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Lithic Sources in the Rocky Mountains of Colorado

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This study describes the nature and scope of flaked stone sources used prehistorically in the Rocky Mountains of Colorado. Data on known sources were compiled from searches of the computerized files of the Office of Archaeology and Historic Preservation (OAHP) in Denver, followed by collation of information provided on standard Colorado site forms. Two file searches were done: one on the 29 counties in Colorado all or partially covering the Southern Rocky Mountains physiographic province, and a second on all sources situated at or above 6,000 ft (1,830 m) elevation. Thus defined, the database includes 180 sources in the 29 mountain counties, and 57 additional sources above 6,000 ft elevation but outside the 29-county area. Factors included in the study of these sources are geologic formation, material type(s), elevation, quarry features present, core reduction strategies, and evidence for associated nonprocurement activities. This study attempts to characterize prehistoric procurement systems throughout the upland environments in Colorado, and provides directions for future research.

INTRODUCTION

In reviewing literature on the archaeology of the Colorado mountains, it is not uncommon to find references to the presence of lithic (especially flaked stone) materials using such general terms as "local chert," "Dakota quartzite," or more specifically "Kremmling chert," "Parker petrified wood," etc. Yet the basis for the assignment of these labels often involves no more than macroscopic, visual rock attributes and the investigator's personal familiarity with a few large or local prehistoric quarries. The implications of extrapolating prehistoric group mobility, territorial size and range, and exchange patterns from such information are huge, but the assumptions that the artifacts we find on mountain sites were made from materials available nearby or in large, well-known quarries are not always well-founded. To begin to clarify the true availability of lithic resources in the mountains, this paper provides a catalog of recorded quarry sites. In that survey coverage in the Colorado mountains averages less than 5 percent per county, the results of this compilation should be seen as no more than a starting point for more accurate interpretations of past landscape use.

Another fact that became clear in researching this subject is how few detailed studies on specific quarries have been done. One of the largest sources in the mountains also was one of the first to be studied, the Trout Creek source zone within the Arkansas River system in Chaffee County (Chambellan et al. 1984). Survey, test excavation, and petrographic analysis (Heinrich 1984) were completed for this important chert source. Another abundant material called Kremmling chert was the subject of a more recent study by Metcalf et al. (1991), who conducted excavations at two sites in Middle Park (Upper Colorado River Basin) and sponsored a geological study on Kremmling chert and other materials as represented at 12 sites in the area (Miller 1991a). Nearby, the major quartzite source on Windy Ridge near Rabbit Ears Pass has been investigated via excavations by archaeologists from the University of Colorado-Boulder (Bamforth 1994), but a final report is not yet available.

Geochemical and other source characterization research likewise has not been a very common endeavor in the Colorado mountains. Burns (1981) studied several obsidian sources in the San Juan Mountains, but could not confirm that prehistoric quarrying had occurred at many of them. Also in southwestern Colorado, Mauz (1993) completed trace element analyses on chert, quartzite, and obsidian artifacts from Snow Mesa, finding evidence both for local procurement and importing of raw materials. Cassells (1995) tried three different methods of distinguishing materials from a variety of well-known sources in the Front Range region, and found that ultraviolet light response was quite useful. Benedict (1981) also provides helpful geological data on Front Range sources.

Regionally, research at quarry sites and more general investigations on the use and movement of lithic materials in prehistoric societies have been of greater interest to archaeologists. Studies of sources on the plains are quite numerous (e.g., Ahler 1977, 1986; Church 1994a; Coffin 1951; Greiser 1983; Haury 1984; Hoard et al. 1993; Ives 1984; Saul 1969). North and west of Colorado, much of the interest naturally has focused on the numerous obsidian sources of the region (Davis et al. 1995; Hughes 1984; Nelson 1984; Nelson and Holmes 1979) but there are important exceptions (e.g., Elston and Raven 1992). It should be obvious that source studies in states adjacent to Colorado must be utilized in research that seeks to define prehistoric landscape use partially or wholly within the Southern Rocky Mountains.

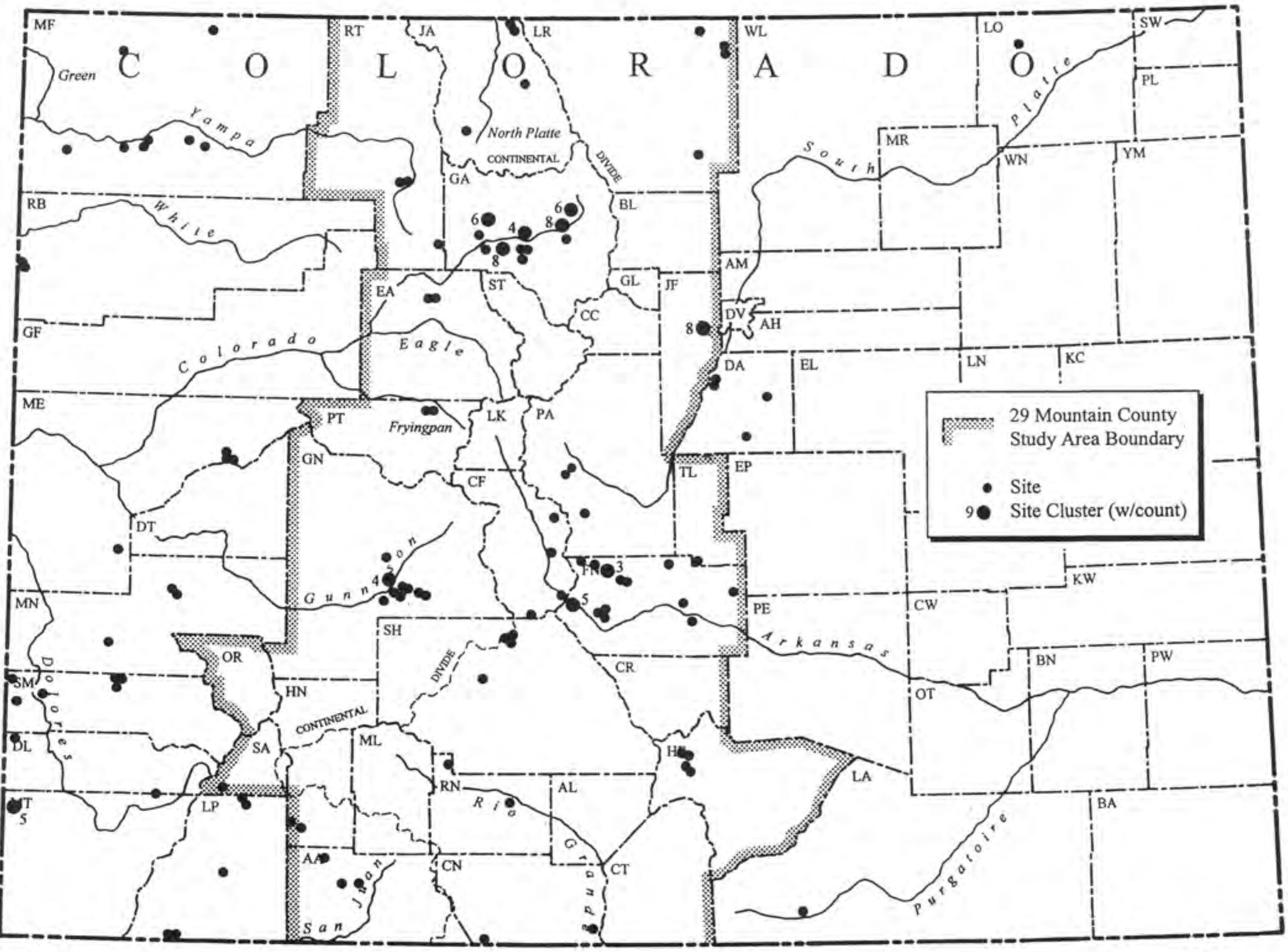

Figure 9.1. Chert, agate, chalcedony, and jasper sources in the Colorado mountains. Relevant county codes are identified in Appendix 9.1.

GOALS AND METHODS OF THE STUDY

The primary goal of the present study simply was to document the number and diversity of toolstone sources in the mountains of Colorado, using the computerized site files at the Office of Archaeology and Historic Preservation (OAHP) in Denver. Beyond this rather mundane task was the attempt to characterize prehistoric procurement systems in upland settings: What core reduction strategies were represented, and in what proportions? What other lithic tool production data were available? What kinds of nonquarrying activities were in evidence? As will become clear, the quality of the database varied widely and some topics of interest could not be addressed with the information at hand.

