PERMIAN QUARTERLY

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Archeologist Ana Steffen holds a map illustrating the complex geology of the Valles Caldera, which located west of Los Alamos, New Mexico in the Jemez Mountains. Obsidian from this locality is found at archeological sites in southeastern New Mexico. Find out more about the use of obsidian inside this issue of the newsletter.

The *Permian Quarterly* is a newsletter for participants in the Permian Basin Programmatic Agreement (PA) and for other interested persons. Its purpose is to provide information in a timely manner about implementation of the PA and to disseminate that information to a wide audience.

Introduction to the Permian Basin Programmatic Agreement

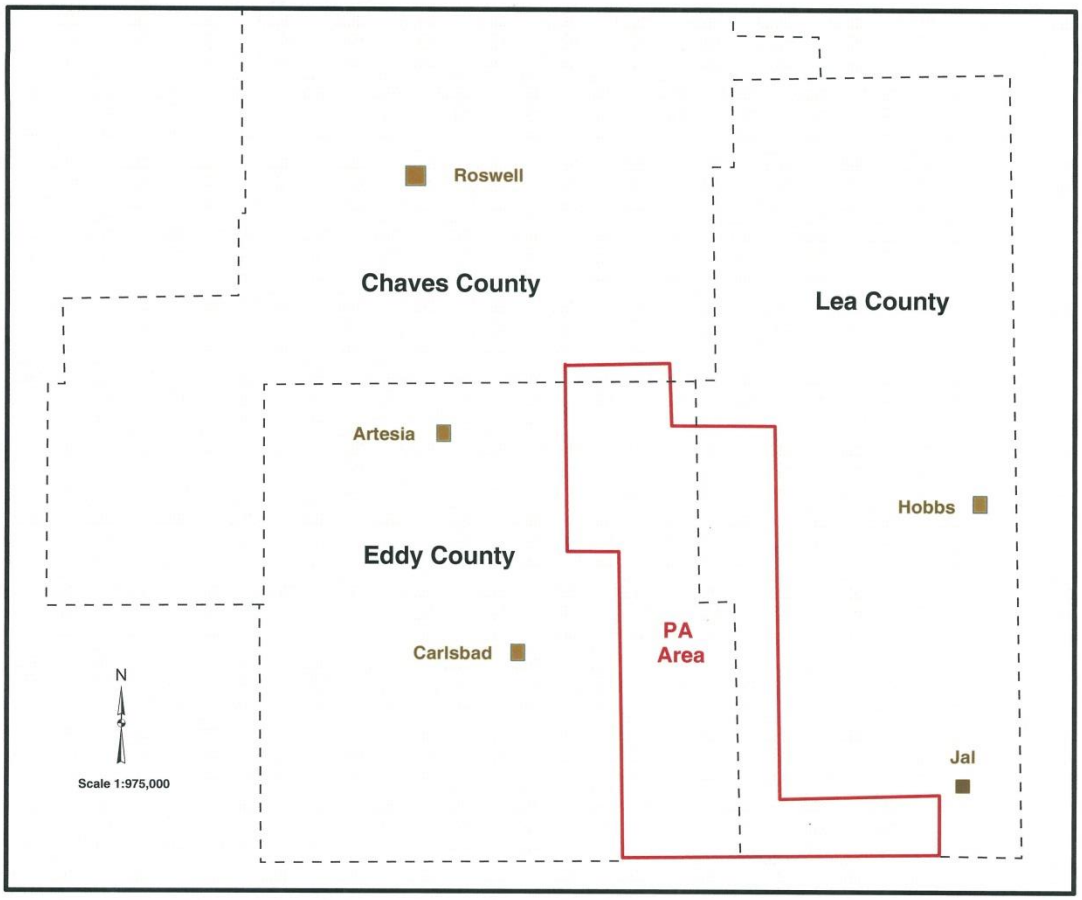

Figure 1. Map showing the Permian Basin PA Area.

