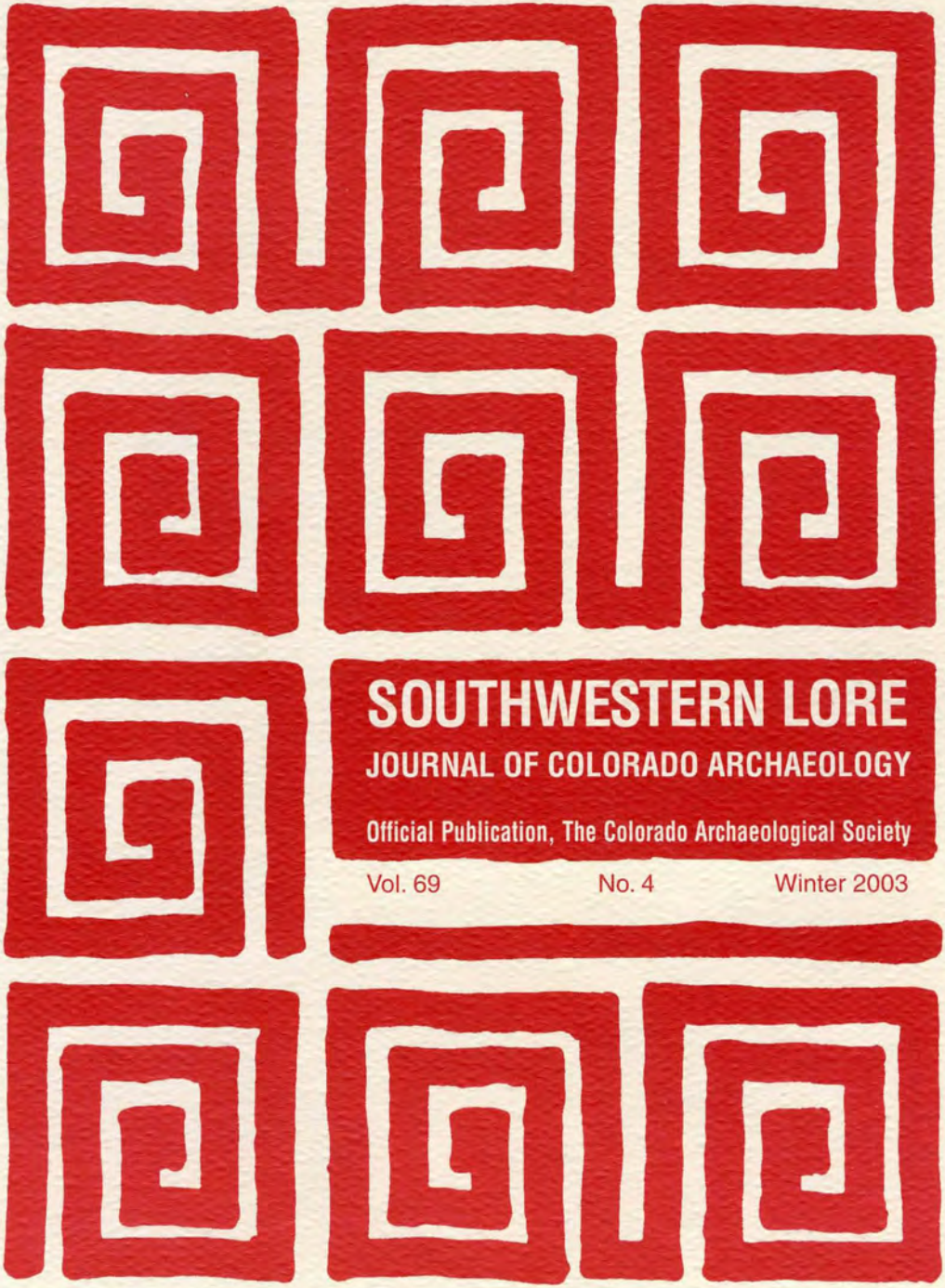

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COLORADO OBSIDIAN? PRELIMINARY RESULTS OF A STATEWIDE DATABASE OF TRACE ELEMENT ANALYSIS

By
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ABSTRACT

Colorado archaeologists have noted the presence of obsidian tools and debitage in archaeological sites for decades, but have recently increased their use of trace element analysis to determine the provenance of the material. Due to the small assemblages at all but a handful of sites, these characterization data have not been synthesized into patterns of regional lithic procurement and/or exchange. This paper discusses some preliminary analysis of a statewide database of provenance studies, and suggests some alternatives to some of the common misconceptions about obsidian use in the region. We also address the probability of undiscovered sources of obsidian within Colorado. The current database of sourcing studies included here reveals a wide geographic range of sources from seven western states, and includes 19 chemically distinct sources.