The methods utilized were quite simple. Two searches were made of OAHP's computerized files. One listed all lithic sources in the 29 counties all or mostly within the mountainous central 40 percent of the state, and the second was to identify all such sources in Colorado above 6,000 ft (1,829 m) elevation. These searches were completed in June 1993 and were updated in April 1995 but, because of a data entry backlog, the database does not include information from site forms received at OAHP between about October 1992 and July 1993. Thus defined, the list of sources included 194 sites in the 29 mountain counties and 48 additional sites outside those counties at elevations exceeding 6,000 ft. Many of the listings were deleted upon further investigation, including sites with multiple site numbers, historical rock quarries, and paleontological quarries. Several others were added to the list based on the author's personal familiarity with recently recorded sites. The final total, then, is 180 sites in the 29 mountain counties and 57 other sites above 6,000 ft elevation.

Rather than relying strictly on encoded data, each site form was perused in compiling all information on quarrying activities, features, geological information, tool diversity and density, material types present, and any other relevant data. In a few cases, missing site forms were adequately replaced by information from associated contract reports. At a minimum, locational data were available for each of the 237 sites in the final compilation. Surprisingly, in three cases the site form made no mention of the type of rock acquired at that location and, not surprisingly, more recently completed forms tended to yield more useful information than older forms. Overall, the most disappointing part of the project was the lack of information about core reduction strategies on the site forms. Local geology was rarely mentioned, and details on artifact assemblages were spotty at best. Still, the available data provide a starting point for future studies.

MATERIAL TYPES

Six illustrations (Figures 9.1–9.6) depict the distribution of different material types in upland areas of Colorado. The raw data upon which these maps are based have been compiled in tabular form (Appendix 9.1).

Crypto-Microcrystalline Silicates

The most common materials in the Colorado mountains are the dense, smooth-textured silicate rocks variously referred to as agate, chert, chalcedony, or jasper. No effort was made to distinguish between these potentially different materials because of the inconsistent usage of these terms by archaeologists and, more importantly, because these materials likely served similar functions in prehistoric tool kits. However, petrified wood quarries have been considered separately because of their obvious potential in sourcing studies.

There are 136 sites in this category, of which 107 are in the 29 mountain counties (Figure 9.1). Clustering of sources is evident in two general areas: Grand County (Middle Park) and a broad zone in the south-central mountains, particularly in Fremont County. Two major, well-known material types encompass most of the Grand County sites. Sites in eastern Grand County generally yield an opaque, iron-rich chert of volcanic origin termed Table Mountain jasper, occurring within the Grouse Mountain basalt (Miocene and Pliocene) and in younger, secondary gravel sources (Izett 1966; Miller 1991a:5).

Quarries in the central and western portions of the county represent procurement of a mottled translucent to opaque material called Kremmling chert, derived from the Troublesome formation (Miocene) as well as in numerous terrace gravel sources (Benedict 1981:124; Izett 1968; Metcalf et al. 1991; Miller 1991a:2–5, 1991b). Materials very comparable to, if not indistinguishable from this chert are available at several quarries mapped in Routt and Eagle counties within the Browns Park formation (Miocene), and in Jackson County within the North Park formation (Miocene). Visually comparable cherts also occur in eastern Pitkin County, but the geological context there is yet unstudied.

The cherty toolstones in the south-central mountains of Chaffee, Gunnison, Fremont, Park, Saguache, and Teller counties derive from much more variable conditions. Their relative proximity to one another is merely a fortunate coincidence, as the geology of this portion of the mountains is quite complex. Largest of these sources, and the second-largest in the database, is the well-known Trout Creek chert quarry in Chaffee County, covering 2,644 acres (1,070 ha; Chambellan et al. 1984) in combined quarry and workshop areas. The main outcrops at Trout Creek are believed to be in the Ordovician age Manitou limestone (Heinrich 1984: 98–99); late Oligocene volcanic activity has altered some of these beds. Very similar cherts and jaspers can be found to the northeast in Park Country and to the southeast in Fremont County at several sites near the Arkansas River. This zone also includes the two highest elevation sites in the sample, both small chert sources on the Continental Divide in northern Saguache County at 11,680 ft (3,560 m).

Other sources in this category are mostly scattered in widely separated sections of the mountains. The small cluster in Jefferson County is found on the west and south sides of Green Mountain near Morrison; some of this chert actually may be petrified wood from the Paleocene age Green Mountain conglomerate (Scott 1972a). About a dozen sources are scattered in and around the San Juan Mountains in southwestern Colorado, including 3 outside the 29 central counties but at elevations above 10,000 ft (3,048 m) in La Plata County and on the Dolores-Montezuma county line. Of course, since survey coverage in the mountains averages about 2 percent per county and is no higher than 8 percent of any of the 29 mountain counties, the true number of toolstone sources must be much higher. The Flattop Butte source in northeastern Colorado is shown for reference purposes only, as it is one of the best-known quarries in the state (Greiser 1983; Ives 1984; Hoard et al. 1992).

Petrified Wood

The distribution of the 26 petrified wood sources in the sample is quite interesting, with a notable lack of sources in the southern part of the mountains (Figure 9.2). Only a couple quarries near Parlin in the Upper Gunnison River Basin have been recorded there, with most of the remainder clustered along the Front Range and in the North Park-Middle Park area. Seventeen of the 26 petrified wood sources are in the northern and central mountains. Another 8 are in the Black Forest area of east-central Colorado, where many other such sources are known but occur at slightly lower elevations. This material, locally known as Parker petrified wood, is found in large quantities within