The PA is an alternate form of compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, that is offered to the oil and gas industry, potash mining companies, and local governments in southeastern New Mexico for federal projects located on Bureau of Land Management (BLM) land or private property. Formerly called the Permian Basin MOA, it was extended for a period of three years in April 2013 as a Programmatic Agreement. The PA area, noted above in red, is located partially in Chaves, Eddy, and Lea counties and generally coincides with a physiographic region in southeastern New Mexico called the Mescalero Plain. Proponents of projects within the PA area may contribute to a dedicated archeological research fund in lieu of contracting for project specific archeological surveys, provided their proposed projects avoid recorded archeological sites. This dedicated fund is then used to study the archeology and history of southeastern New Mexico.

Current PA News

Research Update

Currently six Permian Basin PA projects are underway and are expected to be completed in 2015. Two of these, a National Register of Historic Places context statement for the oil and gas industry and a Lidar aerial inventory of rock ring middens northwest of Carlsbad, are held over from previous contracts under the Permian Basin Memorandum of Agreement (MOA). Additional details about the aerial survey can be found in the Volume 2, Number 2 issue of the *Permian Quarterly* newsletter.

Four are in progress as Permian Basin PA contracts including an evaluation of 145 sites, that contain over 500 radiocarbon dated features, for their potential to answer questions posed in the "Southeastern Regional Research Design and Cultural Resource Management Strategy," by Patrick Hogan. The regional research design serves as a guide, as it organizes and defines current research questions. Also being evaluated is a study of the surface and subsurface indications of four prehistoric archeological sites as potential yardsticks to measure the effectiveness of different testing and excavation techniques. These sites are representative of many located in the sandy soils of the Mescalero Plain and the results of this study are expected to improve the quality of the recording and evaluation of sites in this region. Two other projects are intended to increase our knowledge: one is a plant identification and utilization booklet that examines the use of plants through time by people living in southeastern New Mexico. The other is for the remediation and analysis of the Merchant Site in Lea County. More information about these projects may be found in the November 2014 issue of the *Permian Quarterly*.

Back issues of the *Permian Quarterly* are available at the Bureau of Land Management, New Mexico State Office website at http://www.blm.gov/nm/st/en.html. Use the "Quick Links" section then go to Cultural Resources - Research/Partnerships - Permian Basin Partnership.

Other Archeology News from the Permian Basin

Bureau of Land Management and State Historic Preservation Officer Sign Protocol

A new protocol, effective December 17, 2014, outlines the procedures which will be followed by the New Mexico State Office of the Bureau of Land Management (BLM) and the New Mexico State Historic Preservation Officer (SHPO) to meet their responsibilities under different sections of the National Historic Preservation Act. The protocol in part follows the lead of a national Programmatic Agreement signed in 2012 by the National Conference of SHPOs and the Advisory Council on Historic Preservation, but it is tailored to New Mexico circumstances. A major intent of the New Mexico Protocol is to make information about proposed BLM projects readily available to the public, Indian Tribes, and Pueblos in order for them to comment in a timely fashion. In addition to the public notification requirement customers of the Carlsbad Field Office will notice a change in how the "Area of Potential Effect" of linear projects, such as roads, pipelines, or electric lines, is calculated. Under the previous protocol that area was determined by measuring from the project centerline, but the new protocol requires that the Area of Potential Effect include the width of the authorized right-of-way, plus a buffer of 50 feet on either side. Another requirement that may potentially add time to a project's review is that the SHPO must be consulted in cases where a property's previously determined eligibility to be listed on the National Register of Historic Places is downgraded from eligible to not eligible or from undetermined to not eligible. In practical terms the rest of the provisions of the protocol will not be apparent to CFO

customers and the protocol does not affect the operation of the PA, but applies only to projects that utilize archeological survey for compliance.

Studies Link Southeastern New Mexico Sites to Obsidian Sources

Obsidian is naturally occurring volcanic glass, formed when the molten rock material cools rapidly and its constituent atoms are unable to arrange themselves into a crystalline structure. It is usually an extrusive rock, one that solidifies above the earth's surface. Obsidian is most commonly black in color, but it can be brown, tan, or green and rarely red, blue, orange or yellow, depending upon trace elements or inclusions in its composition. Colors may also occur together and a common combination is "mahogany obsidian," that has black and brown colors swirled together. Obsidian is also an aesthetically pleasing material and artifacts made of it appear smooth, clean, and shiny. Thin edges and artifacts can be translucent.