INTRODUCTION

Many Colorado archaeologists are familiar with attempts to account for the presence of obsidian artifacts in Colorado archaeological sites (e.g., Burns 1981) or to locate sources of obsidian within the state (Heinrich ca. 1985). To date, one prehistorically utilized source of obsidian has been located, and only a preliminary synthesis of the existing obsidian sourcing data from Colorado has been undertaken (Stiger 2001). Black (2000) compiled the lithic quarry data for all types of lithic material from sites in the 29 mountain counties plus other areas in the state over 6,000 feet in elevation in order to illuminate prehistoric lithic use patterns within Colorado. With the exception of the Cochetopa Dome obsidian source and possibly some of the petrified wood sources, the vast majority of chipped stone raw material found within the state is exceptionally difficult to source with either trace element or visual analysis. Lithic source assignments are generally based on the limited familiarity of the researcher with a very small number of poorly defined major sources such as "Kremmling chert" or "Dakota quartzite" (Black 2000). "The implications of extrapolating prehistoric group mobility, territory size and range, and exchange patterns from such information are huge, but the assumptions that the artifacts we find on nearby [archaeological] sites were made from the material nearby or in large, well-known quarries are not always well-founded" (Black 2000:132).

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Archaeologists will continue to find it difficult to understand issues of mobility, territory, and exchange through lithic studies, as the sources of the raw material remain ambiguous.

The accuracy and reliability of obsidian provenance analysis contrasts with the problems outlined above for non-obsidian lithic material, and trace element characterization of obsidian can be used to identify the specific geologic sources of artifacts. In order to successfully conduct obsidian characterization studies, samples from geologic sources of lithic material must be collected and analyzed, and those data used to assemble a database of potential sources for comparison with archaeological samples. Such sampling programs have been undertaken worldwide including New Zealand (Reeves and Ward 1976), the Mediterranean and Middle East (Dixon 1976; Tykot 1998), Mesoamerica (Ford et al. 1997), Oceania (Weisler and Clague 1998), and Canada (James 1986). Much more extensive sampling attempts have been undertaken in the western United States, including the Southwest (Shackley 1998), California (Hughes 1984; Nelson 1984), and the Great Basin (Jenkins et al. 1999). The extent of formal geologic studies roughly correlates with the natural distribution of obsidian, and Colorado and the Southern Rockies are notably lacking in obsidian sources. The recent prehistoric context statement for the region of Colorado that includes the Rockies lists only one possible obsidian source within the state, and claims that most obsidian artifacts can be assumed to originate in New Mexico (Martorano et al. 1999). While one synthetic text on Colorado prehistory lists nothing more than the possible occurrence of sources in the southern portion of the state (Cassells 1997), another does not list obsidian at all in the index (Stone 1999). This does not mean these works are negligent in their reporting of obsidian data, but instead it illuminates the limited knowledge of obsidian use within Colorado.

BACKGROUND

This project began as an attempt to collect obsidian samples from as many of the six possible sources reported by Heinrich (ca. 1985) in order to establish the trace element profiles of the newly discovered sources through X-Ray Fluorescence analysis (XRF; a detailed description of XRF procedures is available at http://www.obsidianlab.com/). These trace element "fingerprints" are unique to individual sources, and the second author of this paper has checked artifacts throughout the western United States to see if artifacts previously classified as "unknowns" match with the new samples. One collecting trip by the primary author (sponsored by an Alice Hamilton scholarship) was made to the Silver Cliff and Ruby Mountain (also known as Nathrop) sources and samples were collected (Figures 1 and 2). Of the six possible sources described in Heinrich (ca. 1985), Silver Cliff and Ruby Mountain seemed the most promising. The Silver Cliff source consists of numerous outcroppings of primary obsidian, but all of the material observed is perlitic glass, resulting in a rock that is very difficult to fracture predictably, and it is unlikely to have been used as a chipped stone raw material.

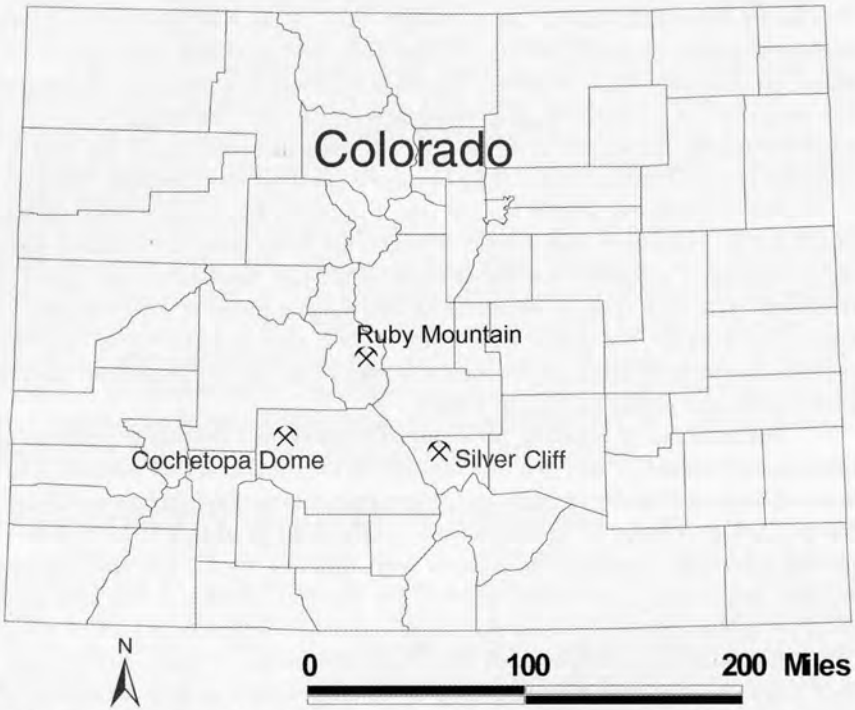

FIGURE 1. Location of obsidian sources within Colorado discussed in the text.

