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Geochemical and Hydration Investigations of Source and Artifact Obsidian from Selected Sites in the Double H Mountains, Humboldt County, Nevada

BLM Report Number CR2-1443

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February 2008

Prepared for:
Oregon-Idaho Utilities Co.
1023 N. Horton St.
Nampa, Idaho 83651

Submitted to:
Winnemucca Field Office
Bureau of Land Management
5100 W. Winnemucca Blvd.
Winnemucca, Nevada 89445

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INTRODUCTION

For many years, the Double H Mountains of northwestern Nevada have been known as a source of high-quality natural glass that was available to the prehistoric inhabitants of the region (Figure 1). At the same time, however, little was known about the geochemical composition and overall geographic distribution of the obsidian associated with this geochemical source. In addition, few archaeological obsidian provenance studies have been carried out in the immediate region around the Double H Mountains and details about the prehistoric procurement and use of the obsidian from the source were virtually nonexistent. In the investigation that is reported in this volume, we attempt to address some of these shortcomings.

Data recovery investigations completed as part of the cultural resources program for Phase IV of Humboldt Telephone's rural communications system allowed for a relatively detailed program of obsidian sampling and general source characterization at the Double H obsidian source in northern Humboldt County, Nevada. Although construction activities were confined to narrow rights-of-way along improved roadways (paved and unpaved) throughout the northern county region, the project corridor circumscribes a broad area around the Double H Mountains, the location of a prominent obsidian source.

We begin with a brief background introducing the Double H source area along with field and analytical methods. We then present the geologic structure of the Double H and Montana Mountains based on previous studies. The documented source areas are presented along with source maps and the results of the trace element analysis of geologic specimens of glass from the source area. Although we are focused on the primary and secondary sources in and around Thacker Pass at the north end of the range; these are related to the broader geographic distribution of the geochemical group. We conclude by looking into the local archaeological patterning of source use. Discrete archaeological components from seven prehistoric sites along Thacker Pass and adjacent to the Quinn River were sampled and provide a glimpse at the economy of local source use over time.

Obsidian artifacts made from toolstone procured from the Double H source areas have been documented throughout northern and central Nevada (Amick 1997; Moore 1990; Walsh et al. 1996). To date, however, the source area has not been well-studied, and a limited number of source samples provide the basis for the source's geochemical signature. The internal variability of the source has not been documented, and the characterization of the various geomorphic contexts of the sources (e.g., primary outcrops or secondary fans), remains incomplete. Moore (1990, 1997) documented several sites and historic-era or modern quarries in the area of Thacker Pass as point sources for Double H obsidian. He went on to define a broad area encompassing the mountain range as the Double H Mountains Obsidian Procurement Area.

This data recovery program, focusing on the obsidian characterization of specimens collected at Double H source areas, has three goals: 1) to collect a broad sample of source material from known geographic points in order to strengthen the documentation of the geochemical variability of the source; 2) to document the primary and secondary distribution of sources available to prehistoric inhabitants of the region; and 3) to gain some insight into the utility of Double H material as a tool for use in obsidian hydration and regional chronometric investigations.