Where available obsidian was the preferred material used to produce stone tools. From a flintknapper's perspective a nodule of obsidian is desirable material to work with because it typically has the same consistency throughout and it breaks with a conchoidal fracture. Striking the prepared edge of an obsidian nodule with a hammerstone, wooden, or bone baton and using an equal force each time, will produce a series of flakes that will be closely similar in size and shape. Likewise, using a tool such as an antler pressure flaker to trim the edges of a tool under production will produce consistent results. Obsidian will react in a predictable fashion for either a novice or skilled flintknapper.

Figure 2. An obsidian projectile point measuring 17 mm x 15 mm x 5 mm.

In terms of geological processes obsidian is produced almost instantaneously when compared to the formation of other kinds of rocks, in particular, sedimentary rocks that can take millions of years to form. Each lava flow also contains within it a particular mixture of elements, such as iron, aluminum, barium, and many others that can be identified and used to characterize an individual flow. The ability to identify obsidian from a specific geographical location, and consequently the artifacts made from it, give obsidian

an enhanced value for certain archeological studies. Because obsidian artifacts were appreciated by prehistoric people and because it can be traced through time and space, obsidian is one of the best measures of population movement and social interaction routinely preserved in the archaeological record.

This article discusses 134 obsidian artifacts from southeast New Mexico that have been analyzed using the X-ray fluorescence (XRF) method, by Dr. Jeff Ferguson of the Archaeometry Laboratory at the University of Missouri Research Reactor Center. XRF is a low cost non-destructive way to determine the chemical elements present in a sample. Large laboratory instruments are available, but often a handheld device is used to expose the sample to x-rays that ionize its component atoms and the resulting radiation is measured in order to determine the chemical elements present.

The analyzed artifacts were collected from 26 sites located in Chaves, Eddy, and Lea counties (see Figure 3). Some came from temporary collections maintained at the Carlsbad Field Office; others were from the Smith collection at the Western Heritage Museum and Cowboy Hall of Fame in Hobbs and the Hicks collection in Carlsbad. Forty-four samples came from excavations completed at the Bob Crosby Draw Site (LA 75163) near Roswell, and housed at the Laboratory of Anthropology in Santa Fe, while two were isolated finds. Obsidian does not occur naturally within this region.