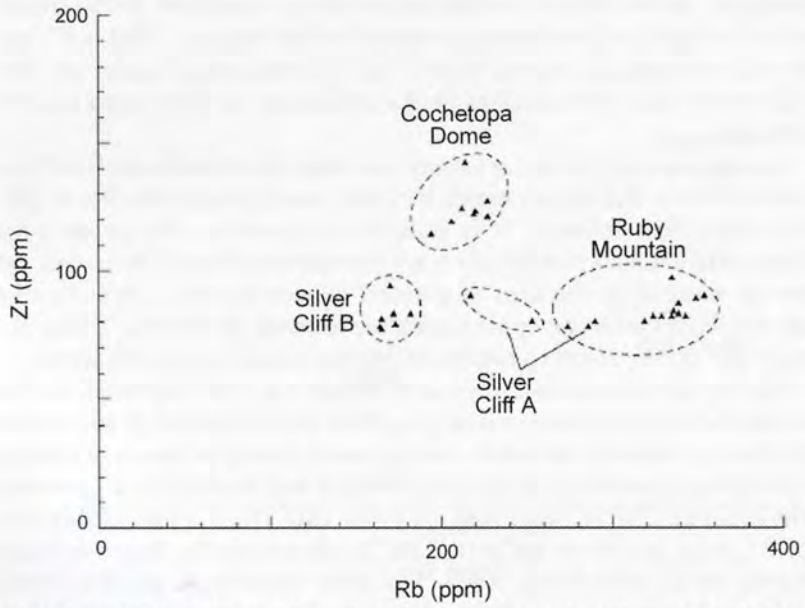

FIGURE 2. Scatterplot of rubidium (Rb) plotted versus zirconium (Zr) for the three Colorado obsidian sources.

The Ruby Mountain source contains dispersed pockets of primary and secondary deposits of small pebbles of obsidian, and nothing over one centimeter in diameter was observed. Neither of these source areas displayed any evidence of prehistoric quarrying activities, and the two new sources were not found in a search of unsuccessfully assigned artifacts in the Northwest Research Obsidian Studies Laboratory database in Corvallis, Oregon.

The Cochetopa Dome source (see Figure 2) has been widely recognized in the literature, and a total of seven artifacts from that source have been recovered at archaeological sites in Gunnison, Saguache, and Chaffee counties. The outcrops of material at the source provide no evidence of quarrying activity, but much of the immediate area is unsurveyed and the specific outcrops utilized prehistorically may be as yet undiscovered (Kevin Black, personal communication 2002).

One method of locating obsidian sources entails intensive geological background research and ground surveys to locate the actual source. This method was used by the authors and others to examine the Cochetopa Dome, Silver Cliff, and Ruby Mountain sources. Obsidian or obsidian-like materials are relatively common in regions with igneous rocks, but the sources are not important to archaeologists if the material does not fracture predictably or does not occur in large enough sizes for the manufacture of tools. After the visits to the Silver Cliff and Ruby Mountain sources, the lead author began to question the efficiency of visiting potential sources scattered across the western half of the state that had only been identified through geological background research. Many of the additional sources identified by Heinrich (ca. 1985) are in difficult to reach areas, have poorly defined proveniences, or are in locations that are no longer accessible. For example, based on the location description provided by Heinrich (ca. 1985:8–9), one of the most promising sources would now be submerged under the Rio Grande Reservoir at what used to be the confluence of Ute Creek and the Rio Grande.

Another means of locating a source involves the identification of characterized artifacts that do not match with the trace element profiles of previously identified sources. It is possible to examine the geographic distribution of artifacts that share a trace element profile and then trace the density of material to the area of greatest concentration, a location that usually correlates with the approximate location of the source. Then, the geologic and survey research can be undertaken much more efficiently.

Placing the sources described in Heinrich (ca. 1985) on hold, we began to search for Colorado archaeological sites that contained an abundance of obsidian, particularly obsidian debitage with cortex in hopes of finding sites revealing a pattern of Colorado obsidian use. Kevin Black (personal communication 2001) suggested we look into the Carter Gulch site (5ST161), a site excavated as a part of the Breckenridge Ski Area expansion during the early 1980s (Black 1983). The lithic assemblage was dominated by obsidian (75 percent, n = 118), and the obsidian artifacts recovered during the excavation were predominantly associated with the Early Archaic

occupation at the site (Black 1983). Most sites in this area (and the rest of Colorado) produce relatively few obsidian artifacts.

