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Analysis of Unmodified Stone Materials From the Cambria Site

CHARLES R. WATRALL *

ABSTRACT — Analysis of the stone materials from the Cambria Site reinforces cultural implications about the site made on formal artifact analysis alone. Secondly, the paper illustrates a simple means of analysis to gain vital information on archaeological site culture history.

One of the main tasks in archaeological research should be the attempt to answer problems relating to the nature of culture process and culture change. The basic data of this research are materials left by a group of people and excavated by the archaeologist. Because the effects of time severely limit the kinds of materials that have been preserved and collected, archaeologists have developed techniques of analysis to recover information both in the field and in laboratory situations.

Many of the most sophisticated techniques are unavailable in the small laboratory for lack of trained personnel, excessive expense, or unavailable complex equipment; but other relatively simple techniques can be used and they may yield valuable, if not most vital, information on culture process.

Some of these simple analytical techniques are described here, along with results that may be obtained in analyzing one kind of archaeological data.

Cultural Implications of Raw Stone Material

The discussion is focused on analysis of unmodified stone materials found in an archaeological site studied by the author in 1968. It will, hopefully, illustrate some of the means and results of the analysis of raw stone materials and the cultural-historical implications of this data. Concomitantly, the discussion will be reporting on unpublished data from an important archaeological site.

The stone refuse materials that are the concern of this paper were excavated from the Cambria village site located in the northwest corner of Blue Earth County in south central Minnesota. The occupation of the Cambria site is estimated at between A.D. 1,000 and A.D. 1,300. The artifact assemblage indicates the site's strongest affiliations to Initial Middle Missouri sites, particularly Brandon, Swanson, Scalp and Ellis Creek, and to Monroe and Anderson Phases at the Dodd Site. Direct influences from Old-Village Middle Mississippian sites, most probably Cahokia and Aztalan, are also evident. Some relationships to Mill Creek sites in Iowa probably occurred, but these seem to have been much less intense.

The lack of adequate stratigraphic controls in the excavations makes the laboratory analysis of the unmodified stone refuse materials even more crucial to a clear understanding of the nature of the Cambria site.

Definitions and Method

The term "unmodified stone refuse" is used here to refer both to unworked stone materials and to chips which were presumably refuse materials of tool manufacturing. The analytical technique used was the examination of each piece of unmodified stone under a binocular microscope. Specimens were washed and broken where necessary to obtain a fresh surface for identification.

Once sorted into gross categories, based on material, the number of specimens was totaled for each raw material category, as was the percentage of each category in relation to the total stone refuse material. These percentages were then compared to the percentages noted in the artifacts themselves.

The analysis is based on several facts:

CULTURAL CHOICES are made in relation to the raw material used in the production of stone artifacts.

AS STONE ARTIFACTS are produced, stone refuse materials may also be produced.

The first of these statements includes the possibility that cultural choices may be made for the acquisition of a specific raw material. Desirable raw materials may be found not to occur locally but may have been imported to the site, thus reflecting possible movements of people or some system of exchange.

It is common in archaeological literature to assume that percentages of unmodified raw stone materials do reflect actual percentages of raw materials used for tool production. Such an assumption, while open to debate, is in fact easily testable in a comparison between percentages of total artifact stone material and percentages of unmodified raw materials. A comparison on this basis for the Cambria materials is shown in Table I, which summarizes data on the unmodified stone materials. Most of the terms used are those common to geological nomenclature (see Spock and Schwartz), but clarification of some terms is necessary because definitions and usage may differ from other archaeological descriptions.

CHALCEDONY has been defined by geologists as an aggregate of excessively fine quartz rather than as a distinct mineral. Occurring as nodules and replacements in sedimentary rocks, chalcedony may be found showing differences in color, texture, translucency, or structure. Common varieties of chalcedony include flint chert, jasper, and carnelian.

Since archaeological terminology usually distinguishes
The term chalcedony is used here to refer to a specific mineral type known as brown chalcedony or “Knife River Flint.” Griffin states that “a mottled brownish chalcedony is said to be from quarries along the Knife River in North Dakota or from gravel deposits in southern Manitoba.” It seems equally probable, according to Wright, that small pebbles of this material also occur in some glacial till in Minnesota.