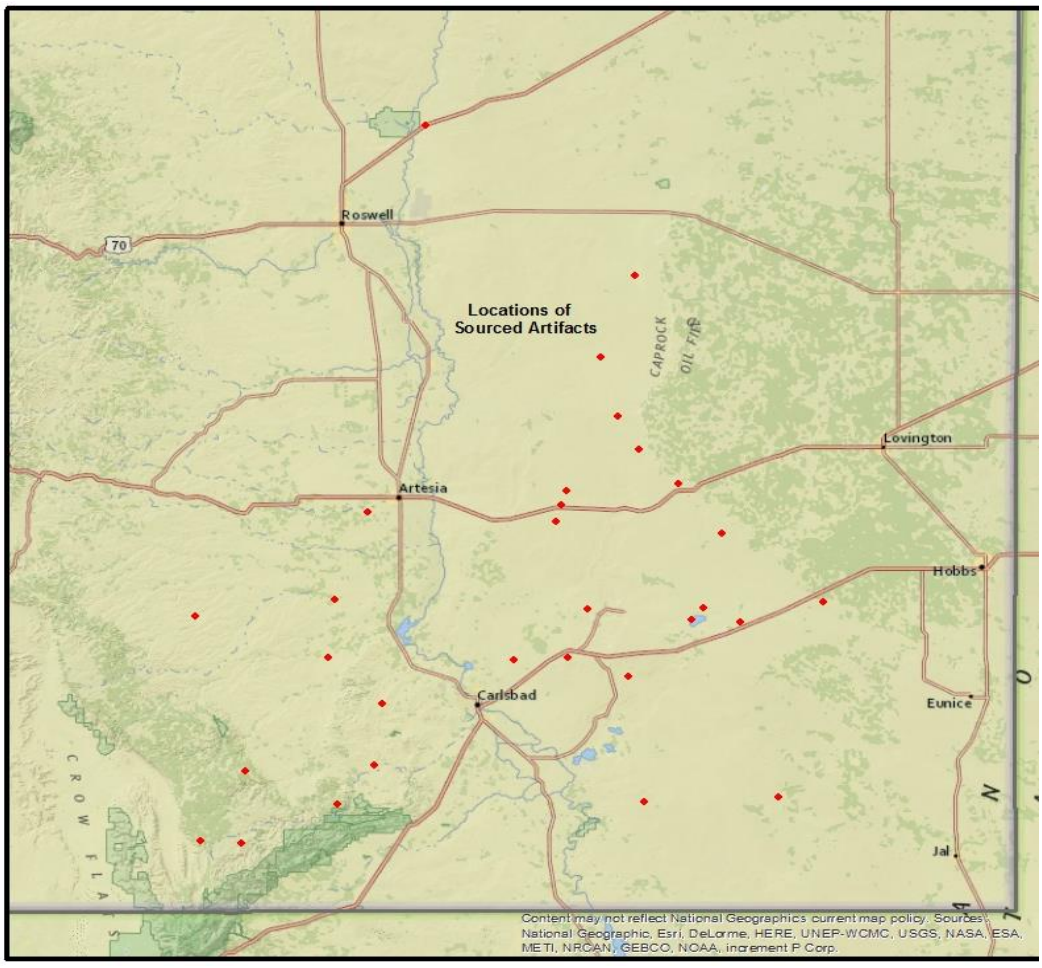

Figure 3. Site and isolated find spot locations of analyzed obsidian artifacts are indicated by red dots.

The artifact types and counts consist of nine projectile points or projectile point fragments, one scraper, and 13 biface fragments. The remainder consisted of waste flakes or shatter produced during tool making, as well as, four probable core fragments.

Determining when the obsidian artifacts were created or used is difficult. Except for the excavated samples from LA 75163, all of the artifacts came from the surface, and none of them, including the excavated artifacts, have been dated by radiocarbon or other direct dating methods. The majority of the artifacts are non-diagnostic waste flakes or biface fragments, leaving us to date them by association with other diagnostic artifacts or projectile point styles that come from the same locations. One biface fragment and one flake are from sites that are thought to date after A.D. 1540. One isolated projectile point find is of an Archaic style, which most closely resembles a *Ventana Side-Notched* point (Justice 2002:166). Justice places this point style in the Late Archaic period circa 3500 – 1800 B.C. All of the other artifacts came from sites that date to the period circa A.D. 500 to A.D. 1400.

The XRF results show that the vast majority (125) of the artifacts, or 93 per cent of the total, come from sources originating in the Jemez Mountains, more specifically from Polvadera Peak, Rabbit Mountain/Obsidian Ridge, and Cerro del Medio in the Valles Caldera. Two artifacts came from Horace Mesa, in the Mount Taylor vicinity, near Grants. One sample is from Gwynn Canyon in southwestern New Mexico and three artifacts are from the Sierra Fresnal source in northern Chihuahua, Mexico. Three artifacts are not assigned to a source (see Figure 5: note that the Jemez Mountains are labelled as Nacimiento Mountains on this map).

Figure 4.

View of Rabbit Mountain from the Valle Grande.

The Valles Caldera is a large caldera, or volcanic crater, (14 miles or 22.5 km across) having a dominant central dome called Redondo Peak that is surrounded by several smaller lava domes (Chronic 1987:152). One of the domes, Rabbit Mountain, forms a portion of the southern side of the caldera, with Obsidian Ridge flanking the mountain on its southeastern slopes. Cerro del Medio is a vent within the caldera located approximately 8 km (5.5 miles) northeast of Rabbit Mountain. Polvadera Peak is a vent from earlier volcanic activity outside of the caldera and to its north. Rock and ash eruptions from Rabbit Mountain, Cerro del Medio, and other vents within the Valles Caldera occurred at different times in the geologic past, and they may be distinguished through trace element analysis. Some flows produced

abundant nodules of obsidian, which became sources of tool stone for prehistoric people, and these flows are distinguished today by a high density of cores and flakes on the ground surface. For example, Obsidian Ridge and adjacent ridges below Rabbit Mountain have localities that may contain nodules, cores, and flakes as dense as 200 per square meter. Nodule size ranges from pea gravel to 16 cm in diameter, but 10 cm nodules were typically chosen by prehistoric flintknappers, judging from flake size (Shackley 2013). Baugh and Nelson (1987) have more complete descriptions of the Jemez Mountain sources. Shackley (2013) has website descriptions of the Jemez sources, as well as obsidian elsewhere in the Southwest.