The entire obsidian assemblage was sent to Northwest Research Obsidian Studies Laboratory. Of the 118 obsidian artifacts, 66 were large enough to allow accurate nondestructive XRF trace element analysis, including two flakes with cortex and one bifacial tool fragment. The results of the analysis were unexpected. We had assumed that this material would have originated from a local source but, instead, all the artifacts were traced to three of the individual sources in the Jemez Mountains area of northern New Mexico (Figure 3). The Polvadera Peak source dominated the assemblage (89 percent, n = 59), followed by Cerro del Medio (nine percent, n = 6), with a single biface fragment correlated with Obsidian Ridge (two percent, n = 1). There was no indication of the use of any local obsidian source but instead there was a clear pattern of procurement of material from at least three distinct sources, all more than 380 km south.

DEVELOPMENT OF A STATEWIDE DATABASE

The apparent lack of any Colorado obsidian in the Carter Gulch assemblage led us to examine the source distribution from other Colorado sites. Stiger (2001:Appendix C) compiled a list of about 300 characterized pieces of obsidian primarily through his personal contacts with contract archaeologists. He made some preliminary interpretations about the movement of obsidian into Colorado, but they were focused on the observation

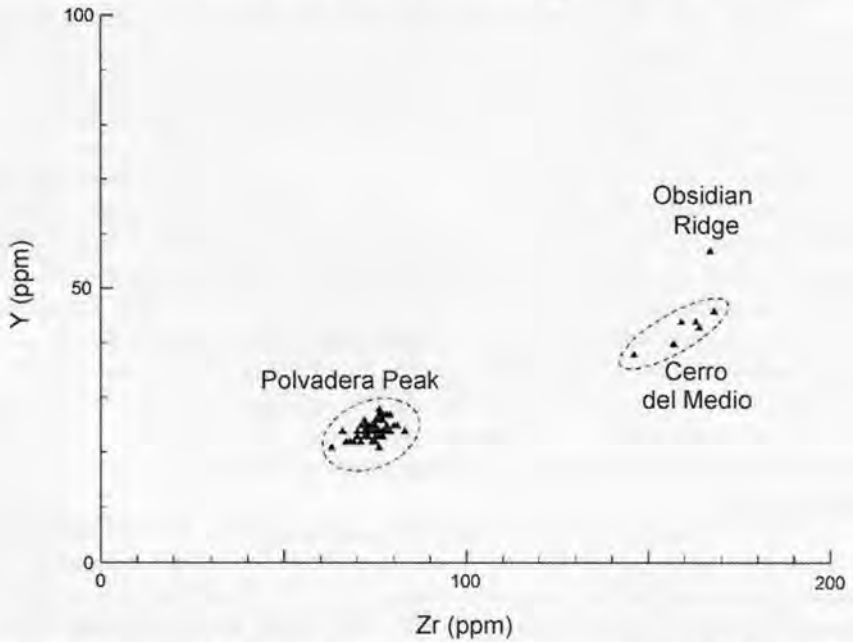

FIGURE 3. Scatterplot of yttrium (Y) plotted versus zirconium (Zr) for the artifacts from the Carter Gulch Site (5ST161).

that obsidian from the southwestern quarter of the state is dominated by material from New Mexico.

We are continuing to add to the database and now have 528 samples characterized from 138 Colorado archaeological sites (Table 1). These new data were compiled through personal communication with contract archaeologists, academic archaeologists, provenance analysts, and our own recent trace element studies.

An understanding of group movements, trade relations, and lithic procurement strategies gained through obsidian provenance analysis requires more than a description of a few flakes from an individual site. Little knowledge is truly gained by determining that a particular site contained a single flake of obsidian from a Jemez Mountains source in northern New Mexico. Of the current compilation of 137 sites, 58 percent (n = 79) have only one characterized piece and an additional 11 percent (n = 15) report only two sourced artifacts. Only six percent (n = 8) of the sites have more than 10 artifacts with source assignments. A large-scale synthesis of obsidian sourcing data is necessary in order to place the sites with a limited obsidian assemblage in context, but such a synthesis requires the cooperation of all archaeologists that conduct sourcing analysis. The primary author of this paper is currently exploring options for establishing a web-based database for submission of obsidian trace element data from Colorado that would be available for research use.

PRELIMINARY RESULTS

Although we are awaiting the results of the analysis of an additional 95 artifacts from southwestern Colorado, there are some preliminary conclusions that can be drawn from the data. Unsuccessfully assigned artifacts account for less than one percent (n = 4) of the analyzed artifacts. Based on our substantial collection of analyzed artifacts, it seems unlikely that there are undiscovered obsidian sources in Colorado that are archaeologically significant. Only eight artifacts have been recovered from the single known utilized source within Colorado, Cochetopa Dome in Saguache County. The material from this source has not been found to exceed a couple of centimeters in diameter but some of the artifacts recovered at a distance from the source appear to be made from slightly larger pieces (Kevin Black, personal communication 2002; Mark Stiger, personal communication 2001). In contrast to the material from outside the state that is available in large quantities and sizes and was transported great distances, the Cochetopa material has not been recovered outside three of the closest counties to the source (Figure 4).