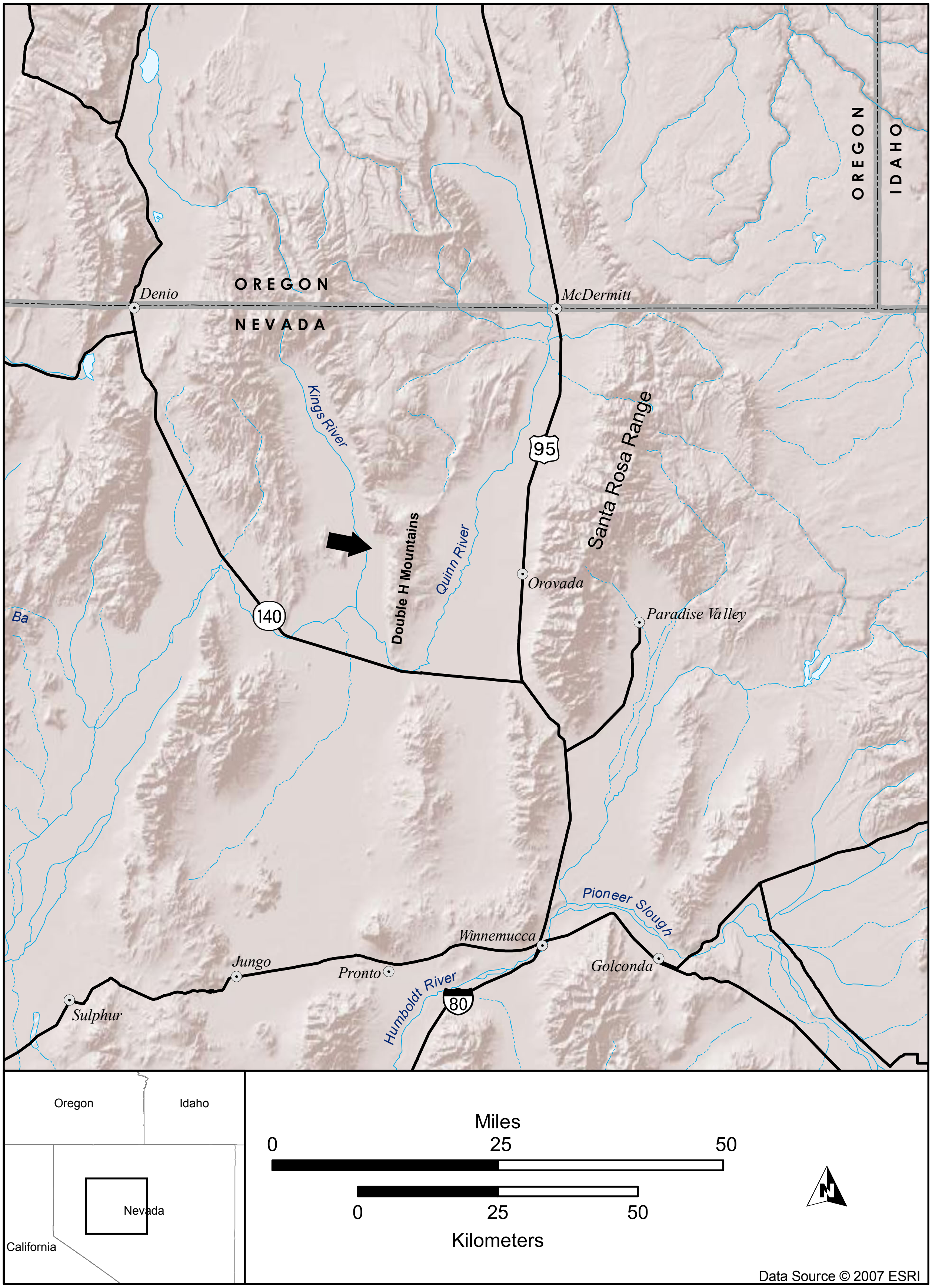

Figure 1. Project Location.

GEOLOGIC SETTING OF THE DOUBLE H SOURCE AREA

The Double H Mountains, a north-south trending range, are actually a southern extension, along with the Montaña Mountains, of the Trout Creek Mountains located along the Nevada-Oregon border at the northern perimeter of the Basin and Range geologic province. The boundary of the province and its transition to the Plateau province to the north is marked by the Orovada rift (Rytuba and McKee 1984), a northwest-trending fault zone. Miocene-age calderas are emplaced along this rift, as well as along the Black Rock structural boundary to the west. Although fifteen calderas have been identified along the boundaries, the McDermitt Complex (15 - 16.1 million years old) which includes portions of the Trout Creek, Montaña, and Double H mountains is the largest (Figure 2).

The McDermitt Caldera Complex has also been identified as the oldest and westernmost of a series of progressively younger silicic calderas extending eastwards towards the Yellowstone caldera. Over the past 16-17 million years, the North American plate has moved southwest over the Yellowstone mantle plume and the Snake River Plain has been left as its track (Fleck et al. 1998, et al. 1994; Pierce and Morgan 1992).