JASPER, as the term is used here, applies to non-translucent cryptocrystalline quartz. Jasper, according to Spock, contains microscopic inclusions of hematite or limonite and may be any color from a light brown to a deep red. A special type of this material, jaspilite, is found in Minnesota in the iron-bearing Soudan Formation of the Vermillion district, Schwartz notes. This rock is a ferruginous chert with conspicuous bands, some a bright red and others light gray to black. The drift itself would have provided a source area.

CHERT is used in this analysis in its usual archaeological context and distinct from its more correct petrological meaning as a form of chalcedony. In the analysis of refuse material, chert was divided into two major categories: oolitic and non-oolitic chert. Oolites, as they occur in chert nodules, are small spherical or ellipsoidal bodies with diameters on the order of one millimeter. In some

TABLE 1. Comparison of stone materials for unmodified refuse and artifacts, numerically and in percentages.

<table>
<thead>
<tr>
<th>Stone Material</th>
<th>Unmodified Stone</th>
<th>Unmodified Artifacts</th>
<th>Unmodified Stone</th>
<th>Artifacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oolitic chert</td>
<td>4637</td>
<td>535</td>
<td>62.8</td>
<td>59.6</td>
</tr>
<tr>
<td>Non-oolitic chert</td>
<td>1004</td>
<td>117</td>
<td>13.6</td>
<td>13.0</td>
</tr>
<tr>
<td>Fine gray non-oolitic chert</td>
<td>83</td>
<td>44</td>
<td>1.1</td>
<td>4.9</td>
</tr>
<tr>
<td>Brown chalcedony</td>
<td>23</td>
<td>7</td>
<td>.3</td>
<td>.8</td>
</tr>
<tr>
<td>Jasper/jaspilite — red</td>
<td>12</td>
<td>2</td>
<td>.2</td>
<td>.2</td>
</tr>
<tr>
<td>Jasper/jaspilite — yellow</td>
<td>7</td>
<td>1</td>
<td>.09</td>
<td>.1</td>
</tr>
<tr>
<td>Quartz</td>
<td>456</td>
<td>1</td>
<td>6.2</td>
<td>.1</td>
</tr>
<tr>
<td>Obsidian</td>
<td>1</td>
<td>0</td>
<td>.01</td>
<td>0</td>
</tr>
<tr>
<td>Gabbro or basalt</td>
<td>102</td>
<td>29</td>
<td>1.4</td>
<td>3.2</td>
</tr>
<tr>
<td>Quartzite — pink or red</td>
<td>45</td>
<td>9</td>
<td>.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Quartzite — white</td>
<td>189</td>
<td>34</td>
<td>2.6</td>
<td>3.9</td>
</tr>
<tr>
<td>Granite, schist gneiss,</td>
<td>320</td>
<td>31</td>
<td>4.3</td>
<td>3.4</td>
</tr>
<tr>
<td>feldspars</td>
<td>301</td>
<td>2</td>
<td>4.1</td>
<td>.2</td>
</tr>
<tr>
<td>Limestone</td>
<td>47</td>
<td>169</td>
<td>.6</td>
<td>18.8</td>
</tr>
<tr>
<td>Limonite and iron concentractions and hematite</td>
<td>96</td>
<td>8</td>
<td>1.3</td>
<td>.9</td>
</tr>
<tr>
<td>Copper</td>
<td>1</td>
<td>1</td>
<td>.01</td>
<td>.1</td>
</tr>
<tr>
<td>Mortar or concrete</td>
<td>10</td>
<td>0</td>
<td>.13</td>
<td>0</td>
</tr>
<tr>
<td>Slate</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>.1</td>
</tr>
<tr>
<td>Unidentified</td>
<td>44</td>
<td>4</td>
<td>.6</td>
<td>4</td>
</tr>
<tr>
<td>TOTAL</td>
<td>7378</td>
<td>897</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

these as various types of minerals and usually classes chalcedony as a separate entity, some discrepancies arise in the usage of the terms.

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limestones entire beds of oolites have been converted, by replacement, to silica minerals (chalcedony) without the loss of this spherical form, as Spock has reported.

Chert occurs in Minnesota in the Prairie du Chien Formation and in the Galena Formation in the southeastern portion of the state. In Prairie du Chien Formation, both the Oneota dolomite and the Shakopee dolomite members contain chert materials. In the Oneota member chert is not a common constituent except in the southwestern portion of the state, where it appears abundantly in the upper sixty feet. The chert in this zone is fossiliferous and is light to medium gray in color. A white to medium gray porcellaneous chert occurs in minor amounts throughout the Prairie du Chien as small irregular nodules along the bedding planes.

