PREHISTORIC LITHIC MATERIALS ON CEDAR MESA, SOUTHEASTERN UTAH: SOURCE IDENTIFICATION AND ASPECTS OF REGIONAL DISTRIBUTION

by

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ABSTRACT: During the course of the archaeological survey project conducted between 1972 and 1973 on Cedar Mesa, southeastern Utah, the problem of the sources of prehistoric Anasazi stone tool material and the implications of material distributional variation through time was studied. A methodology for differentiating discrete material types was employed based on macroscopic analysis and differentiation of recovered site materials and comparison with identified potential source or actual prehistoric quarry material. Ten discrete material types, from on and around Cedar Mesa and from as far away as 40 miles eastward, could be identified to at least the level of source geologic formation. Discontinuities between the Basketmaker II, Basketmaker III, and Pueblo occupation phases on the mesa, implied by marked temporal differences in the frequencies of certain types, correlate with and support available dendrochronological and ceramic evidence.
A good deal of specialized attention has been given in recent years, within the archaeological and geological fields, to the identification and discrimination of source-specific stone or lithic material occurrences. The archaeologist, of course, is often interested in pinpointing the source of certain stone types, such as cherts and obsidians used in making the tools and debitage found at prehistoric sites. Thin section analysis or quite elaborate laboratory techniques yielding trace element profiles are usually necessary to unambiguously pinpoint the exact source of a particular stone type found in an archaeological context. Much literature has arisen from work in this area, a notable example of which is the identification of obsidian from Government Mountain in northern Arizona as a rather widely used prehistoric tool material and the application of this knowledge in site dating by obsidian hydration measurement. In general, such studies are time consuming and expensive, and the studies tend to be at a detailed and fine level of analysis.

At more general levels of analysis, such as where a wide range of stone material from an archaeological area is being classified, the time and expense necessary in the employment of such techniques cannot be supported,
nor can the use of such detailed level analyses necessarily be justified on methodological grounds.

The purpose of my presentation today is to briefly describe a stone or lithic source study which produced useful results, at least at a general level, through a macroscopic classification and discrimination of archaeological site and source stone materials, employing no laboratory techniques.

Between 1972 and 75 I participated in the Cedar Mesa Project, a sampling survey conducted by W. D. Lipe and R. G. Matson of a large upland area in southeast Utah. The twenty by twenty mile pinyon-juniper woodland project area is located on Cedar Mesa or the Grand Gulch Plateau, just north of Mexican Hat and the San Juan River, sixty miles west-northwest of Four Corners. My study of lithic material source identification, which was conducted as something of an aside to the parent sampling project, had the principal objectives of (1) defining the types of lithic material used prehistorically on Cedar Mesa in terms of ability to be discriminated and identified with potential source occurrences and (2) identifying the source areas of these various material types in a narrow enough way to be useful to the study of prehistoric settlement of the Grand Gulch Plateau.
The methodological approach of the lithic source study, outlined in Fig. 1, was twofold: Initially, lithic material from sites on the Mesa, as it began to be available after collection and fieldlab processing, was studied in an attempt to sort out and separate distinct sets of material which could be expected to correspond to distinct sources on or around the Mesa. This was done macroscopically, based on the various materials' more obvious physical and mechanical properties. The materials studied encompassed a rather wide variety of chert, jasper, and quartzite types, virtually all from unmetamorphosed sedimentary sources. A tentative typology of stone material types was developed which was valuable in assessing the range of material used here prehistorically and in learning the more characteristic forms within this range. However, this initial typology had serious drawbacks due to the fact that about half of the material types could be found to intergrade into one another, in some way, if enough pieces were examined, and there was at this initial stage no way of knowing for sure which sets of material characteristics actually indicated source specificity.

At this point it became necessary to implement the second aspect of the study, the field search for actual occurrences of tool grade lithic
material on and around Cedar Mesa. Reasonable success in this search
came slowly over several seasons after numerous weekend excursions to locations
not covered by the main project sample survey, our growing familiarity with
the geology of the region, occasional good luck, and the invaluable help of
several interested local contacts.