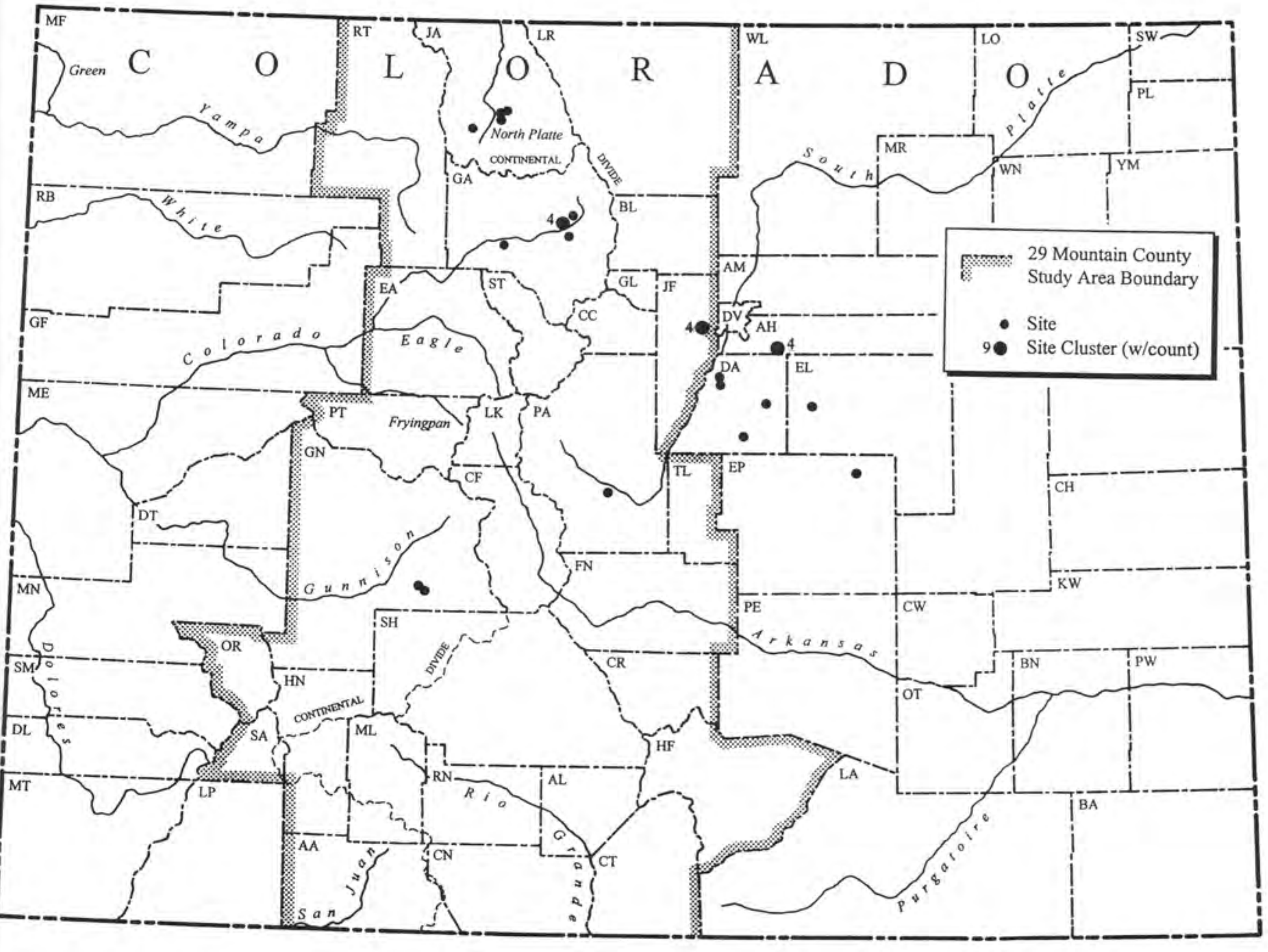

Figure 9.2. Petrified wood sources recorded in the Colorado mountains.

the Dawson arkose (Paleocene and early Eocene) and in many secondary deposits. Farther north, the Jefferson County materials around Green Mountain probably derive from the correlative Green Mountain conglomerate, but silicified woods also are known from the underlying Denver formation of Upper Cretaceous and Paleocene age (Benedict 1981:126; Scott 1972a).

To my knowledge, few geological studies have been conducted on the silicified woods found west of the Front Range, which might identify distinguishing characteristics between sources. Izett (1968:42) does place the fossil woods from eastern Grand County within the Middle Park formation (Paleocene), suggesting that distinctions with contemporaneous materials from the eastern slope may not be obvious. Clearly, however, the potential is there for source-specific characterizations of silicified woods and might succeed where comparable efforts with nonfossiliferous cherts have failed.

Quartzites

The second most commonly encountered material type in Colorado is quartzite (there was insufficient information available on the site forms to distinguish between metaquartzites and orthoquartzites, although in most cases this probably made little difference functionally for prehistoric groups). There are 116 quartzite sources in the database, of which 84 are in the 29 central counties (Figure 9.3). Note the continued clustering of sources in the south-central mountains, most notably in Gunnison County. As those familiar with Gunnison County archaeology can attest, the number of recorded sources there is an arbitrary figure at best, as the ground is virtually paved with quartzite for long stretches in many areas. Site boundaries there are drawn more for convenience than to reflect archaeological reality. The cluster not only includes such extensive source zones—primarily in the Junction Creek formation (Jurassic)—but

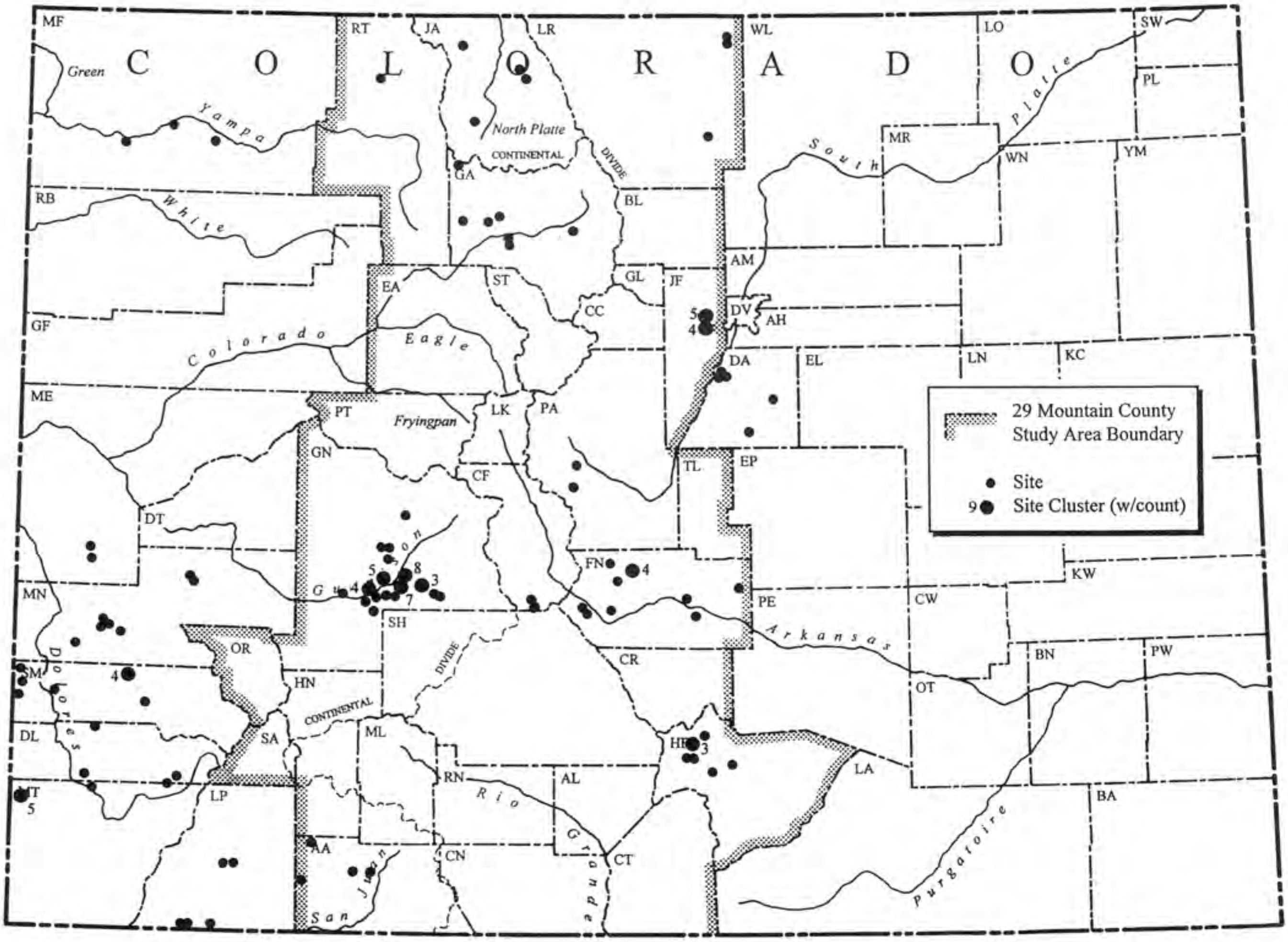

Figure 9.3. Quartzite sources in the uplands of Colorado.

also one of the smallest sites in the database where a single quartzite boulder was worked (5GN339).

Significant numbers of quartzite sources also occur in Fremont, Jefferson, Grand, and Jackson counties, and in scattered locations elsewhere. One of the larger sources in northern Colorado, for example, is the Windy Ridge quarry near Rabbit Ears Pass, which exhibits literally hundreds of pits representing huge labor investments in removing the sandstone caprock to extract the quartzite (an orthoquartzite, according to Cassells [1995:231–232]; also see Benedict 1990). As is true in many parts of the Front Range and west of the mountains near the Utah border, the Windy Ridge quartzite is exposed in an outcrop of the lower Cretaceous-age Dakota group. Scores of other quartzite sources are present in Colorado outside the 29 central counties, such as on the Uncompahgre Plateau and in southeastern Colorado, but are at relatively low elevations.

Igneous Rocks

Fine-grained to glassy volcanics usable as toolstone are not particularly abundant in Colorado, totaling 15 recorded sources of which 13 are in the 29 mountain counties (Figure 9.4). Specific materials utilized include basalt and rhyolite with 5 sources each, andesite and obsidian with 2 recorded sources each, and 1 welded tuff source. Contrary to expectations, not all such sources are in the southern portion of the mountains where volcanic deposits predominate, as quarries have been recorded in North Park, Middle Park, and Taylor Park in Gunnison County, just to name three. The largest site in the database is a rhyolite source covering over 3,240 acres (1,313 ha) at elevations up to 11,600 ft (3,536 m) on the Mineral-Rio Grande county line. It occurs in ash-flow tuffs of late Oligocene age (formation uncertain; site form data and Tweto [1979]).