If other yet-to-be-discovered sources exist, then we would expect the material to exhibit a very limited distribution. The only three counties containing unknown artifacts are Rio Blanco (n = 1), Grand (n = 1), and Las Animas (n = 2). Heinrich (ca. 1985) does not report any possible obsidian sources near Rio Blanco or Las Animas counties, but he does describe three possible sources in Larimer County and other possible sources in Jackson

TABLE 1. Provenance of Obsidian Artifacts from Colorado Sites.

Site	No. of Obsidian Artifacts	Obsidian Source	Reference
ARCHULETA			
5AA ??	1	No Agua Peaks, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
	4	Polvadera Peak, NM	Stiger 2001
CHAFFEE			
5CF358	1	Cochetopa Dome, CO	Stiger 2001
	1	Rio Grande Gravels, NM	Stiger 2001
DOLORES			
5DL ??	12	Polvadera Peak, NM	Stiger 2001
	6	Cerro del Medio, NM	Stiger 2001
	1	Mineral Mountain, UT	Stiger 2001
	1	Obsidian Ridge, NM	Stiger 2001
	1	Government Mountain, AZ	Stiger 2001
5DL499	1	Polvadera Peak, NM	Stiger 2001
5DL687	2	Polvadera Peak, NM	Stiger 2001
5DL690	1	Polvadera Peak, NM	Stiger 2001
5DL691	1	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5DL896, 1176	2	Polvadera Peak, NM	Stiger 2001
	11	Rio Grande, Cochiti, NM	Stiger 2001
	2	Mule Creek, NM	Stiger 2001
5DL1227	1	Polvadera Peak, NM	Stiger 2001
	2	Cerro del Medio, NM	Stiger 2001
5DL1228	1	Polvadera Peak, NM	Stiger 2001
5DL1253	1	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
	1	Government Mountain, AZ	Stiger 2001
	1	Wild Horse Canyon, UT	Stiger 2001
EAGLE			
5EA595	1	Polvadera Peak, NM	Stiger 2001
5EA625	3	Teton Pass, WY	Stiger 2001
5EA838	1	Polvadera Peak, NM	Stiger 2001
	1	Wild Horse Canyon, UT	Stiger 2001
5EA909	1	Cerro del Medio, NM	Stiger 2001
	1	Wild Horse Canyon, UT	Stiger 2001
5EA1052	2	Polvadera Peak, NM	Stiger 2001
5EA1082	1	Polvadera Peak, NM	Stiger 2001
5EA1099	1	Polvadera Peak, NM	Stiger 2001
5EA1100	1	Polvadera Peak, NM	Stiger 2001
5EA1101	1	Polvadera Peak, NM	Stiger 2001
GRAND			
5GA22	4	Cerro del Medio, NM	Stiger 2001
5GA277	1	Polvadera Peak, NM	Stiger 2001
	1	Malad, ID	Stiger 2001
5GA869	1	Polvadera Peak, NM	Craig Skinner, personal communication 2002
	8	Malad, ID	Craig Skinner, personal communication 2002

Site	No. of Obsidian Artifacts	Obsidian Source	Reference
5GA961	10	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5GA1600	1	Unknown	Stiger 2001
5GA1602	1	Cerro del Medio, NM	Stiger 2001
5GA2009	1	Polvadera Peak, NM	Stiger 2001
GARFIELD			
5GF308	1	Polvadera Peak, NM	Stiger 2001
5GF1666	1	Bear Gulch, ID	Stiger 2001
5GF1667	1	Malad, ID	Stiger 2001
5GF1687	1	Polvadera Peak, NM	Stiger 2001
5GF1692	1	Polvadera Peak, NM	Stiger 2001
GUNNISON			
5GN ??	1	Polvadera Peak, NM	Stiger 2001
5GN10	1	Cochetopa Dome, CO	Stiger 2001
5GN161	1	Jemez, NM	Stiger 2001
5GN207	4	Polvadera Peak, NM	Stiger 2001
5GN289	1	Cochetopa Dome, CO	Stiger 2001
5GN810	1	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5GN817	5	Timber Butte, ID	Bonnie Pitblado, personal communication 2002
	3	Cochetopa Dome, CO	Bonnie Pitblado, personal communication 2002
	1	Cerro del Medio, NM	Bonnie Pitblado, personal communication 2002
5GN1611	2	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5GN1835	29	Polvadera Peak, NM	Stiger 2001
	1	Obsidian Ridge, NM	Stiger 2001
	1	Cochetopa Dome, CO	Stiger 2001
5GN2318	3	Polvadera Peak, NM	Stiger 2001
5GN2428	1	Polvadera Peak, NM	Stiger 2001
HINSDALE			
5HN65	3	Polvadera Peak, NM	Stiger 2001
5HN229	1	Polvadera Peak, NM	Stiger 2001
	1	Red Hill, NM	Stiger 2001
5HN268	1	Cerro del Medio, NM	Stiger 2001
5HN317	1	Polvadera Peak, NM	Stiger 2001
5HN320	1	Polvadera Peak, NM	Stiger 2001
LAS ANIMAS			
5LA ??	1	Polvadera Peak, NM	Stiger 2001
	2	Cerro del Medio, NM	Stiger 2001
5LA1211	5	Jemez, NM	Shackley 1997
5LA1416	31	Jemez, NM	Shackley 1997
	1	Red Hill, NM	Shackley 1997
	2	Unknown	Shackley 1997
LAKE			
5LK232	2	Polvadera Peak, NM	Stiger 2001

