12. Prineville, Oregon.
1983b4 *Wildlife Guzzlers Cultural Resource Survey Report*. BLM Prineville District Report No. 83-05-21. Prineville, Oregon.
- Enneberg, Marci
1987 *Musser Reservoir Fence Cultural Resource Survey Report*. BLM Prineville District Report No. 87-05-18. Prineville, Oregon.
- Ellis, David, and John L. Fagan
1993 *Data Recovery Excavations at Broken Tops Site (35MU57) Portland, Oregon*. Report Submitted to Scientific Resources, Inc. Lake Oswego, Oregon. Archaeological Investigations Northwest, Report No. 31.

- Fagan, John L.
- 1988 *Clovis and Western Pluvial Lakes Tradition Lithic Technology at the Dietz Site in South-central Oregon*. In *Early Human Occupation in Far Western North America: The Clovis-Archaic Interface*, edited by Judith A. Willig, C. Melvin Aikins, and John L. Fagan, pp. 389-416. Nevada State Museum, Anthropological Papers No. 21, Carson City, Nevada.
- 1990 Temporal and Technological Variability in the Use of Obsidian at the Dietz Site. Paper presented at the 43rd Annual Northwest Anthropological Conference March 1990, Eugene, Oregon.
- 1996 Obsidian Hydration Analysis of Clovis and Western Pluvial Lakes Tradition Artifacts from the Dietz Site. Paper presented at the Twenty-Fifth Great Basin Anthropological Conference, October, 1996, Kings Beach/Lake Tahoe, California.
- 2011 *Results of Blood Residue Analysis on 41 Obsidian Artifacts from Glass Buttes, Harney and Lake Counties, Oregon*. Archaeological Investigations Northwest, Inc. Report No. 2729. Portland, Oregon.
- Ferguson, Jeffrey R. and Craig E. Skinner
- 2005 Bone Cave: A Severely Disturbed Cave Site in Central Oregon. *North American Archaeologist* 26(2):221-244.
- Flenniken J. Jeffery and Anan Raymond
- 1986 Morphological Projectile Point Typology: Replication Experimentation and Technological Analysis. *American Antiquity* 51(3): 603-614.
- Flenniken, J. Jeffery
- 1981 *Replicative Systems Analysis: A Model Applied to the Vein Quartz Artifacts from the Hoko River Site*. Washington State University Laboratory of Anthropology Reports of Investigations No. 59. Pullman, Washington.
- Forbes, P. L.
- 1936 *True Experiences of "Poor Si" in Eastern Oregon*. Bedrock Press, Los Angeles, California.
- Gilbert, M. Thomas P., D. Jenkins, A. Götherstrom, N. Naveran, J. Sanchez, M. Hofreiter, P. Thomsen, J. Binladen, T. Higham, R. Yohe II, R. Parr, L. Cummings, and E. Willerslev
- 2008 DNA from Pre-Clovis Human Coprolites in Oregon, North America. *Science*, 320: 1-4.
- Great Basin Center for Geothermal Energy
- 2012 Great Basin Center for Geothermal Energy. University of Nevada Reno. Electronic document <http://www.unr.edu/geothermal/explactivity.htm>, 2012.
- Griffin, Dennis and Debi L. Soper
- 1984 *Rattlesnake Pasture Prescribed Burn Cultural Resource Survey Report*. BLM Prineville District Report No. 84-05-23. Prineville, Oregon.
- Harwood, Ray
- 2001 The Search for Ted Orcutt: Eugene's Journey. *Indian Artifact Magazine* 20-1: pp. 6-7, 72-74.
- Hughes, Richard E.
- 1978 Aspects of Prehistoric Wiyot Exchange and Social Ranking. *The Journal of California Anthropology* 5(1): pp. 53-56. Davis, California.
- 1983 X-ray Fluorescence Characterization of Obsidian. In *The Archaeology of Monitor Valley: 2. Gatecliff Shelter*, edited by David Hurst Thomas, pp. 401-408. Anthropological Papers of the American Museum of Natural History Vol. 59, Part 1. New York, New York.
- 1990a *X-Ray Fluorescence Laboratory Report*. Prepared for Cheryl A. Mack, Zone Archaeologist, Mt. Adams Ranger District, Troutdale, Washington.