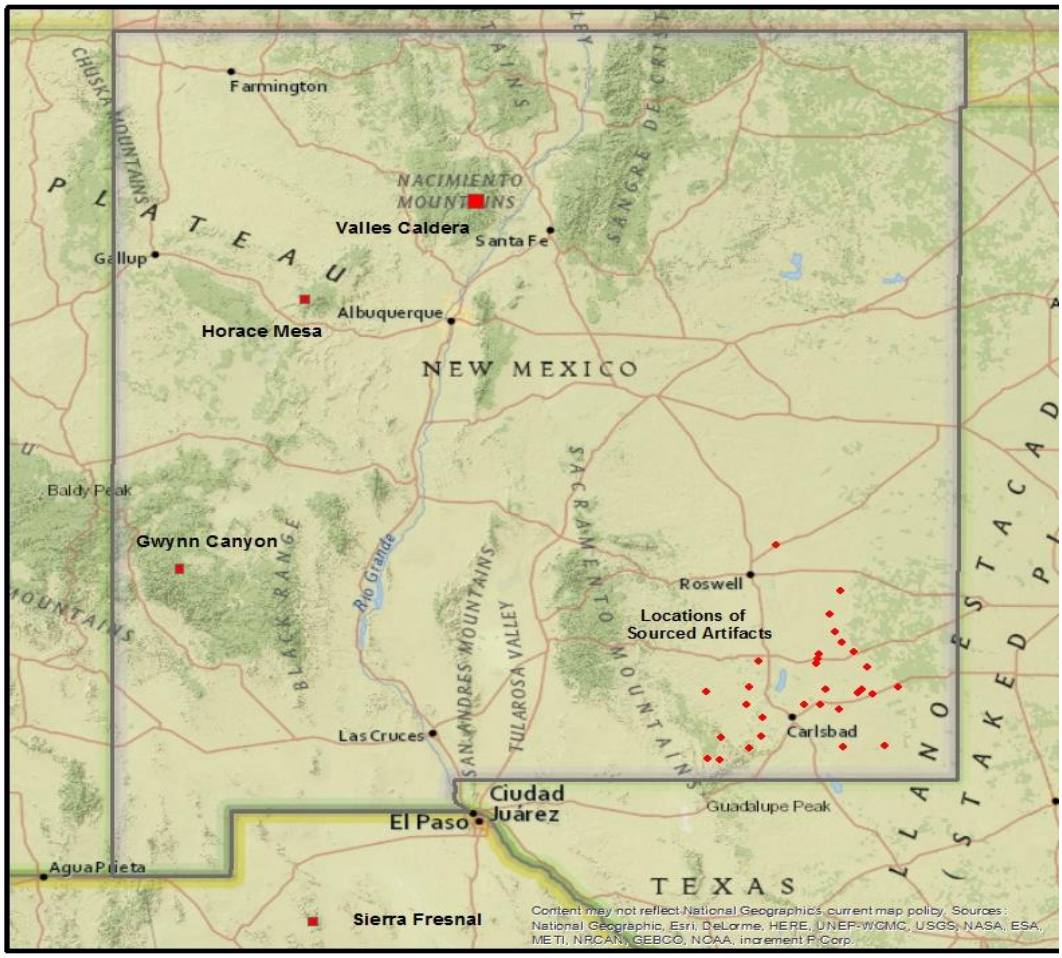

Figure 5. The location of the Valles Caldera and other obsidian sources is shown as red squares. Obsidian from these sources in southeastern New Mexico is shown by a series of red dots.