Site	No. of Obsidian Artifacts	Obsidian Source	Reference
LA PLATA			
5LP ??	7	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5LP525	2	Polvadera Peak, NM	Stiger 2001
5LP537	1	Cerro del Medio, NM	Stiger 2001
5LP556	1	Polvadera Peak, NM	Stiger 2001
5LP695	5	Polvadera Peak, NM	Reed 2001
	6	Cerro del Medio, NM	Reed 2001
5LP696	2	Polvadera Peak, NM	Reed 2001
	4	Cerro del Medio, NM	Reed 2001
5LP1826	1	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5LP1978	1	Polvadera Peak, NM	Stiger 2001
5LP1986	1	Polvadera Peak, NM	Stiger 2001
5LP4944	1	Polvadera Peak, NM	Reed 2001
MESA			
5ME213	1	Polvadera Peak, NM	Reed 2001
	1	Malad, ID	Reed 2001
5ME625	1	Wild Horse Canyon, UT	Reed 2001
5ME1536	2	Polvadera Peak, NM	Stiger 2001
	1	Rio Grande, Cochiti, NM	Stiger 2001
5ME3876	1	Cerro del Medio, NM	Reed 2001
5ME4971	3	Polvadera Peak, NM	Reed 2001
	2	Obsidian Ridge, NM	Reed 2001
	1	Wild Horse Canyon, UT	Reed 2001
5ME5183	1	Rio Grande, Cochiti, NM	Stiger 2001
5ME5997	2	Teton Pass, WY	Stiger 2001
5ME6144	1	Bear Gulch, ID	Stiger 2001
5ME6298	1	Cerro del Medio, NM	Stiger 2001
5ME11465	4	Polvadera Peak, NM	Reed 2001
	1	Wild Horse Canyon, UT	Reed 2001
MOFFAT			
5MF CMT ??	1	Bear Gulch, ID	Stiger 2001
5MF694	1	Wild Horse Canyon, UT	Stiger 2001
5MF1711	1	Malad, ID	Stiger 2001
5MF1915	4	Malad, ID	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5MF2631	1	Browns Bench, NV/ID	Stiger 2001
5MF2792	1	Polvadera Peak, NM	Stiger 2001
5MF2849	1	Malad, ID	Stiger 2001
5MF2850	1	Polvadera Peak, NM	Stiger 2001
5MF2862	1	Wild Horse Canyon, UT	Stiger 2001
5MF2942	1	Malad, ID	Stiger 2001
5MF2998	1	Polvadera Peak, NM	Stiger 2001
	1	Teton Pass, WY	Stiger 2001
5MF3161	1	Malad, ID	Stiger 2001
5MF3164	1	Malad, ID	Stiger 2001
5MF3286	1	Bear Gulch, ID	Stiger 2001
5MF3307	1	Malad, ID	Stiger 2001
	3	Wild Horse Canyon, UT	Stiger 2001
5MF3312	1	Teton Pass, WY	Stiger 2001