- 1990b The Gold Hill Site: Evidence for a Prehistoric Socioceremonial System in Southwestern Oregon. In *Living with the Land: The Indians of Southwest Oregon*, edited by N. Hannon & R. K. Olmo, pp. 48-55. Southern Oregon Historical Society, Medford, Oregon.
- Johnson, Keith E. and Eugene V. Ciancanelli
- 1984 Geothermal Exploration at Glass Buttes, Oregon. *Oregon Geology* 46:15-19.
- Jenkins, Dennis L.
- 2005 *Archaeological Pedestrian Survey of the Hampton-Glass Buttes Section (MP62 to 75), U.S. Highway 20, Deschutes and Lake*

- Counties, the Torkelson/Erickson Road Intersection (MP4.57), U.S. Highway 20, Deschutes County, and GI Ranch (Lake County) and Riley (Harney County) Quarries.* State Museum of Anthropology Museum Report 2005-243. Eugene, Oregon.
- 2008 Distribution and Dating of Cultural and Paleontological Remains at the Paisley Five Mile Point Caves in the Northern Great Basin; An Early Assessment. In, *Paleoindian or Paleoarchaic?: Great Basin Human Ecology at the Pleistocene-Holocene Transition*, edited by Kelly E. Graf and Dave N. Schmitt, pp. 57-81. University of Utah Press, Salt Lake City, Utah.
- Jenkins, Dennis L., Thomas J. Connolly, and C. Melvin Aikens
- 2004 *Early and Middle Holocene Archaeology of the Northern Great Basin.* University of Oregon Anthropological Papers 62. Museum of Natural History and Department of Anthropology, University of Oregon, Eugene, Oregon.
- Jenkins, Dennis L. and Thomas J. Connolly
- 2006 *Archaeological Testing and Evaluation of Five Sites and an Isolate Cluster at Glass Buttes, Central Oregon Highway (U.S. 20), Lake County, Oregon.* A Report to the Geo-Environmental Services Unit Oregon Department of Transportation. Museum of Natural and Cultural History, University of Oregon, Museum Report 2009-005, Eugene, Oregon.
- Jenkins, Dennis L., L. Davis, T. Stafford Jr., P. Campos, B. Hockett, G. Jones, L. Cummings, C. Yost, T. Conneley, R. Yohe II, S. Gibbons, M. Raghaven, M. Rasmussen, J. Pajmans, M. Hofreiter, B. Kemp, J. Barta, C. Monroe, M. Gilbert, and E. Willerslev
- 2012 Clovis Age Western Stemmed Projectile Points and Human Coprolites at the Paisley Caves. *Science* 337: pp. 223-228.
- Kooyman, Brian, L.V. Hills, Shayne Tolman, and Paul McNeil
- 2012 Late Pleistocene Western Camel (Camelops Hesternus) Hunting in Southwest Canada. *American Antiquity* 71(1);115-124.
- Kroeber, Theodora
- 1961 *Ishi In Two Worlds: A Biography of the Last Wild Indian in North America.* University of California Press, Berkeley and Los Angeles, California.
- Lebow, Clayton G., Richard M. Pettigrew, Jon M, Silvermoon, David H. Chance, Robert Boyd, Yvonne Hajda, and Henry Zenk
- 1990 *A Cultural Resource Overview for the 1990's, BLM Prineville District, Oregon.* Cultural Resource Series No. 5, US Department of the Interior, Portland, Oregon.
- Loy, William G., Allan Stuart, Aileen R. Buckley, and James E. Meachum
- 2001 *Atlas of Oregon.* University of Oregon Press, Eugene, Oregon.
- Mack, Joanne M.
- 1975 *Cultural Resources Inventory Of The Potential Glass Buttes Geothermal Lease Area, Lake, Harney And Deschutes County, Oregon.* Department of Anthropology, University of Oregon.
- McClure, R. H.
- 1989 Alpine Obsidian Procurement in the Southern Washington Cascades: Preliminary Research. *Archaeology in Washington* 1:59-70.
- Minor, Rick
- 1985 Paleo-Indians in Western Oregon: A Description of Two Fluted Projectile Points. *Northwest Anthropological Research Notes* 19(1):33-40.
- Minor, Rick and Lee Spencer
- 1977 *Site of a Probable Camelid Kill at Fossil Lake, Oregon: An Archaeological Evaluation.* Report of the Department of Anthropology, University of Oregon, Eugene, to the Bureau of Land Management, Lakeview District. Lakeview, Oregon.