Although the one thousand plus square mile area which had to be considered
could have been a discouragingly large area within which to attempt to gain a
comprehensive knowledge of the location of tool-quality lithic sources, there
was a key which made the task a practical one. This key was the horizontal
or only mildly folded sedimentary geology of the study area and the rather
consistent lithology within a particular sedimentary unit or facies over considerable
distances, often much greater than the width of the study area itself. That
is, a particular chert or quartzite could be expected to be found only in a
certain stratigraphic position but would often be widespread within the
geologic unit at that position. Thus, the problem was not so much one of
considering total geographic area as of considering exposures of the various
geologic units in the study area and of learning the relevant lithology of
these units. This has no doubt been independently noted by many students

In all, over 60 occurrences of tool-quality lithic material were found, including in situ stratigraphic sources, secondary stream deposits, and twelve definite prehistoric quarry/workshop locations. While this is certainly not a complete inventory of specific source locations in the study area, it was sufficient to define in a useful way the source areas of all the lithic material types commonly used prehistorically on Cedar Mesa.

Combining then the results of the tentative typology of archaeological site material from Cedar Mesa with the study of source occurrences in the local region yielded a working typology of macroscopically distinguishable lithic materials with a varying but still useful degree of source-specificity. Admittedly, none of the types could be definitely correlated with a specific source locality. However, they could each be confidently (that is, after making some low-level mini-max assumptions) correlated with a relatively restricted source area with a definite orientation to the sampled habitation center of Cedar Mesa itself. For example, a particularly characteristic
brown quartzite occurred stratigraphically at the very base of the Permian Cedar Mesa Sandstone, exposed within the study area only in a thin band around the southern end of Cedar Mesa and in the lower portions of the several large canyons which flow south of the Mesa. Two other characteristic cherts were found to derive from exposures of the Jurassic Morrison Formation occurring near Montezuma Creek some forty miles east of Cedar Mesa (Fig. 2).

In all, some ten material types, encompassing most all of the varieties of lithic material used prehistorically on the Mesa, could be identified and confidently related to source areas. As might be expected, most of these types, with the notable exception of the two Morrison Formation materials, had their sources on or immediately adjacent to Cedar Mesa itself. The lithic types determined by this study are described in Appendix I.

The question can now be asked, can the typology and source information developed at this level of macroscopic analysis be useful to the more general archaeological study of prehistoric settlement in the study area? To attempt to answer this in the affirmative I will give an example drawn from an examination of lithic material from a sample of dated sites on Cedar Mesa. In this example the relative frequencies of three stone types are
compared between the three periods of Anasazi occupation on Cedar Mesa, which were: a Basketmaker II phase between A.D. 200 and 400, a Basketmaker III phase in the late A.D. 600s, and a Pueblo period occupation lasting from A.D. 1100 to 1270 (Matson and Lipe 1978). Although the continuous Pueblo occupation can be divided ceramically into four phases (Matson and Lipe, n.d.), three of dominantly Mesa Verde and one of dominantly Kayenta Branch affiliation, it has been considered as a single phase in this example.

What I will call Type A, the brown quartzizite local to the mesa, was heavily utilized during the Basketmaker II phase, constituting an average of 40% of the lithic material used during that phase (Fig. 3). It was also commonly used during the following Basketmaker III and Pueblo occupations, but dropped in frequency to 19 and 12%, respectively. On the other hand, the two Morrison Formation types, obtained from well east of the mesa, and which I'll call Types B and C, were virtually absent from the Basketmaker II occupation. During the following Basketmaker III occupation, however, Type B constituted fully 21% of the sample collection, and then dropped in frequency to 8% during the Pueblo period. Type C, though, was still virtually absent
during the Basketmaker III occupation, but was common during the Pueblo period, with an average frequency of 9%.