Both obsidian outcrops are on the flanks of Cochetopa

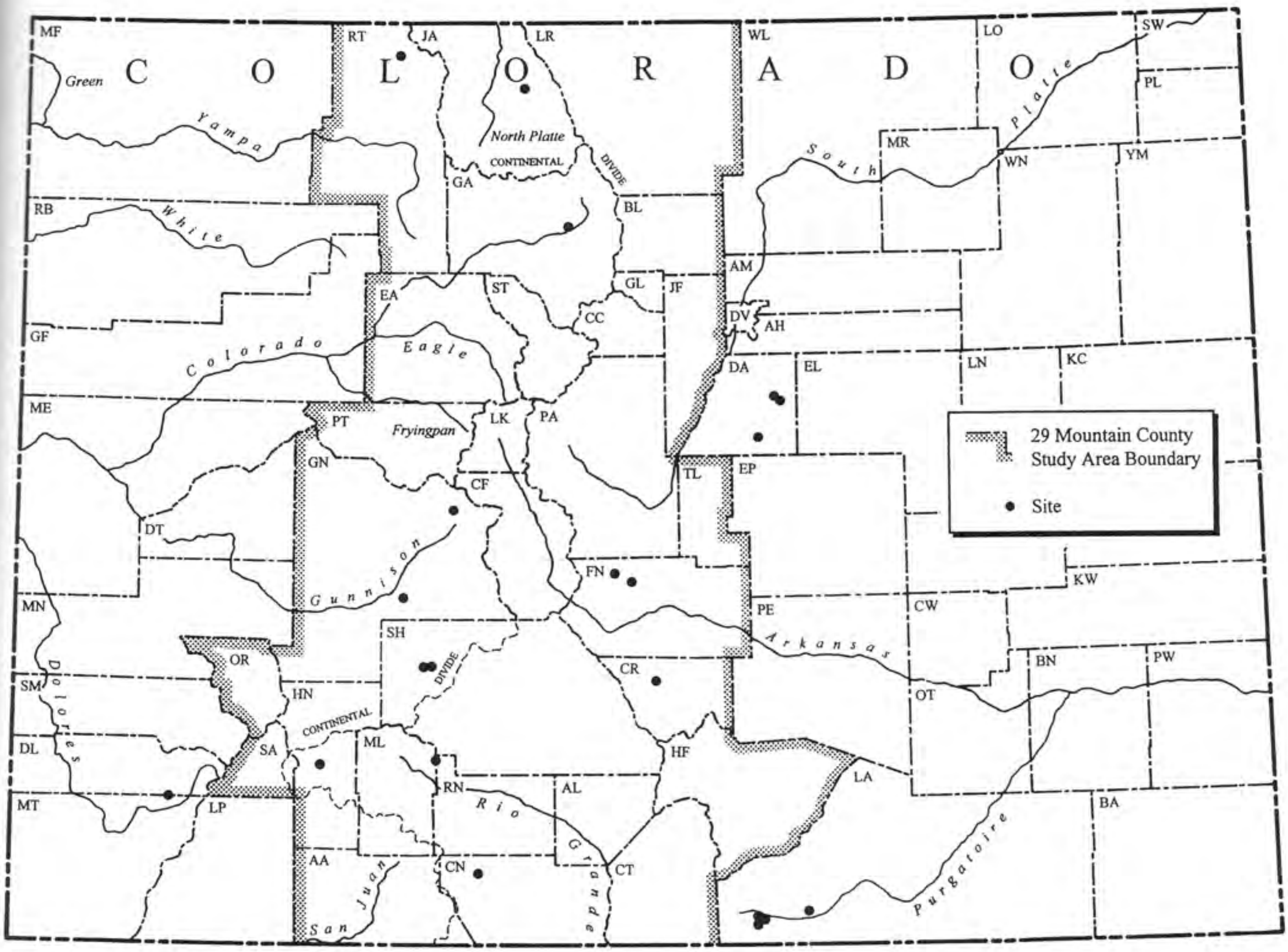

Figure 9.4. Igneous rock sources, including obsidian, recorded in the Colorado mountains.

Dome in Saguache County, in quartz latitic lavas of late Oligocene age (Tweto 1979). Even though no quarrying or workshop debris has been found at those sites, the trace element signature of this obsidian has been matched in collections from sites in adjacent counties (e.g., Montgomery et al. 1986). Other small sources of obsidian have been reported from the San Juan Mountains (e.g., Burns 1981) but, to date, no additional quarries have been confirmed.

Miscellaneous Material Types

Five other material types complete the inventory of toolstone sources (Figure 9.5). Siltstone accounts for 8 of these sources, all of which are outside the 29 mountain counties in western and southwestern Colorado. They outcrop there in the Upper Cretaceous age Mesa Verde group (Gordon et al. 1983:13–15). The term siltstone also has been used to describe the dark gray to black, fine-grained toolstone found on the Park Plateau around Trinidad, but argillite may be a more accurate identification for this material. One argillite-siltstone quarry has been recorded about 6,000 ft elevation in Las Animas County. This source probably occurs within the Raton formation of Upper Cretaceous and Paleocene age (Tweto 1979).

Granitic rocks are common finds as ground stone artifacts in the mountains, but only one possible quarry for this material has been recorded, in Gunnison County. Even this source is questionable, but the description of materials on the site form renders an off-site evaluation difficult. Kvamme (1977) describes another possible source of material for grinding stones, in the hogback country west of Fort Collins in Larimer County. Large, apparently ancient pits at this site are suspected sandstone quarrying features. Located within the Ingleside formation (Permian), the site contrasts with Historic period quarrying of sandstones in the nearby Lyons formation (also Permian age), although prehistoric exploitation of the latter also is documented (e.g., Cassells 1995).

One hematite source in western Eagle County represents the only mineral pigment material in the database. This source is in the Leadville limestone of Mississippian age. Again, site documentation clearly underrepresents the frequency with which indigenous groups must have utilized such resources. Casual surface collecting may have been a more typical procedure than quarrying of concentrated deposits, however.

Finally, three lithic sources in the site files did not include a description of the material type—two are in Larimer County and one is in Huerfano County. In the latter case, known quartzite sources virtually surround the unspecified quarry and suggest a probable material type, but no such speculation is warranted for the Larimer County sites.

SUMMARY DATA

Putting these data together, the aforementioned clustering in Fremont (26 quarries), Grand (41 quarries), and Gunnison (44 sites) counties is reinforced (Figure 9.6). Combined, these three areas encompass fully 47 percent of the 237 sites in the sample, and nearly 62 percent of the sources in the 29 mountain counties. Sampling error is an unlikely explanation for this clustering as no more than 5 percent of these three counties has been formally surveyed. Another measure of the abundance of toolstone sources is to compare the number of recorded quarries with the total number of prehistoric sites in each county (excluding isolated finds). The same three counties also top this accounting: quarries constitute about 8.5 percent of the sites in Fremont County, 7 percent in Grand County, and 6 percent in Gunnison County.

In locational terms, elevations of all sources in the sample range from 5,200 ft (1,585 m) at a chalcedony quarry in the Larimer County foothills to 11,680 ft (3,560 m) at the two chert quarries on the Continental Divide in Saguache County. Average elevation is 7,787 ft ± 1,255 ft (2,373 m ± 383 m; one-sigma range), and 10 sources exceed 10,000 ft (3,048 m) in elevation. Quarry sizes range from 8 sq m at a site in Roxborough State Park in Douglas County, to 3,244 acres (1,313 ha) at the rhyolite quarry on the Mineral-Rio Grande county line. Average size is 53 acres (21.5 ± 119.3 ha; one-sigma range), which translates to a site roughly 463 sq m.

However, the huge standard deviation suggests that quarry size is governed more by geological and other natural factors, rather than by patterned human behavior.

Although the geological formation was specified in only 21 cases, careful reading of the site forms suggests a more general but, perhaps, more useful breakdown is possible—namely, distinguishing between primary bedrock sources and secondary sources in terraces, pediment gravels, alluvial fans, stream beds, and the like. In the 29 mountain counties 135 sources are primary, 34 are secondary, 2 sites have both kinds of source material, and 9 sites have descriptions too vague to make a determination. An additional 46 primary sources and 12 secondary sources are in the high-elevation sample outside the mountain counties. All told, over 75 percent of all sources in the database are at primary bedrock outcrops.