Site	No. of Obsidian Artifacts	Obsidian Source	Reference
5MF3330	1	Wild Horse Canyon, UT	Stiger 2001
5MF3440	1	Malad, ID	Stiger 2001
	1	Wild Horse Canyon, UT	Stiger 2001
5MF3618	1	Malad, ID	Stiger 2001
5MF3737	4	Malad, ID	Stiger 2001
	1	Wild Horse Canyon, UT	Stiger 2001
	3	Black Rock Area, UT	Stiger 2001
5MF4340	1	Obsidian Cliff, WY	Stiger 2001
MINERAL			
5ML144	1	Polvadera Peak, NM	Stiger 2001
MONTROSE			
5MN ??	8	Polvadera Peak, NM	Stiger 2001
	1	Wild Horse Canyon, UT	Stiger 2001
5MN1505	1	Polvadera Peak, NM	Stiger 2001
5MN1734	1	Polvadera Peak, NM	Stiger 2001
5MN1957	1	Polvadera Peak, NM	Stiger 2001
5MN2379	1	Wild Horse Canyon, UT	Stiger 2001
5MN2637	1	Jemez, NM	Stiger 2001
5MN2809	1	Polvadera Peak, NM	Stiger 2001
5MN2815	1	Polvadera Peak, NM	Stiger 2001
5MN2841	1	Polvadera Peak, NM	Stiger 2001
5MN2842	1	Polvadera Peak, NM	Stiger 2001
5MN2858	1	Polvadera Peak, NM	Stiger 2001
5MN2934	1	Polvadera Peak, NM	Stiger 2001
5MN4253	1	Polvadera Peak, NM	Reed 2001
MONTEZUMA			
5MT ??	3	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5MT4631	1	Polvadera Peak, NM	Stiger 2001
5MT9644	1	Polvadera Peak, NM	Stiger 2001
5MT9648	1	Cerro del Medio, NM	Stiger 2001
5MT11234	1	Polvadera Peak, NM	Stiger 2001
OURAY			
5OR ??	1	Cerro del Medio, NM	Stiger 2001
5OR (16 sites)	31	Polvadera Peak, NM	Stiger 2001
	6	Jemez, NM	Stiger 2001
	4	Red Hill, NM	Stiger 2001
	1	Mule Creek, NM	Stiger 2001
	1	Government Mountain, AZ	Stiger 2001
5OR48	1	Cerro del Medio, NM	Stiger 2001
PARK			
5PA1764	2	Obsidian Cliff, WY	Gordon Tucker, personal communication 2003
RIO BLANCO			
5RB314	1	Malad, ID	Stiger 2001
5RB2828	3	Malad, ID	Stiger 2001
	1	Black Rock Area, UT	Stiger 2001
5RB2873	2	Malad, ID	Stiger 2001
5RB2947	10	Obsidian Cliff, WY	
	1	Unknown	

Site	No. of Obsidian Artifacts	Obsidian Source	Reference
5RB3448	1	Malad, ID	Stiger 2001
5RB3643	1	Wild Horse Canyon, UT	Stiger 2001
5RB3807	1	Malad, ID	Stiger 2001
5RB3821	1	Wild Horse Canyon, UT	Stiger 2001
ROUTT			
5RT345	1	Polvadera Peak, NM	Stiger 2001
	2	Cerro del Medio, NM	Stiger 2001
	4	Kelly Canyon, ID	Stiger 2001
	1	Bear Gulch, ID	Stiger 2001
5RT1223	1	Polvadera Peak, NM	Stiger 2001
SAGUACHE			
5SH1458	1	Cochetopa Dome, CO	Stiger 2001
SAN MIGUEL			
5SM ??	8	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5SM708	1	Polvadera Peak, NM	Stiger 2001
5SM1125	4	Polvadera Peak, NM	Stiger 2001
5SM1452	2	Polvadera Peak, NM	Stiger 2001
	1	Cerro del Medio, NM	Stiger 2001
5SM1527	1	Polvadera Peak, NM	Stiger 2001
5SM1532	1	Polvadera Peak, NM	Stiger 2001
5SM2136	3	Polvadera Peak, NM	Stiger 2001
5SM2425	1	Polvadera Peak, NM	Reed 2001
	2	Wild Horse Canyon, UT	Reed 2001
5SM2478	1	Polvadera Peak, NM	Reed 2001
	2	Cerro del Medio, NM	Reed 2001
5SM2578	1	Polvadera Peak, NM	Stiger 2001
SUMMIT			
5ST161	59	Polvadera Peak, NM	This paper
	15*	Polvadera Peak, NM	This paper
	6	Cerro del Medio, NM	This paper
	1	Obsidian Ridge, NM	This paper
TOTAL	528		

* Results by LA-ICP-MS

and Grand counties. These sources possibly could be the origin of the single unknown from Grand County, but if this were the case we would expect to see a larger presence of this material. Of the 29 characterized artifacts from Grand County, 66 percent (n = 19) are from the Jemez source area in northern New Mexico, and 31 percent (n = 9) are from the Snake River Plain source area (see Figure 4). If there was a viable source in the vicinity of Grand County it should be much more apparent in the characterized obsidian assemblage. The possibility of undiscovered prehistorically quarried obsidian sources within Colorado seems unlikely, and the combination of geological fieldwork and provenance analysis results do not support it.