Although these figures can and should be refined considerably by an examination of a much larger sample of the sites collected by the Cedar Mesa Project, they do indicate marked differences in lithic source exploitation patterns between the three occupational periods on Cedar Mesa. The Basketmaker II exploitation range is much more localized than that of the following periods, lacking the indicated ties with the Mesa Verde Branch heartland area to the east of Cedar Mesa. In another way, the frequency differences of Types B and C suggest population or adaptational discontinuities between the three occupation periods on the Mesa, supporting the independent C\(^{14}\), dendrochronological, and ceramic evidence for breaks of several hundred years between occupations. Also, a closer examination of any frequency variation between the four ceramic sub-phases of the apparently continuous Pueblo occupation may shed light on the question of Kayenta versus Mesa Verde Branch cultural affiliation (Matson and Lipe, n.d.). Finally, this knowledge of differing lithic type frequencies between occupational periods should be useful in dating those sites on the Mesa lacking ceramics, architectural, or organic remains.
So, in conclusion, there appears to be considerable utility in carrying out a lithic material source study at a purely macroscopic level. And, of course, such a study can be a desirable or necessary prelude to conducting more detailed lithic source and distribution studies which can more justifiably take advantage of advancing laboratory techniques.
REFERENCES CITED

Blakeman 1975 (paper delivered at SAA meetings on macroscopic lithic source identification)

Matson and Lipe 1978

Matson and Lipe n.d.

Morris 1939

Woodbury 1954
APPENDIX I

TYPOLOGY OF PREHISTORIC LITHIC MATERIAL,

CEDAR MESA, UTAH

(This will form the basis for Appendix I. It will use some revision, and splitting, and renaming of item (12), and incorporation of some newer information)
1) **Brown Quartzite (A)**—an opaque tan to chocolate brown quartzite, sometimes containing streaks or areas of red jasper. A great range exists in degree of replacement of the original sand grains, ranging from no replacement to apparently complete replacement. Working quality hence varies greatly.

**Tools**—cores, numerous hammerstones, large and small scrapers, points and blades, utilized flakes, and waste flakes.

**Source**—Cedar Mesa Sandstone Member (of Cutler Formation)—Halgaito Formation (red slopes below white Cedar Mesa Sandstone) contact zone, exposed along south end of Cedar Mesa. Samples can be found only as far east as the west fork of Lime Creek. Samples have been found from there west to the first canyon west of Johns Canyon, and can probably be found as far west as Slickhorn Canyon. Rarely, artifactual pieces of this material show water-borne wear, as if they were obtained from the gravels of one of the larger canyons at the south end of Cedar Mesa, such as Slickhorn, Johns, or even the San Juan.

**Comments**—a fairly tough stone material. However, it can be pressure flaked and soft hammer struck. It isn’t prone to step- or hinge-fracture, but it
will do so if struck in certain ways. The material may nearly equal
in amount the sum of all other lithic types in this collection.

2) **Purple Quartzite**--an opaque purple-brown quartzite similar in many
respects to type (1), and like it can show good conchoidal fracture with
a relatively unpronounced bulb of percussion. The wide range in degree
of sand grain replacement shown in type (1) was not seen in this type,
however, perhaps due to the small sample and to the possibility of quite
a different source for this material than for type (1). Material in the
collection of this type is fairly smooth-surfaced and homogeneous.

**Tools**--small scrapers, points, utilized flakes with some pressure retouch,
a toothed piece, and waste flakes.

**Source**--undiscovered. A similar material is common in Horse Flats,
northwest of Cedar Mesa. Source may be Cedar Mesa Sandstone-Rico contact
zone exposed in Dark and woodenshoe canyons.

**Comments**--only a handful of flakes of this material were present in this
collection.
3) **Red-purple Chert**—an opaque but lustrous, off-red to brown and purple-brown (with occasional mottling of these colors) chert. Translucent in thin areas of flakes.

**Tools**—point, drills, small scrapers, small cores, utilized and retouched flakes, waste flakes.

**Source**—off south end of Cedar Mesa, in particular from area of workshop site three miles due south of the Mokee Dugway.