Activity Analysis

As previously mentioned, details on quarrying activity generally were not provided on the site forms. The presence of quarrying pits was specifically mentioned at 17 sites, at which typically only 1 to 3 pits were noted; 12–15 pits are present at 3 sites, above which the number of pits jumps drastically to uncounted numbers at the Trout Creek chert source and "100s" at the Windy Ridge quartzite quarry. Pits for heat treatment of raw material were identified at Trout Creek during test excavations (Chambellan et al. 1984), and other surficial evidence of intentional thermal alteration was mentioned at 5 additional sites.

In general, core reduction strategies were not detailed on most site forms. However, 69 sites were described as having bifacial cores or bifacial blanks or preforms present, suggesting a general bifacial reduction strategy was represented at a minimum of 29 percent of the quarries in the sample. At 10 sites, a split cobble approach was mentioned. Blade cores were specifically noted at three quarries, and randomly flaked cores were described from two quarries. Two other quarries in Grand County yielded what were described as tortoise cores, suggesting the use of a Levallois-like reduction technique (e.g., Oakley 1956:49–54). At a basalt quarry in Conejos County, the archaeologist suggested raw "block transport" down the mountain had occurred more frequently than on-site reduction. In general, it would not be advisable to draw any conclusions or extrapolations about the core reduction strategies summarized above given that the typical site form failed to provide any such data whatsoever.

Compiling evidence for nonquarrying activities at lithic sources was a more successful endeavor, in that most site forms were relatively complete in documenting the presence of tools and features observed at the quarries. Interest in this aspect of the archaeological record stems from the recognition that, ethnographically, hunter-gatherer groups often follow an embedded procurement strategy for lithic materials, typically gathering raw materials for implements "incidentally to the execution of basic subsistence tasks" (Binford 1979:259). Observation of such artifacts as grinding tools and projectile points within quarries should be common if subsistence pursuits held priority over lithic procurement in prehistoric land-use strategies.

The results of the present study, however, in terms of nonquarrying features are quite diverse but not particularly abundant. Of the 35 sites where such features were noted

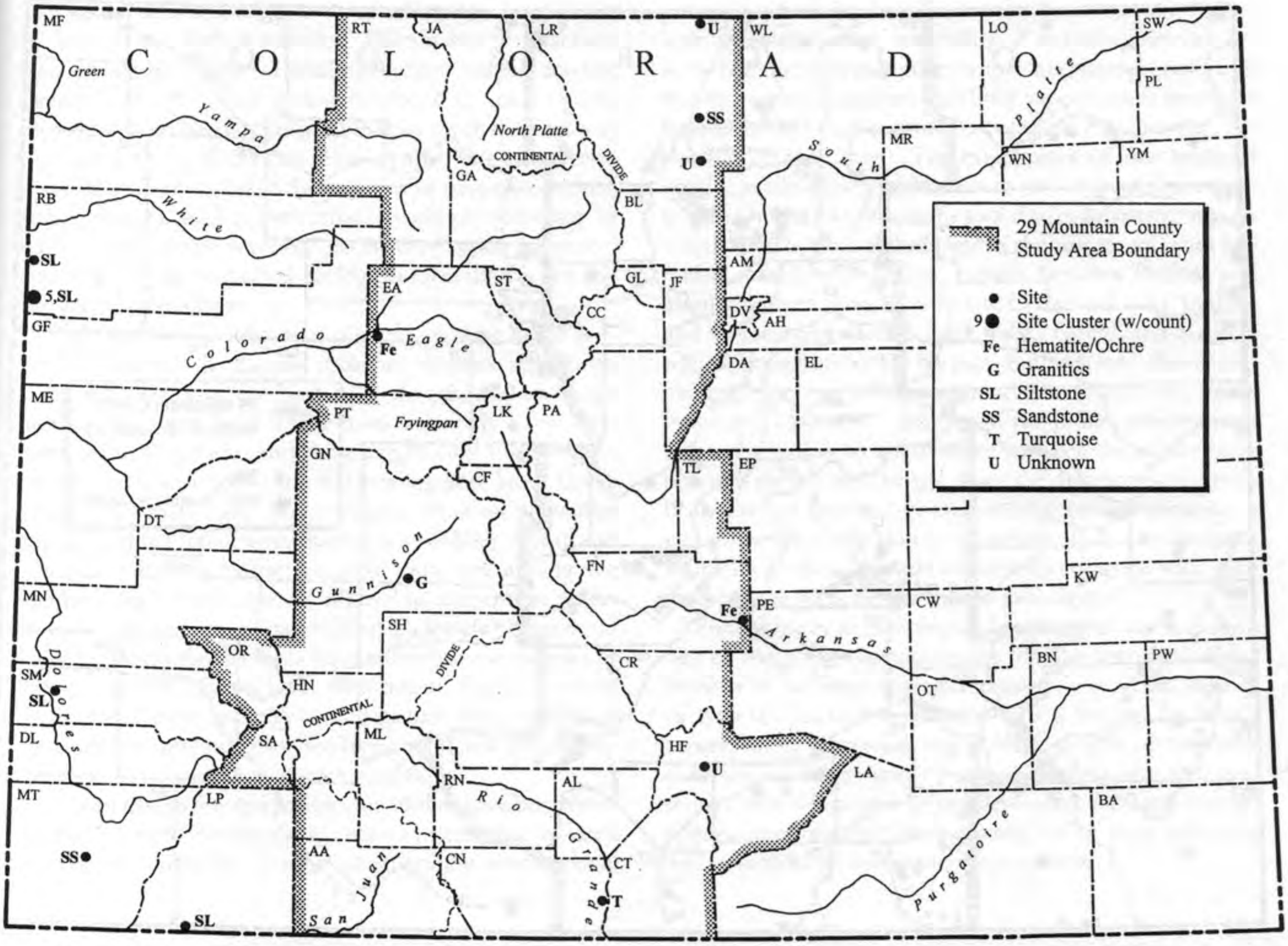

Figure 9.5. Miscellaneous sources.

(i.e., 15 percent of the quarries in the database), 18 have definite firepits or cobble concentrations suspected to be firepits, and 3 sites have ash or charcoal stains. Six sites exhibit rock cairns, 6 sites have simple rock alignments, and 4 quarries co-occur with stone circles. Two lithic sources in Grand County, upon excavation, yielded the remains of simple mud-and-stick huts (Wheeler and Martin 1982, 1984), and a third quarry in the same region exhibited three post molds from a structure of uncertain function. One site in Moffat County has two large stains suggested to be pithouse remnants. Single occurrences of a rockshelter, burial, trail, rock art, a depression, and an Anasazi habitation complex round out the inventory of nonquarry features.

Another way to assess the prevalence of nonquarrying activities at these sites is to look at both tool diversity and specific tool classes. In considering the categories of biface, uniface, and hammerstone as classes directly related to quarrying and core reduction activity, the presence of additional tool classes then may indicate that other activities took place. Of course, the more classes represented, the more likely that nonquarrying activities actually occurred. Up to ten tool classes are present at the 237 sites in the sample—more than ten classes probably are present at some quarries but descriptions such as "some tools" and "many tools" prevented a more exact accounting. Twenty-nine sites (12 percent) have four or more tool classes present and, therefore, probably hosted activities other than toolstone procurement.