- Moore, Joe
- 2009 *Great Basin Tool-Stone Sources.* The NDOT Obsidian and Tool-Stone Sourcing Project: 2002 Progress Report. Nevada Department of Transportation, Carson City, Nevada.
- Newman, Margaret E.
- 1990 *The Hidden Evidence from Hidden Cave, Nevada: An Application of Immunological Techniques to the Analysis of Archaeological Materials.* Ph.D. Dissertation, Department of Anthropology, University of Toronto, Ontario, Canada.

- Northwest Research Obsidian Studies Laboratory
2012 *Northwest Research Obsidian Studies Laboratory*. Electronic document, <http://www.obsidianlab.com/>, 2012.
- Oetting, Albert C.
2004 Obsidian Use on Buffalo Flat, Christmas Lake Valley, Oregon. In *Early and Middle Holocene Archaeology of the Northern Great Basin*, edited by Dennis L. Jenkins, Thomas J. Connolly, and C. Melvin Aikens, pp. 233-240. University of Oregon Anthropological Papers 62. Museum of Natural History and Department of Anthropology, University of Oregon, Eugene, Oregon.
- O'Grady, Patrick and Scott P. Thomas
2011 Clovis in Oregon: Recent Archaeological Investigations in the Northern Great Basin. Paper presented at the Society for American Archaeology Conference, Sacramento, California.
- O'Grady, Patrick, Scott P. Thomas, and Michael F. Rondeau
2009 Recent Fluted-Point Finds in Eastern Oregon. *Current Research in the Pleistocene* 25: pp. 100-102.
- O'Grady, Patrick, Scott P. Thomas, Craig E. Skinner, Jennifer J Thatcher, Michael F. Rondeau, and John L. Fagan
2012 The Dietz Site: Revisiting the Geochemical Sourcing and Hydration Measurement Properties for the Fluted and Stemmed Artifacts from 35LK1529, Lake County, Oregon. Paper presented at the 33rd Great Basin Anthropological Conference, October 2012, State Line, Nevada.
- Orr, Elizabeth L., William N. Orr, and Ewart M. Baldwin
1992 *Geology of Oregon*. Kendal/Hunt Publishing Company, Dubuque, Iowa.
- Oregon Department of Environmental Quality
2012 *Environmental Cleanup Site Information (ECSI) Database Site Summary Report – Details for Site ID 2576, Glass Buttes Mine*. Electronic document, <http://www.deq.state.or.us/lq/ECSI/ecsidetail.asp?seqnbr=2576>, 2012.
- Ozburn, Terry and Dan Stueber
2001 Obsidian Clovis Points in Western Oregon. In *Current Archaeological Happenings in Oregon*. Association of Oregon Archaeologists, Vol. 26, No. 2 Summer 2001: 21-28, Eugene, Oregon.
- Ozburn, Terry, Eric Forgeng, and Dan Stueber
1997 The Circumstantial Evidence for Clovis Occupation of Western Oregon. Paper presented at the fall meeting of the Association of Oregon Archaeologists, Jacksonville, Oregon.
- Ozburn, Terry L., Judith S. Chapman, Eric E. Forgeng, Maureen N. Zehendner, and John L. Fagan
1998 *Archaeological Test Excavations at the Celilo Treaty Fishing Access Site*. Archaeological Investigations NW, Inc., Report 138. Prepared for the U.S. Army Corps of Engineers, Portland, Oregon
- Pinson, Ariana O.
2011 The Clovis Occupation of the Dietz Site (35LK1592), Lake County, Oregon, and it's Bearings on the Adaptive Diversity of Clovis Foragers. *American Antiquity* 76(2): 285-315.
- Rondeau, Michael F.
2007a Results From The Study of Three Fluted Projectile Points From Lake County, Oregon. CalFLUTED Research Report No. 38, Manuscript on file, Rondeau Archaeological, Sacramento California.
2007b Fluted Points And Bifaces From The Burns District, Bureau Of Land Management, Oregon. CalFLUTED Research Report No. 43, Manuscript on file, Rondeau Archaeological, Sacramento California.
- Sharp, Nancy D., Terri P. Fulton, Philip A. Fulton, and Kenneth E. Juell
1997 *Cultural Resources Inventory of the Proposed FTV Western Build Part 1: Oregon Volume 1*. Northwest Archaeological Associates, Inc. Seattle, Washington, Touch America, Inc., and David Evans & Associates, Inc., Seattle, Washington.