**Comments**—an excellent material for working. Many flakes show a very unpronounced bulb of percussion. This material might alternatively be called a "flinty jasper" by virtue of its opaque but lustrous, smooth, surface.

4) **Gray Chert**—an opaque but lustrous chert similar to type (3), but light gray to black in color, with some pieces grading to a light red-brown in color, with some pieces grading to a light red-brown color. Translucent in thin areas.

**Tools**—bifaces, points, blades, drills, utilized and retouched flakes, waste flakes.
Comments—an excellent material for working. Types (3) and (4) probably represent a continuum with a bimodal distribution of the polythetic traits upon which the types are based. The difference between the types may or may not have spatial significance.

5) Red Jasper—a pure red chert, commonly called jasper. It is opaque even in thin areas of flakes, and is somewhat lustrous, although generally less so than types (3) and (4). Color ranges from an intense light red to a brownish light red. Its surface is very smooth.

Tools—points, waste flakes, scrapers, utilized flakes, and small cores.

Source—nodules and lenses in limestone beds in lower portion of Cedar Mesa Sandstone. Exposures along south end of Cedar Mesa, along east side of Cedar Mesa (in particular from quarry site in canyon below Cigarette Spring), and at some locations in deeper canyons on Cedar Mesa proper (in particular, samples were found in a limestone bed low in Todie canyon, about one half mile above Grand Gulch). The only good sized source so far seen is that below Cigarette Spring.

Comments—an excellent material for working.
6) **Streaked Yellow-Red Jasper**—a light red, opaque, somewhat lustrous chert with yellow streaks. This material is, like type (5), commonly called jasper. It has a wavy, rather tortured looking, banded body.

**Tools**—cores, numerous hammerstones, utilized flakes, some points, waste flakes.

**Source**—exposures of Chinle Formation, and in washes, such as Kane and Grand Gulch, which drain Chinle exposures. Samples of this material found **in situ** in Mudstone-Sandstone member of Chinle one mile north-northwest of the Bears Ears in Burch canyon. Many of the artifacts in the collection of this material show water-borne wear, indicating that they were obtained from one of the larger washes, probably either Kane, Grand, or White Canyon.

**Comments**—a very poor quality material. It has a very rough fracture and is rather tough. Samples obtained from Grand and Kane washes have a great deal of internal fracturing. There are several variations on this basic type which seem to have spatial significance. There is a form with a great deal of pure yellow in it which probably comes from the west of Cedar Mesa (Carl Mahon of the Monticello BLM office reports a source of a similar sounding
material four miles south of Clay Hills Pass between Whitlwind Draw and Steer Gulch. Bill Lipe reports that jasper with a great deal of pure yellow is common in sites in the area of the junction of the San Juan and Colorado Rivers, west and south of Cedar Mesa. There is a very whitish and a very brownish variety, neither of which has a known source. There is also a pale yellow-brown variety, samples of which have been found occurring as free float on the slopes above Utah 95 where it crosses Fish Creek.

7) **Dark Streaked Chalcedony**--a milky, sometimes quite dark, semi-translucent chalcedony streaked with white, red, yellow, and black in varying combinations. It has a very smooth fracture.

**Tools**--bifaces, utilized flakes, retouched flakes, waste flakes, toothed pieces, small cores.

**Source**--much of the artifactual stone from the collection shows water-borne wear, and some shows a cortex of type (6). Most of the material of this type is probably from same source as type (6). Some may be from canyons on east side of Cedar Mesa, or at least be confused with material from that area (see type 9).

**Comments**--a good working material.
8) **Light Streaked Chalcedony**—a milky white semi-translucent chalcedony with intermittent streaks of reds, purple, and yellow. It has a smooth fracture.