Turning to specific tool categories, only 21 site forms (9 percent) mentioned the presence of hammerstones and 1 other site exhibited a probable anvil. No other evidence of quarrying tools such as wedges was mentioned; of course, perishable tools such as wood or antler digging sticks, levers, and punches would not be expected other than from excavated contexts (e.g., Metcalf et al. 1991:42–48). Thirty sites yielded grinding implements and nine had ceramic scatters which, by themselves, probably can be taken as evidence for nonquarrying activities. Seventy-two sites (30 percent) have

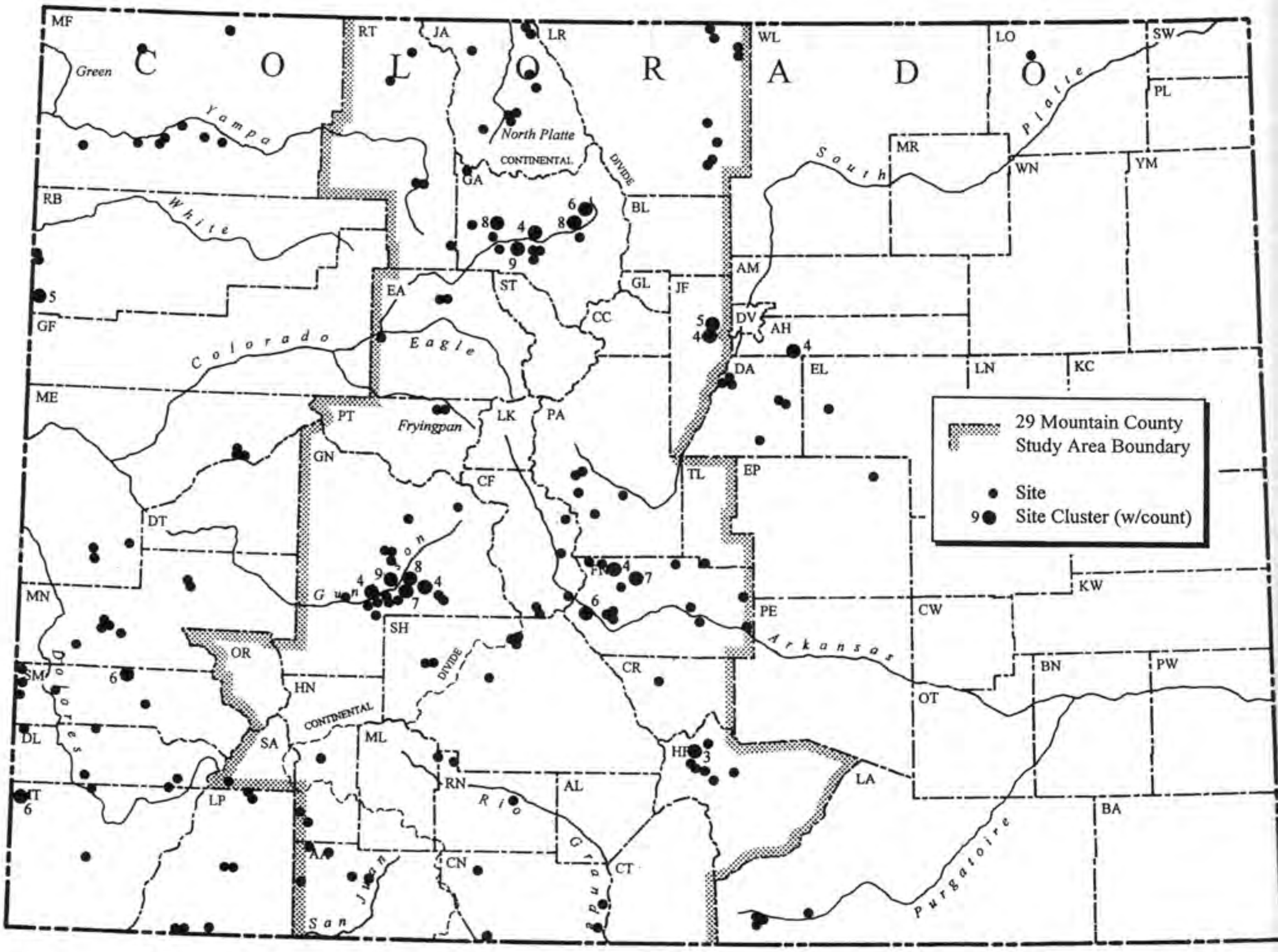

Figure 9.6. All recorded toolstone sources combined.

projectile points or grinding tools as the most obvious evidence for food procurement activity, but 146 quarries (62 percent) have at least one tool not obviously for lithic procurement tasks (scrapers and generic flake tools are most common). These data lend only moderate support to the observation of the primacy of subsistence activities over lithic procurement in ethnographic studies, but more excavations are needed to test the accuracy of these tool frequency figures.

Total tool densities reach the uncounted "hundreds" at several sites, and 29 sites yielded at least ten tools total regardless of the class(es) represented. Combining data from both features and artifacts, 52 sites (22 percent) have relatively clear evidence for nonquarrying activities. As an aside, noting that 12 site forms mentioned the presence of choppers, one wonders if these "tools" might actually be production blanks, since choppers seem to be quite rare in the author's personal experience in the mountains. In going back through the records, 11 of those 12 sites were recorded more than 12 years ago when, perhaps, the use of functional labels for tools was subject to less scrutiny.

Lastly, evidence for the presence of lithic materials other than those being quarried at each site was tabulated. The idea here is that materials from known sources document the movement of prehistoric groups across the landscape and, given sufficient data, this information can be used to begin documenting territorial ranges, group interaction, and the like. Among the 237 sites in the database, 91 (about 38 percent) contain one or more material types other than those which were being procured on-site. Thirteen of these 91 sites yielded obsidian artifacts (excluding the Cochetopa Dome source area), with which group movements and exchange systems can be more easily addressed.

DIRECTIONS FOR FUTURE RESEARCH

While there is little doubt that the quality and reliability of information in OAHP's computerized database is variable at best, the trends noted above certainly suggest a number of avenues for further research. From a strictly practical standpoint, the exercise of reading through roughly 200 site forms filled out over a period of about 30 years clearly showed that archaeologists need to do a much better job of describing the artifacts and features observed on surveys. Providing a laundry list of the presence of uncounted cores, flakes, bifaces, and hammerstones without bothering to write even a single sentence about core types, reduction strategies, or the suspected geological formation is not doing good archaeology.

Secondly, too few rigorous mineralogical or other geological analyses of specific toolstone sources have been completed to permit the kinds of settlement and exchange studies advocated here. There have been only a few such analyses in Colorado, and those are limited to the larger source zones such as for the Kremmling and Trout Creek cherts (Heinrich 1984; Miller 1991a). Neutron activation analysis (Mauz 1993), x-ray fluorescence (Miller 1991a), and ultraviolet light response (Cassells 1995) are among the methods far too infrequently utilized in attempts to differentiate among source materials in Colorado. Further, at only 19 sites in the database have either test excavations or large-scale excavations been undertaken. Future work at toolstone sources *invariably* should include the expertise of geologists or mineralogists. See Ives (1985) for a useful statement on the importance of such studies.

Given that so few quarry-specific studies have been done in the Colorado mountains, it is not surprising that research on the organization of lithic procurement among local groups has been limited. Regionally, however, such studies have generated some interesting, if not controversial, results. For example various measures and interpretations of transport costs associated with lithic procurement strategies have been included in some recent quarry studies (e.g., Elston and Raven 1992). The importance of raw material quality, availability (e.g., distance to source), and abundance in the manufacture of specific tool classes versus the organization of the lithic technology in prehistoric societies has fueled considerable debate, notably between Binford and Gould (Binford 1989; Binford and O'Connell 1984; Binford and Stone 1985; Gould 1980, 1985; Gould and Saggers 1985, among others). For his part, Binford (1979:260) deemphasizes distance as a component of transport cost in the Nunamiut case as ". . . the cost of the [lithic] procurement was not referable to the distance between the source location and the location of use, since the distance would have been traveled anyway," given that lithic procurement was a task embedded in subsistence pursuits. How procurement strategies in the Colorado mountains compare with such models have yet to be adequately investigated.

Finally, many archaeologists familiar with the archaeology of the Colorado mountains may be surprised at the number of toolstone sources recorded there so far. Most of us typically make reference only to a few of the larger sources when discussing the possible origins of materials observed on other types of sites. Hopefully, the data presented here—however incomplete—will enhance our interpretations of both the prehistoric use of lithic resources and of settlement systems in the mountains.