The Caldera Complex straddles the border between northern Humboldt County, Nevada, and southern Malheur County, Oregon. The caldera complex is thought to consist of several nested calderas (Rytuba and Glanzman 1978) that developed over a period of several million years during the mid-Miocene time; the nested calderas are evident in the rocks of the region's mountain ranges (Rytuba et al. 1979). Geologic investigations of the caldera area began with work by Yates (1942), and the area retains scientific interest due to the potential for gaining insight into caldera complexes and the geologic history of the western United States. Obsidian, or similar glass-rich deposits, has often played a role in geochemical analyses and identification of caldera formations. In the McDermitt caldera, obsidian occurs within various ash sheet-flows and tuffs as nodules, pods, lenses, and as part of vitrophyre (a crystal-bearing obsidian, or any porphyritic igneous rock having a glassy groundmass [Bates and Jackson 1987]) and vitric-rich (glassy) units. The works of Greene (1976), Hargrove (1982), and Rytuba (1976) provide useful starting points for context and location of obsidian-bearing units within this caldera complex.

PREVIOUS GEOLOGIC INVESTIGATIONS IN THE MCDERMITT COMPLEX

Hargrove (1982), re-examining the work of Rytuba and Glanzman (1978), identified five nested and overlapping calderas from five regional eruptions of ash-flow tuff. Based on detailed sampling during his stratigraphic traverse of the range, the first three eruptive events and associated cooling units are exposed in the Double H Mountains. As mapped by Rytuba (1976), the range consists mainly of these three units (Figure 2). Vitrophyres up to fifty feet thick mark the base of the two early units (Rytuba 1976). Greene (1976) mapped the rhyolite of Jordan Meadow as continuous across Thacker Pass, extending from the Montaña Mountains southward into the Double H range. Some of these units have glassy tops and at various stratigraphic levels obsidian nodules and vitrophyre blocks are eroding onto the hillsides (Greene 1976:40).

Hargrove (1982) sampled the vitrophyres and conducted a detailed stratigraphic traverse of the range. The two youngest units of the five identified by Hargrove (1982) are exposed in the Trout Creek mountains. Greene (1976), within the White Horse Creek section, sampled a basal tuff that contains lenses of dense glass. This unit underlies a rhyolite with a vitric basal contact that is six feet thick. In the Montaña Mountains, Hargrove (1982) investigated a geologic sequence that includes several units of vitrophyre. One of these, the Crystal Vitrophyre, is a mappable unit exposed on the south side of the Montaña Mountains near Thacker Pass. This unit is rich in a dense, black, obsidian-like glass. There are also several units of vitrophyre, though they are typically of limited extent and occur in several stratigraphic horizons. Most of these units, however, are described as lithic-rich, that is, the amount of glass is limited. The less lithic-rich (i.e., more glassy) vitrophyres of this unit are black or dark to olive green and are extremely susceptible to weathering. In addition, minor pods and lenses of vitrophyre are scattered throughout the complex in areas such as Pole Creek, Rock Creek, and Reiser Creek. These vitrophyres are often located at the basal portions of the ash-flow sheets of the volcanic sequence. These areas have the potential for localized obsidian deposits.