**Tools**—small cores, waste flakes, utilized and retouched flakes, toothed pieces, notches, and scrapers.

**Source**—appears to be a variation of type (7) and hence is probably derived from the same source. Some artifactual pieces in the collection show a cortex with water-borne wear. The difference between the characteristics of types (7) and (8) may have spatial significance with respect to the location of the original derivation of the materials.

**Comments**—a good working material.

9) **White Chalcedony**—a milky white, translucent, unstreaked chalcedony with grades from a very pure white to a blackish, diffused dark color. Some examples grade to opaque, especially the very white areas. The surface is generally rather rough in fracture, although some fracture surfaces are very smooth, the more opaque examples being the smoother.

**Tools**—hammerstone, points, waste flakes, and utilized and retouched flakes.
Source--from east side of Cedar Mesa, in particular from a quarry site in shales along west side of Comb Wash one half mile south of Snow Flat turnoff on Comb Wash road. Samples also found one mile north in lower Road wash.

Comments--some examples are very good working material. There exists a salmon colored chalcedony (which under close inspection is seen to be composed of a whitish translucent body with many small red dot-like inclusions) which may be considered a variety of this type. A sample of it was found at the quarry site mentioned just above, and some flakes of it are found in the artifactual collection.

10) Rose Chalcedony--a colorless to reddish and purplish translucent chalcedony, which is unstreaked, having its color evenly diffused in the body of the material. Its fracture surface is rather rough.

Tools--a hammerstone, utilized flakes, and waste flakes.

Source--from the east side of Cedar Mesa where types (9) and (5) were found. A continuum can be shown between types (5), (9), and (10), using artifacts and
field samples of raw material, but the spatial significance of these
types is indicated by the difference in the material make-up of the
quarries mentioned, under types (5) and (9), below Cigarette Spring
and near Comb Wash.

Comments—a fairly good working material.

11) Obsidian—black, opaque and translucent to transparent obsidian
pieces, all of which are smooth fracturing.

Tools—points, bifacial thinning and waste flakes.

Source—unestablished. Flagstaff area is a possible source. The areas of the
Aquarius Plateau and the igneous mountains in southwest Emery County, Utah,
northwest of Cedar Mesa, and the area of the Chuska mountains in northwest
New Mexico may have potential source lava flows.

Comments—based on visual characteristics, there are four varieties in
the collection:

a) a transparent variety with dark areas and specks.

b) a darkly transparent variety with black specks and white crystals.

c) a transparent variety with heavy black streaks and areas.

d) an opaque black variety.
The bifacial thinning flakes are of variety (d). The points, four in all, are of the other varieties, and are in general quite worn on their tips and edges.

12) **Bluff East (B) & (C)**--several varieties of light pastel colored (pink, white, brown, green, gray), opaque, powdery textured cherts. The gray colored stone can be more lustrous than the others, while the green variety is sometimes fairly bright in color. All these varieties, while generally non-lustrous, can grade to lustrous surfaces. A gray-white to cream colored quartzite, having the original sand grains very apparent in the body of the material, is included here in this group by virtue of its source area.

**Tools**--points, a drill, bifaces, a carinated scraper, utilized flakes, waste flakes.

**Source**--Morrison Formation exposures which cover a very large area east of Bluff, Utah, extending towards Cortez and Four Corners. Several quarry sites have been located near the town of Montezuma Creek, Utah, which yielded material of this type. The creamy variety (white with reddish,
bluish, and brownish areas) can be found in Chinle pebble lenses, but not in large enough sizes to have been artifactually utilized.

Comments--as set up here, this is a very heterogeneous type, and it could be meaningfully broken down into several subtypes, each with their own varieties. It was given this treatment here because it represents only a small amount of material in this collection of Basketmaker II lithics, and because it all comes from similar sources well to the east of Cedar Mesa. This type is much better represented, proportionately, in the later Basketmaker III and Pueblo sites from Cedar Mesa.