- Skinner, Craig E.
1983 *Obsidian Studies in Oregon; An Introduction To Obsidian and An Investigation of Selected Methods Of Obsidian Characterization Utilizing Obsidian Collected At Prehistoric Quarry Sites In Oregon*. Volumes I & II. Unpublished Master's thesis, Department of

- Anthropology, University of Oregon,
Eugene, Oregon.
- Skinner, Craig E., Ann C. Bennett-Rogers, and
Jennifer J. Thatcher
1999 Obsidian Studies of Two Possible Wealth
Blade Fragments from the Umpqua/Eden
Site (35-DO-83), Central Oregon Coast:
Results of X-Ray Fluorescence and Obsidian
Hydration Analysis. *Current Archaeological
Happenings in Oregon* 24(2):17-23.
- Skinner, Craig E., and Jennifer J. Thatcher
2003 *X-Ray Fluorescence Analysis and
Obsidian Hydration Rim Measurement of
Artifact Obsidian from 34 Archaeological
Sites Associated with the Proposed FTV
Western Fiber Build Project, Deschutes,
Lake, Harney, and Malheur Counties,
Oregon*. Report 1998-56 prepared for
Northwest Archaeological Associates,
Seattle, Washington, by Northwest Research
Obsidian Studies Laboratory, Corvallis,
Oregon.
- Skinner, Craig E., Jennifer J. Thatcher, Dennis L.
Jenkins, and Albert C. Oetting
2004 X-Rays, Artifacts, and Procurement
Ranges: A Mid-Project Snapshot of
Prehistoric Obsidian Procurement Patterns in
the Fort Rock Basin of Oregon. In *Early and
Middle Holocene Archaeology of the
Northern Great Basin*, edited by Dennis L.
Jenkins, Thomas J. Connolly, and C. Melvin
Aikens, pp. 221-232. University of Oregon
Anthropological Papers 62. Museum of
Natural History and Department of
Anthropology, University of Oregon,
Eugene, Oregon.
- Sobel, Elizabeth
2001 Obsidian Use at Cathlapotle and
Clahlelah: Implications for Understanding,
Exchange and Mobility on the Lower
Columbia. *Current Archaeological
Happenings in Oregon* 26(4): pp. 3-12.
- 2012 An Archaeological Test of the "Exchange
Expansion Model" of Contact Era Change on
the Northwest Coast. *Journal of
Anthropological Archaeology*, 31; 1-21
- Soper, Debi L. and Dennis Griffin
1984 *Highway Pasture Prescribed Burn
Cultural Resource Survey Report*. BLM
Prineville District Report No. 84-05-24.
Prineville, Oregon.
- Spencer, Lee, and Calvin Schmidt
1989 *The Cal Schmidt Clovis Site*. Lee Spencer
Archaeology Paper No. 1989-5. Prepared for
the Bureau of Land Management, Lakeview
District, Oregon.
- Stueber, Daniel
2010 The Use of Indirect Percussion with
Stone Punches for Manufacturing
Rectangular Cross Section Type 1 Adzes
during the Moa-Hunter Period of the Maori
Culture in New Zealand. In *Experiments and
Interpretation of Traditional Technologies:
Essays in Honor of Errett Callahan*, edited
by Hugo Nami, pp. 325-343. Ediciones de
Arqueologia Contemporanea, Buenos Aires.
- Titmus, Gene I. James C. Wood
1986 An Experimental Study of Projectile
Point Fracture Patterns. *Journal of California
and Great Basin Anthropology* 8(1):37-49.
- Williams, Shirley B.
1990 *Immunology and Archaeology: Blood
Residue Analysis of Three Sites*. Unpublished
Masters Thesis, Department of
Anthropology, Portland State University,
Portland, Oregon.
- Wilson, I.R.
2009 *Archaeological Excavation Park Farm
Site (DhRq22)*. Report Title: 2007- 0126: by
I.R. Wilson Consulting Ltd. for Proposed
Shopping Centre, Pitt Meadows, British
Columbia.
- Woods, James C.
2010 *Gene L. Titmus, A Legendary Figure in
Idaho Archaeology*. Artifacts. Idaho
Archaeological Society, Inc., Vol. 27, No. 2.
Boise, Idaho.