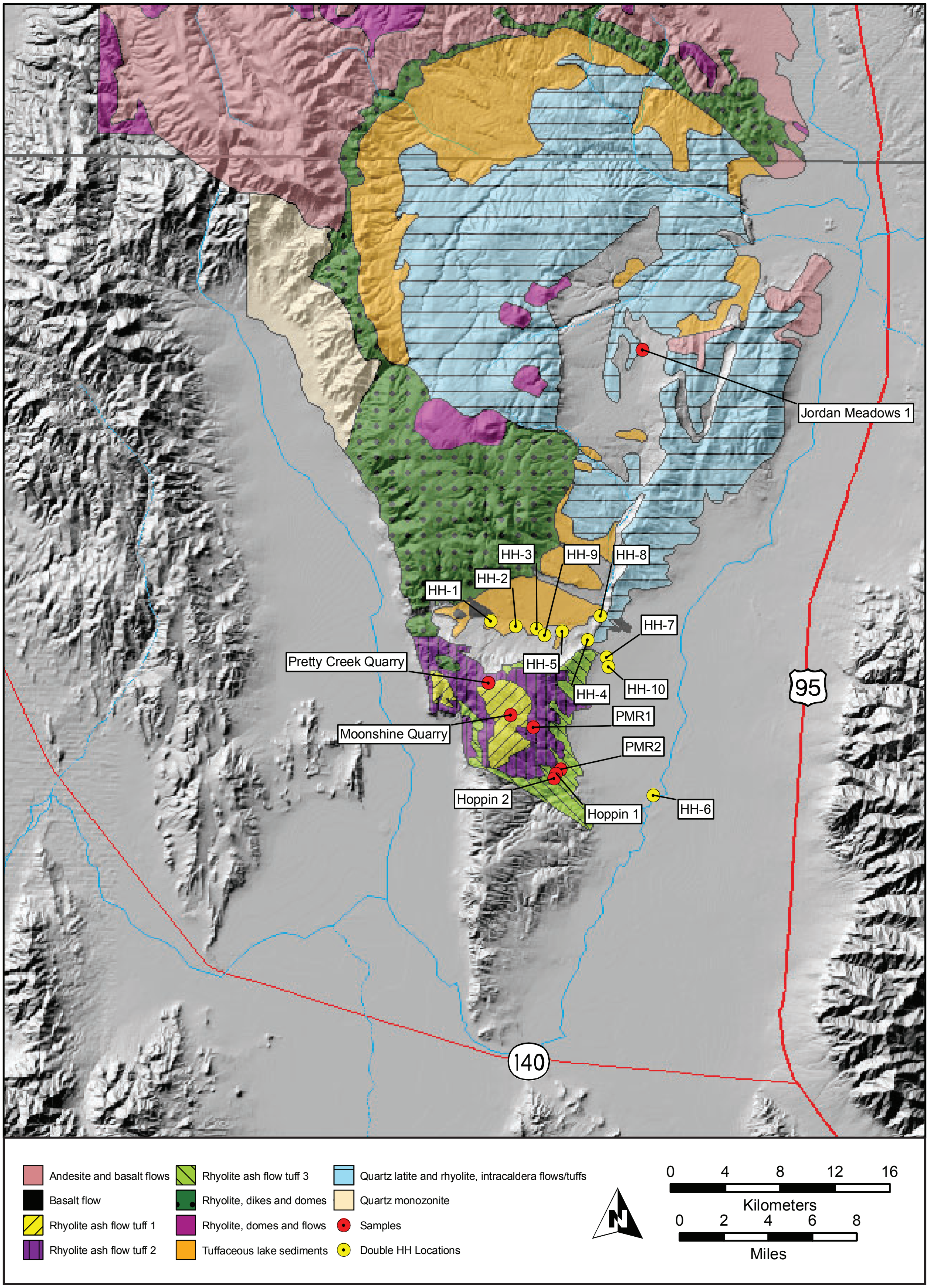

Figure 2. Obsidian Source and Sample Localities and Geologic Map.

Within the McDermitt Caldera, Greene (1976) mapped several intra-caldera lavas and specifically mentions obsidian localities within the vitrophyre units. These include the Hoppin Peaks rhyolite, the McDermitt Creek rhyolite, and Black Mountain quartz latite. The Hoppin Peaks rhyolite has mappable units of vitrophyre, including the main unit high on the plateau forming the lower portions of the Hoppin Peaks and Salient Peak. A yet higher vitrophyre is present on the southernmost Hoppin Peak. At this location fragments of vitrophyre blanket the outcrop area. The McDermitt Creek rhyolite has a basal section that contains some vitrophyre.

Greene (1976) also identified several "special localities" in his examination of the volcanic rocks of the McDermitt Caldera. Three of these specifically address the location of obsidian or vitrophyre. One of these is near the Cordero mine. At this location a basal zone of the Jordan Meadows rhyolite crops out with a few lenses of black glass. On nearby Reiser Creek, also mentioned by Hargrove (1982), a greenish black vitrophyre crops out. The third location is on a ridge between Long Canyon and Jordan Meadow Flat. Here, at the base of a cooling unit, are lenses of glass with nodules of obsidian concentrated on the ground surface. Greene (1976:37) proposed that similar concentrations of obsidian nodules in the local vicinity are from this basal zone. The Black Mountain quartz latite also has a vitric basal portion with denser vitrophyre interlayered throughout the unit.

Further research into the geology, geochemistry, and mineral resources of rocks and caldera structures associated with the McDermitt Caldera Complex may be found in Castor and Henry (2000), Conrad (1984), Hargrove and Sheridan (1984), Noble and Parker (1974), Noble et al. (1988), Rytuba (1994), Rytuba and Conrad (1981), Wallace and Roper (1981), and Wallace et al. (1980). The results of the geochemical analysis of source obsidian from the Double H Mountains has been previously reported by Moore (1997) and Noble and Parker (1974).