There is a great deal of variability in the appearance of this chert, even in the samples from a single source location, although it may be possible to relate artifactual pieces or sets to specific source locations. The artifacts on Cedar Mesa of what might be called the "Bluff East" type are mainly of two sorts: 1) (C) a creamy chert with bluish and/or brownish banding (the same sort of material Norris is referring to), and 2) (B) a green, sometimes speckled looking stone which is sometimes a chert and sometimes more of a very fine-grained quartzite. Mr. Chet Grounds (personal communication) of Bluff says that material very similar
to or the same as (1) was quarried near highway 262 about four miles east of the Bluff-Blanding highway. The quarry areas shown to Paul Sneed and myself by Carl Mahon, near the town of Montezuma Creek, yielded a great deal and variety of material, including much banded chert, although this banded chert overlapped only slightly in appearance with (1). The overlap in appearance with (2), however, was as good as total.

Most of all the bluff East material is apparently coming from the Brushy Basin member of the Morrison formation, which has exposures, from Cottenwood Wash west of Blanding, southeast to the Four Corners and east into Colorado. The main exposures are along the San Juan River and Arido Creek and in Montezuma, Cross, and Squaw Creek canyons.

Morris (1939) states that the chert from which tcamahias are made probably comes from a single source south of the San Juan near the Four Corners, but it appears that it is actually coming from a number of locations in the area outlined in the preceding paragraph. Woodbury (1954), in his discussion of tcamahias (Prehistoric Stone Implements of Northeastern Arizona, Papers of the Peabody Museum of American Archaeology and
Ethnology, No. 34, 1954), follows Morris as to the source of the banded chert, which they both call "hornstone." Woodbury has a good discussion of the use of tcamahias among the ethnographic Pueblos and possible relationships to prehistoric occurrences.

13) Petrified Wood--petrified wood ranging in color from pure black to streaked brown, composed of opaque chert and jasper, having something of a longitudinal grain.

Tools--a scraper, a point, utilized and retouched flakes, and waste flakes.

Source--unknown. Other varieties of petrified wood have been seen in Grand Gulch wash and on the slopes off the south end of Cedar Mesa.

Comments--there were two varieties found in this collection:

a) a pure black, lustrous variety from which the tools mentioned were made.

b) a brown streaked, non-lustrous variety from which the waste flakes were made.
14) **Large-grain Quartzite River Cobble Fragments**—cobble fragments showing large wash water-borne wear.

_**Source**_—probably one of the large rivers of the general southeast Utah area, such as the Colorado or the San Juan, or perhaps one of the larger secondary washes, such as Recapture Wash.

15) **Black Siliceous Stone**—an opaque, non-lustrous, rough surfaced crypto-crystalline siliceous stone, black in color.

_**Tools**_—waste flakes.

_**Source**_—unknown.

_**Comments**_—may be related to type (4).

16) **Exotic**—various stone materials having no resemblance to stone known to originate on or near Cedar Mesa.

_**Tools**_—two points, two blade-like flakes, three waste flakes, and one bifacial thinning flake.

_**Source**_—unknown. Some "exotic" material may in fact be unusual variations of local material. Material from the Morrison Formation east of Cedar Mesa can look quite exotic on Cedar Mesa, and strictly speaking it is.
However, the materials assigned to type (12) are common on Cedar
Mesa and have a known source, and so are not here being considered
exotic.

Comments--one of the points appears to be pre-Basketmaker.

17) Unidentifiable--non-exotic stone that is not assignable to any
definite type.

Comments--only a very small percentage of the total collection had to be
put in this category.

The following type was added for the analysis of the surface and excavated
Basketmaker II material from West Johns, quad 19, sites 3 and 7, 1973 Cedar
Mesa Project.

18) Purple Chert--a purple to purple-gray, opaque, lustrous to non-lustrous chert
sometimes having red jasper inclusions. Fracture is smooth but irregular
in the lustrous examples, frosty and slightly speckled looking in the non-
lustrous examples. It is a rather tough material.

Source--samples have been obtained from the same areas off the south end of
Cedar Mesa as outlined for type (1), although this purple chert has been
observed a little further east in Lime Creek proper.