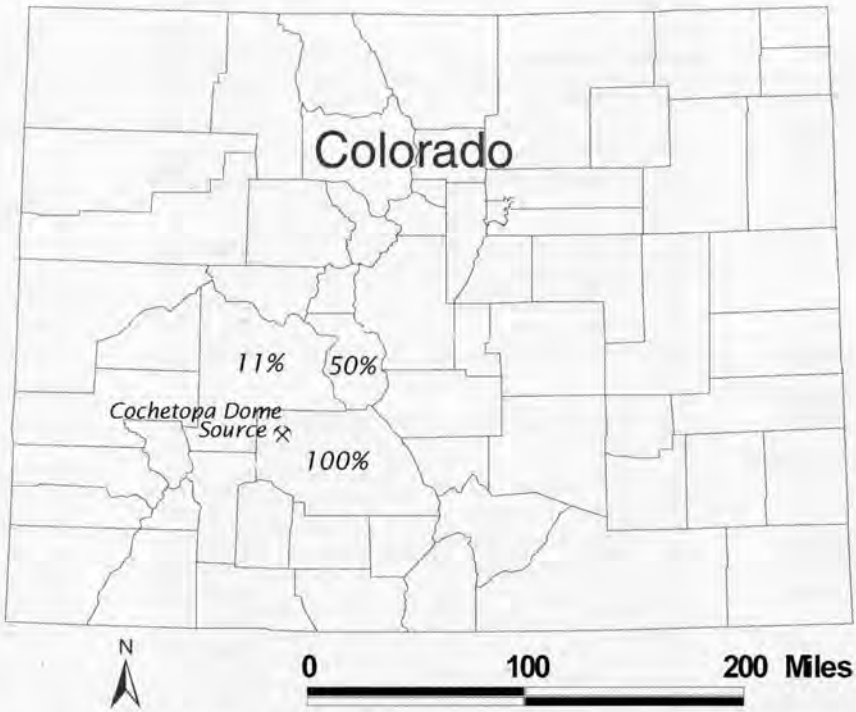

FIGURE 4. The distribution of artifacts sourced to Cochetopa Dome by percentage of the assemblage for that county. The sample sizes for the counties are: Gunnison = 57, Chaffee = 2, and Saguache = 1.

Another preliminary discovery from this research counters some of the current perceptions about obsidian use in Colorado. The state site files are filled with statements about obsidian procurement. For example, dates are sometimes assigned to sites based on the presence of obsidian. Some interpretations hold that obsidian was not traded into Colorado until the Late Archaic at the earliest, a view not supported by this study. While most formal tools made from obsidian are Late Prehistoric projectile points, Bonnie Pitblado (personal communication 2002) collected an obsidian Late Paleoindian projectile point base from Montezuma County, and excavations have revealed significant Early Archaic obsidian assemblages in Gunnison and Summit counties (Black 1983; Bonnie Pitblado, personal communication 2002). Based on the sourcing data from the Carter Gulch site described previously, the dominance of obsidian from the Jemez source area in northern New Mexico was clearly in place by the Early Archaic. Sources in the Snake River Plain area also have been recovered from Early Archaic contexts (Bonnie Pitblado, personal communication 2002) more than 1,000 km from the source. Most of the characterized obsidian assemblage in the state comes from surface sites with little chronological control, making detailed analysis of the temporal patterns of obsidian movement difficult.

FIGURE 5. Locations of obsidian sources and source areas from which material has been recovered in Colorado archaeological sites.

Also prominent in archaeological interpretations is the assumption that obsidian in Colorado archaeological sites originated from either the Jemez source area or the Obsidian Cliff source in Wyoming. Obsidian in Colorado sites derived from at least 19 distinct sources in seven western states (Figure 5). The Jemez source area accounts for the majority of the state's

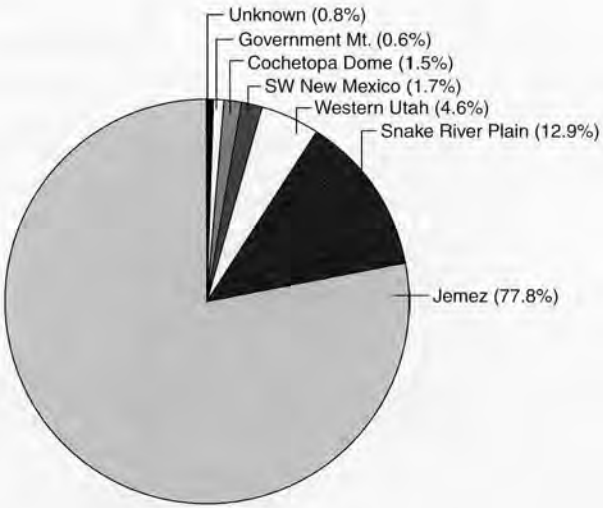

FIGURE 6. Frequency of various source areas within the sourced obsidian database for Colorado.

characterized obsidian assemblage, but the Timber Butte source, approximately 1,000 km away, accounts for five artifacts from Gunnison County. Figure 6 shows the contribution of the source areas illustrated in Figure 5 that were recovered and sourced from Colorado archaeological sites. A more detailed study of the patterns outlined here is currently underway.

CONCLUSIONS

Few sources of archaeological data are as straightforward and informative as those provided through the trace element analysis of obsidian artifacts. As demonstrated here, the small numbers of characterized artifacts that are often available at obsidian-poor Colorado sites can be combined to reveal regional patterns that may be significant in our understanding of lithic procurement and exchange behaviors. The potential for this research, however, often remains buried in filing cabinets or hidden in the gray literature of individual site reports. Through the continuation of the research summarized here and the participation of the Colorado archaeological community, small obsidian provenance projects hold the promise to make a significant contribution to our understanding of the archaeology of the region.

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