Appendix 9.1
Catalog of Individual Lithic Sources

County/Site Number	Material(s)**	Elevation (ft)	Comments
Archuleta County			
5AA758	Chert and quartzite	7,520	Obsidian artifacts present
5AA987	Quartzite	8,820	Gray, maroon, and purple colors
5AA1150	Chert	7,320	Red and brown colors
5AA1165	Quartzite	8,820	
5AA1556	Chert and quartzite	7,720	
Arapahoe County			
5AH411*	Petrified wood	6,000–6,100	Tan, brown, red, black colors; Parker petrified wood (PPW)
5AH682*	Petrified wood	5,975–6,100	Tan, brown, red, black, PPW; obsidian also present
5AH684*	Petrified wood	6,000–6,100	Tan, brown, red, black, PPW
Chaffee County			
5CF84	Yellow-brown and dusky red chert	8,700–10,000	Trout Creek source; obsidian and ceramics present
5CF188	Chert	8,080	
5CF204	Quartzite	8,490	
5CF206	Chert and quartzite	8,800	
Conejos County			
5CN35	Gold chert	9,680	Obsidian artifacts present
5CN146	Basalt	10,600–11,200	"Block transport" suggested
5CN230	Red and purple chert	7,980	Gray to tan cortex
Custer County			
5CR54	Red andesite?	8,080	"Volcanic material" source
Douglas County			
5DA173*	Chert, quartzite, petrified wood	6,287	Multicolored materials
5DA305*	Petrified wood, quartzite, jasper	6,380	Yellow jasper; other colors not noted
5DA534*	Quartzite	6,150	
5DA535*	Petrified wood, quartzite, jasper	6,170	
5DA909*	Rhyolite	6,620	
Dolores County			
5DL311*	Chert	6,760	
5DL1325*			see 5MT10357
5DL1552*	Gray quartzite	6,935	Ceramics also present
5DL1648*	Quartzite	7,800	Pale whitish gray quartzite
Eagle County			
5EA317	Red hematite	6,600	Rock art also present
5EA779	Chalcedony	8,400	Similar to Kremmling chert
5EA782	Chalcedony	8,320	Similar to Kremmling chert
Elbert County			
5EL257*	Petrified wood	6,600	Brown-gold
El Paso County			
5EP1288*	Petrified wood	6,380	Brown
Fremont County			

5FN48	Yellow chert	6,900	
5FN58	Chalcedony	8,050	Gray, brown, white, pink colors
5FN64	Chert and quartzite	6,100	Tan-yellow quartzite; white, pink, red, purple, tan chert
5FN72	Chert and chalcedony	7,480	"Jasper Hill"; red, yellow, black-colored
5FN177	Chert and quartzite	5,350	White, tan, gray chert; tan, pink, green, gray, white quartzite
5FN354	Jasper and chalcedony	8,535–8840	Brown, red, white, black, "translucent" jasper
5FN387	Jasper	8,200	Brown, red, yellow, variegated colors
5FN438	Quartzite	8,570–8,660	Red, brown, white, gray colors
5FN440	Pink quartzite	8,530	
5FN449	Quartzite	8,630	Tan, red, pink, gray, white colors (especially tan and red)
5FN468	Quartzite	8,485	Red, white, brown, tan, gray colors
5FN506	Basalt	8,040	
5FN507	Chert and quartzite	7,160	Multicolored quartzites
5FN508	Chert, quartzite, chalcedony	7,160	Yellow, red, gray mottled chert; red, pink, yellow chalcedony; multicolored quartzites
5FN719	Red quartzite and gray chert	6,080	
5FN777	Chalcedony	8,960	Red, white, blue colors
5FN782	Quartzite	9,000–9,040	Gray, white, tan, pink colors; obsidian also present
5FN785	Jasper and quartzite	7,960	Dark gray-black quartzite; red agatized jasper; "oatmeal chert" with quartzite inclusions
5FN867	Quartzite	9,150	Red and brown colors
5FN868	Chert	9,049	Butterscotch, maroon, white, gray, dark brown, olive colors
5FN870	Chert	9,100	Brown and maroon colors, similar to Trout Creek chert
5FN874	Andesite	9,251	Tan and purple colors
5FN875	Tan-brown chert	9,200	
5FN985	Chert	8,000	Yellow-olive, buff, gray, red, pink, brown, white colors in solid, mottled and banded types
5FN986	Chert	7,880	Gray, red, gold colors: solid, banded, mottled types
5FN1023	Gold and red chert	7,000	
Grand County			
5GA5	Yellow-orange jasper	8,200–8,760	Table Mountain (TM) jasper
5GA7	Chalcedony, quartzite and petrified wood	7,400	Includes Kremmling chert (KC: mottled and white-gray-brown)
5GA50	Quartzite	7,800–8,000	
5GA100	Quartzite	7,930	Reddish and gray colors
5GA119	Red jasper	8,180	TM material
5GA120	Red jasper	7,980	Quarry status questioned by Wheeler and Martin (1984:66)
5GA122	Petrified wood and jasper	8,160–8,280	
5GA128	Jasper	8,000–8,440	Red, tan, banded green, blue colors
5GA129	Black petrified wood	8,200	
5GA130	Red jasper	8,200	TM material
5GA151	Red-brown jasper	8,200–8,293	Granby site, excavated; obsidian artifacts present
5GA153	Red(?) jasper	8,120–8,226	TM material
5GA156	Chert and petrified wood	7,964	Honey-brown petrified wood
5GA184	Chalcedony and chert	7,760	KC material
5GA186	Chert	8,160	KC material
5GA195	Chert	7,400–7,760	KC material; Barger Gulch site, tested
5GA212	Jasper?	8,040–8,180	
5GA229	Gray-brown(?) quartzite	9,200	
5GA238	Yellow and red jasper	8,000	TM material
5GA239	Yellow and red jasper	8,000	TM material
5GA252	Gold and red jasper	8,220	TM material
5GA253	Yellow and red jasper	8,140	TM material
5GA265	White and honey-brown chert	7,920	KC material
5GA266	White chert	7,920	KC material
5GA631	Chert	7,550	KC material
5GA672	Chert, basalt, jasper, and	8,000	Includes KC and TM materials

	petrified wood		
5GA680	Petrified wood and jasper	7,920–8,080	Hill-Horn site, excavated; obsidian also present
5GA685	Gray quartzite	9,000–9,350	Windy Ridge site; also recorded as 5GA872; minor amounts in brown and maroon colors
5GA846	Chert	7,340–7,440	KC material
5GA914	Chert	7,655	KC material
5GA925	Chert	7,480	KC material
5GA977	Chert	7,680	KC material
5GA1092	Petrified wood, chert, quartzite	8,000	
5GA1143	Chalcedony, chert, quartzite	7,460–7,500	May be same site as 5GA747
5GA1144	Chert	7,520–7,720	KC material; excavated
5GA1172	Chert	7,680	KC material; bone, antler, and juniper quarrying tools excavated
5GA1174	Chert	7,720	KC material
5GA1187	Chert	8,240	KC material
5GA1201	Tan and orange chert	8,420	KC(?) material
5GA1424	Chert	8,000	KC material
5GA1852	Chert	8,030	KC material
Gunnison County			
5GN1	Quartzite	7,680	
5GN6	White-pink quartzite	7,410	
5GN50	Quartzite	7,570–7,600	
5GN194	Red quartzite	8,110	
5GN201	Quartzite(?)	7,720	
5GN220	Brown quartzite	7,650–7,670	
5GN339	Quartzite	9,640	One boulder quarried
5GN340	Quartzite and chert	9,520	
5GN383	Red quartzite	8,140	
5GN397	Quartzite and chert	8,320–8,520	White and yellowish white quartzites; white and white-banded cherts
5GN433	Chert	8,840	Brown, white, maroon, and green
5GN435	Brown and green chert	8,800	
5GN436	Gray quartzite	8,340	
5GN447	Chert	8,800	Brown, white, red-maroon, black colors
5GN450	Reddish brown and green chert	8,840	
5GN814	Rhyolite	7,980–8,030	
5GN842	Gray quartzite	8,010–8,030	
5GN850	Gray quartzite	7,900–8,120	
5GN852	Yellow chert and gray quartzite	7,920–8,120	
5GN890	Quartzite	7,820–8,400	
5GN901	Tan chert and gray quartzite	7,900–8,040	
5GN920	Petrified wood	8,400–8,600	
5GN944	Quartzite	8,960–9,080	Pink, white, brown, and mottled yellow
5GN950	Quartzite	8,600–8,760	Brown, white, gray, red, and multicolored
5GN951	Gray and pink quartzite and granitics	8,520–8,760	
5GN956	Tan and other quartzite	8,120–8,400	
5GN958	White quartzite	8,280–8,460	
5GN972	Quartzite and chalcedony	7,880	Yellow and gray quartzites
5GN988	Gray-white quarzite	8,400–8,500	
5GN989	Quartzite	8,220–8,400	
5GN1002	Jasper, quartzite, and petrified wood	8,120–8,200	
5GN1004	Quartzite	8,200–8,320	Multicolored quartzites
5GN1592	Reddish brown and white quartzite	8,720	
5GN1744	Light brown rhyolite(?)	9,420	"Granular volcanic" rock
5GN1762	Quartzite	7,780	
5GN1876	Quartzite	8,600	
5GN1877	Quartzite	8,200	
5GN1897	White, purple, red quartzite	8,040	White quartzite dominant
5GN1898	White, red, pinkish quartzite	7,980	White quartzite dominant
5GN1899	White, red, purple quartzite	8,000	White quartzite dominant
5GN2091	Quartzite	8,080	
5GN2198	Gray quartzite	7,900	Obsidian also present
5GN2414	Quartzite and chert	8,000	Obsidian also present