Obsidian nodules may be found in the Valles Caldera and surrounding Jemez Mountains and also as a constituent of gravel deposits within streams that drain the mountains, most notably within the Rio Grande as far south as Las Cruces. X-ray fluorescence analysis of obsidian samples collected from gravels in the vicinity of Las Cruces show Obsidian Ridge as the dominant source in three of the four samples. Obsidian from Cerro del Medio, however, was not found in any of these gravel deposits

(Church 2000: 659). The differential distribution of obsidian from the Valles Caldera in distant stream deposits is influenced by a number of variables, but the relatively late eruption of Cerro del Medio and the limited stream power of the Jemez river and other streams draining the caldera limits the possibility that obsidian from this source will become incorporated into distant secondary deposits (Steffen and LeTourneau 2007). In fact, it has not been found outside the caldera (LeTourneau 2009), and this limited distribution increases its usefulness as an analytical tool for examining the distribution of artifacts through time and space in the archeological record.

Figure 6. An obsidian core and flakes at a workshop on the Cerro del Medio in the Valles Caldera.

Figure 7. A concentration of obsidian flakes and cores at a workshop on the Cerro Del Medio.

The analyzed obsidian from sites in southeastern New Mexico is a sample representing artifacts that were collected. Most of the artifacts found during an archeological survey are recorded, but then left in place in recognition of the fact that the context of an artifact, where it is located and its relationship to surrounding artifacts or permanent site features, can be as important as the artifact itself. A review of survey and excavation reports was undertaken in 2009 in order to place obsidian artifacts into a context describing the use of obsidian through time and in space within the CFO. Though dated the gist of the review is still pertinent. The reports reviewed constitute part of the "gray literature" reporting past archeological work in southeastern New Mexico done in response to federal cultural resource management laws and regulations. In 2010 there were 23,593 reports describe the results of surveys, testing, and excavation for projects, primarily oil and gas wells, and the roads, pipelines, flow lines, power lines, and tank batteries supporting oil and gas production. The majority of these reports describe small scale projects, for example, a well pad and associated road or the route of a flow line from a well to a tank battery. Positive reports, those recording archeological sites, potentially may describe obsidian artifacts, but at present finding those reports and searching for obsidian notations requires physically reviewing each one. This is a daunting task that was not attempted. Instead, 103 reports describing relatively large survey areas in which numerous sites were recorded or reports that included the testing and excavation of sites impacted by oil and gas projects were selected for review. Of the 103 reports reviewed, 17 noted the presence of obsidian artifacts at 30 sites. The artifacts, totaling 42 in all, were almost all flakes. Exceptions are one retouched flake that was classified as a scraper and one fragment that was described as having a retouched edge.

The distribution of these obsidian artifacts is similar to that of the sourced artifacts. This is not unexpected, because the reviewed reports document localities within the CFO where most archeological survey and excavation have taken place. Four of the obsidian artifacts noted in these reports have been sourced using the XRF method. These consist of three flakes and one projectile point. One of the flakes was from a site with a Paleoindian component. All of these artifacts originated at Cerro del Medio (Kemrer 1998: Appendix D; Dillingham 2009).

Also of interest are reported sites where no obsidian was found. The 103 reports contain information on a total of 463 sites that include an identification of the stone assemblage found at each. Of this total, 433 sites, or 94 per cent, had assemblages with no obsidian artifacts (Stein 2009).

Figure 8. Paul Tosa, past Governor of Jemez Pueblo, points to salient features of an obsidian flake at the Valles Caldera.

Bringing together these different bits of information we can say that obsidian was not a commonly used lithic artifact material, but it was apparently imported into the region in small quantities during all of the currently recognized prehistoric time periods, as well as into the early historic period, before metal replaced stone as the preferred material for certain tools and projectile points. The Jemez Mountains sources of the Valles Caldera - Polvadera Peak, Rabbit Mountain/Obsidian Ridge, and Cerro del Medio – constitute the majority of the sourced artifacts being 93 per cent of the total. To date artifacts from the other distant sources - Gwynn Canyon, Horace Mesa, and Sierra Fresnal - have been found mixed in association with artifacts sourced to the Valles Caldera.