5GN2419	Quartzite and chert	8,045	White and gray quartzite; various chert colors including red
Huerfano County			
5HF81	Unknown	7,180	
5HF122	Quartzite	6,607	
5HF133	Quartzite	7,260	
5HF294	Gold and red quartzite	7,880–7,960	
Hinsdale County			
5HN7	Chert	11,200	
5HN132	"Weak red" rhyolite	9,960	
Jackson County			
5JA1	Quartzite	8,340	
5JA22	Chert	8,900	Similar to cherts at 5RT89
5JA218	Quartzite	8,180	
5JA235	Chert/petrified wood and quartzite	8,260	Brown cryptocrystalline rock
5JA256	Petrified wood	8,250	
5JA293	Petrified wood	8,250	
5JA320	Petrified wood	8,180	
5JA349	Chert, basalt, and quartzite	8,230	
Jefferson County			
5JF65	Petrified wood, chert, and quartzite	5,880	
5JF68	Quartzite and chert	5,730	
5JF69	Petrified wood, chert, and quartzite	6,000	
5JF169	Petrified wood, quartzite, and jasper	6,855	Brown petrified wood, reddish brown quartzite, yellow-brown jasper
5JF216	Quartzite	5,800	
5JF777	Jasper and quartzite	6,000	Yellowish brown to maroon dominant
5JF778	Jasper, chert/chalcedony and quartzite	6,000	Yellowish brown to maroon dominant
5JF779	Jasper and quartzite	5,960	Yellowish brown to maroon dominant
5JF780	Quartzite, jasper, and petrified wood	6,000–6,020	Yellowish brown to maroon dominant
Las Animas County			
5LA5935*	siltstone/argillite	6,540	Black chert; gray silstone-argillite
Logan County			
5LO34*	Chalcedony and chert	4,370	Flattop Butte source
La Plata County			
5LP2085*	Quartzite	6,790	Anasazi potsherd present
5LP2221*	Quartzite and chert	6,700	
5LP2273*	White and gray chert	11,200	
5LP2274*	Chert	11,160	White, gray, and red colors
5LP2644*	Gray quartzite	6,197	Anasazi habitation present
5LP3380*	Chert, quartzite, and siltstone	6,150	
Larimer County			
5LR47	Quartzite	5,500	
5LR54	Unknown	5,340	
5LR111	Unknown	6,440–6,480	
5LR148	Sandstone	Unknown	Site form doesn't match description by Kvamme (1977)
5LR269	Quartzite and chert	5,500	
5LR272	Quartzite and tan chalcedony	5,404	
5LR955	Red chalcedony	5,200	Red and white inclusions
5LR1490	Chert	7,080–7,180	Tabular violet and gray colors with white linear inclusions
Mesa County			
5ME5969*	White and gray chert	7,420	
5ME6613*	Chalcedony	9,980	Clear, gold and tan colors
5ME7001*	White quartzite	8,220	Use of source questionable
Mineral County			

5ML62	Pink rhyolite	11,000–11,600	Also has site 5RN169; largest site in database
Moffat County			
5MF928*	Chalcedony and chert	6,704	Cross Mountain site; reddish brown, red, black and other colors; also has ceramics
5MF1674*	Chert	7,500	"Pumpkin" and red-white colors
5MF2677*	Chert	6,240	
5MF2942*	Quartzite	5,980–6,180	Purple, maroon, red, and pink colors
5MF3461*	Chert	6,165–6,765	Yellow ("pumpkin"), brown, red, dark gray, green, purple colors; also has ceramics
5MF3524*	Quartzite and chert	6,460	Purplish gray and white quartzite with yellow and red staining; chert colors not noted
Montrose County			
5MN3416*	Quartzite	6,360	
5MN3417*	Quartzite	6,200	
5MN3429*	Quartzite and chert	6,400	Brown mottled chert; tan quartzite
5MN3488*	Quartzite	6,060	
Montezuma County			
5MT8239*	Chert	6,130	Mottled yellow color with black-brown bands and swirls; also has Anasazi ceramics
5MT9299*	Quartzite and chert	6,050	White, gray, reddish, and green quartzites; ceramics also present
5MT9801*	Quartzite	6,060	
5MT10357*	Welded tuff, quartzite and chalcedony	10,000	Also has site 5DL1325; pink and white quartzite; green welded tuff
5MT10512*	Quartzite	6,650	
5MT10574*	Oolitic chert and quartzite	6,170	Tan, green and red banded chert; cream-colored quartzite
5MT11633*	Quartzite and chert	6,200–6,260	White and brown chert; gray quartzitic sandstone
Park County			
5PA18	Petrified wood	8,700	
5PA125	Deep red quartzite	8,945	
5PA148	Agate	9,140	
5PA486	Chert and quartzite	9,200	Gold dendritic chert similar to Trout Creek source; pink and white quartzite; obsidian present
5PA521	Jasper, chalcedony	9,150	
Pitkin County			
5PT87	Chert, chalcedony	8,080	White chert-chalcedony, resembles Kremmling chert
5PT88	Chert, chalcedony	8,060	White chert-chalcedony, resembles Kremmling chert
Rio Blanco County			
5RB1719*	Tan siltstone	6,200	
5RB1723*	Tan siltstone	6,120	
5RB1726*	Siltstone	6,000	Tan and banded gray-brown colors
5RB1729*	Siltstone	6,160	Tan and banded gray-brown colors
5RB1730*	Siltstone	6,260	Tan and mottled gray-brown colors
5RB2856*	Chert and siltstone	7,280–7,360	Brown algalitic chert; brown and gray solid chert; tan siltstone; obsidian also present
Rio Grande County			
5RN169			See 5ML62
5RN262	Jasper	8,100	
5RN278	Chert/jasper	9,340	Gold, orange, brown, and red colors
Routt County			
5RT82	Basalt	9,650–9,725	
5RT89	Chert	8,720	Yellow-brown and white-clear colors, the latter similar to Kremmling chert and to cherts at 5JA22
5RT93	White quartzite	10,400	Also has site 5RT48
5RT452	Chalcedony	7,300	
5RT453	Chalcedony	7,180	

San Juan County			
5SA67	Gray chert	8,840	
Saguache County			
5SH1113	Green chert	11,680	On Continental Divide
5SH1114	Chert	11,680	Green, gold and brown colors; on Continental Divide
5SH1125	Jasper and chert	11,000	Red and gold jasper; cream-colored chert
5SH1318	Gray-black obsidian	9,000	Cochetopa Dome source; no artifacts observed
5SH1319	Gray-black obsidian	8,970	Cochetopa Dome source; no artifacts observed
San Miguel County			
5SM884*	Chalcedony, chert, quartzite, siltstone	6,080–6,180	Gray quartzite; other colors not noted
5SM2042*	White quartzite	7,600	
5SM2054*	White quartzite	6,360	
5SM2116*	Chert and quartzite	6,480	Gray and tan quartzite; green and mottled gray-tan chert
5SM2124*	Chert and quartzite	6,850	Gray and white quartzite; gray, white and green chert
5SM2412*	White quartzite	7,050	
5SM2654*	Quartzite	7,000	Includes gray-tan mottled type
5SM2656*	Gray quartzite	7,250	
5SM2668*	Chert and quartzite	6,800	Gray, red-gray, green, gray-green, white and red chert; gray, white and pink-gray quartzite
5SM2672*	Red chert	6,800	Other colors present
5SM2673*	Chert	6,800	Off-white and greenish gray colors
Teller County			
5TL101	White chert	6,240	

* = site outside 29 mountain counties
** = color specified if known (see Comments for diverse colors)
[additional details on individual sites available upon request]

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