We can thus broadly characterize the use of obsidian in southeastern New Mexico, but there are still many intriguing questions to be answered, among them the most obvious is, "How did it get here?" The straight line distance from the northern most site, LA 75163, to the Valles Caldera is approximately 246 miles (396 km). Did people travel directly to the Jemez Mountains or were there middlemen trading obsidian from neighbor to neighbor until its final disposition at a site in the southeast? Another possibility is that the obsidian was distributed by individual traders, such as the "Turk," encountered by the Coronado expedition in 1540, who traveled far distances between different societies (Wedel 1982).

As noted above only obsidian from Cerro del Medio is confined to the caldera. Obsidian from other sources can be found in gravels of the Rio Grande and it is possible that the river supplied some of the material that is found at southeastern New Mexico sites. Dr. Jeff Ferguson, who has sourced numerous samples from southern New Mexico, however, has suggested that perhaps all of the obsidian came directly from the Jemez Mountains source:

> *The relative frequencies of the Jemez subsources are particularly interesting. It is generally assumed that the majority of the obsidian used in south-central and southeastern New Mexico was collected from secondary deposits along the Rio Grande. Church (2000) sampled secondary deposits around Las Cruces and El Paso and found knapable obsidian from both the Obsidian Ridge and Polvadera Peak sources. Both Obsidian Ridge and Polvadera Peak are older than the flow at Cerro del Medio and have clearly eroded into and been deposited throughout the Rio Grande Valley. Cerro del Medio has not been found in knapable sizes far beyond the Jemez caldera, and thus material from this subsource must have been initially procured directly from the area of the source. I have observed a relatively consistent frequency of about 25% of the Jemez material comes from the Cerro del Medio subsource. This percentage is fairly consistent regardless of the distance from the Jemez Mountains. If the groups in southern New Mexico were procuring their obsidian directly from the Rio Grande gravels in southern New Mexico then the percentage of Cerro del Medio should significantly drop off. There is fairly strong evidence for initial procurement directly from the source, with limited, if any, use of the secondary deposits along the Rio Grande (Ferguson 2010).*

In addition to obtaining and distributing obsidian, other questions revolve around who used the obsidian at its destination? Were they socially important people? Experienced flintknappers making projectile points for members of their group? Women who used stone tools in their daily activities? Was obsidian a curiosity or a valued commodity? The answers to these questions require more knowledge of sites in southeastern New Mexico than is available at present. Most of our information comes from surveys and at this level much important specific site detail is missing and interpretation is limited.

Prehistoric people in southeastern New Mexico were not the only distant users of obsidian from the Jemez Mountains. Steffen and LeTourneau (2007) compiled data from a variety of published and unpublished studies to demonstrate that Rabbit Mountain/Obsidian Ridge artifacts have been reported from as far away as western North Dakota (1400 km or 870 miles from the source), as well as from a site in southeastern Nebraska, Val Verde County in west Texas, and in Mississippi near the famous Poverty Point site. Cerro del Medio obsidian is reported from two counties in eastern Texas at a distance of 1070 km (665 miles) from the Valles Caldera and from sites in western Nebraska, as well as central and south central Kansas. Polvadera Peak obsidian is present at a site in Rice County central Kansas (800 km or 500 miles distant). Although a biased sample, the 1,153 identified artifacts that were sourced consisted of 72 per cent that are worked flakes, non-tool debitage, and cores, while the remaining 29 per cent are shaped tools, such as bifaces, projectile points, and drills. Projectile points comprise 12 percent of the total number of artifacts. The southeastern New Mexico sample, which is biased in its collection methods, includes 82 per cent consisting of flakes and cores, 17 per cent shaped tools, and 6 per cent that are projectile points.

Archeologists are fortunate to be able to identify the sources of obsidian and the artifacts made from those sources. Prehistory literally means before history, so there are no written sources to consult when attempting to understand the many thousands of years of human occupation of what is now southeastern

New Mexico. What are available to archeologists are the artifacts and physical remains of camps and villages, as well as a limited number of rock art sites. Studying these resources and interpreting them through significant research questions provides an avenue to the past.

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