In the Shakopee dolomite member of the Prairie du Chien, chert is not generally a common constituent but is used as a differentiating criteria between the upper and lower dolomite members. In the Shakopee member oolitic, arenaceous types of chert are common while they are relatively uncommon in the Oneota member. Samples of white to light gray oolitic chert were collected from some Shakopee outcrops near Hastings and from outcrops on a transect from Cannon Falls to Vasa.

Comparison of Properties

A comparison of these samples with the oolitic chert refuse materials seemed to show both color and structure affinities between the two. While there were color variations in the refuse materials which did not occur in the collected samples; this lack may be a product of insufficient sampling of these possible raw material sources. Regardless of color variations, the general lithologic characteristics were similar, and it would appear probable that some of the sources of the oolitic chert were in the Shakopee member of the Prairie du Chien Formation or less probably from the Oneota dolomite member. Outcrops of this formation occur in the southeastern portion of Minnesota, where good exposures may be found along the Cannon River and other streams.

Other chert sources occur in Minnesota in small amounts in the upper portion of the Platteville Formation and in the Galena Formation, which contains chert in southeastern Iowa, southwestern Wisconsin and northwestern Illinois according to Schwartz.

From the above data certain implications may be made concerning the greater bulk of the chert materials. It seems evident that the greatest portion of chert raw materials were not obtained locally. More likely, these materials were brought to the site from what appears to be the southeastern portions of Minnesota and possibly from adjacent states. The quantities of oolitic and non-oolitic refuse materials would argue that this importation occurred in fairly appreciable quantities or at least on a regular basis.

It would seem likely that these raw materials were transported in part over routes along the rivers leading in the southeastern portion of the state, most probably the Minnesota, the Mississippi, and the Cannon Rivers. Other access routes might include the Zumbro, Blue Earth, Des Moines, and Cobb Rivers.

It seems likely, also, that among the non-oolitic chert there may be refuse materials which have their source in adjacent states. Without adequate comparative samples and/or spectrographic analysis, it was impossible to differentiate other possible source areas for the non-oolitic chert refuse.

One type of non-oolitic chert was separated out during analysis. This has been termed here "fine gray non-oolitic chert." This material is a very fine gray chert, the majority of which was unbanded and had no inclusions of any sort. Because of its fineness, this material would have been excellent for tool production. Stone tools made of this material showed better workmanship. This could be attributed to superior individual craftsmanship, but it is felt here to be more likely a function of the material itself. As this fine gray chert was somewhat unique, the source of that material might have been outside of Minnesota. The investigator could find no chert of similar type from Minnesota. This hypothesis was confirmed when one fragment was found with a portion of a fossil mollusk in it. Although fragmentary, enough of the fossil was present for identification. Professor Robert Sloan of the Geology Department of the University of Minnesota identified this fossil as a *productid brachiopod* with a source area in possibly a Devonian or Mississippian chert. Sources for this type of material might exist from southern Iowa to St. Louis, Missouri. An alternate source area is possibly in the Black Hills of South Dakota.

One fragment of obsidian was found in the refuse materials. No artifacts were found to be made of this material. The nearest sources for obsidian would probably be near Yellowstone, Wyoming, or the Black Hills, Berg notes.

Gabbro and basalt, although they occur in source areas in the northeastern portion of Minnesota can be found in the drift materials themselves, and that was probably the source area for those materials.

Two types of quartzite are listed in the refuse material breakdown. These varieties were separated on color differences which were felt to be indications of different source areas. About thirty-five miles upstream from Mankato, on the Minnesota River, there are exposures of pre-Cambrian rocks. In a series of terraces along the north wall of the valley, there are outcroppings of red quartzites. This location and some of the quartzite exposures near New Ulm are, according to Schwartz, probably the source areas for the red and pink quartzites found in the Cambria materials. Some of these red and pink quartzites also may have their ultimate sources in the Pokegama quartzite outcrops in the extreme southwestern part of the Mesabi Range in Minnesota, Berg suggests.

The white to tan-colored quartzites noted in the refuse and artifact materials do not appear to be local. Berg reports that sources for this type occur in Wisconsin, in Barron County near Baraboo, and at Silver Hill near Sparta. The Barron County outcrops are partially drift covered but the "Silver Hill Sugar Quartzite" outcrops show evidence of extensive aboriginal quarrying. Access between these areas and the Cambria Site would have
been comparatively easy along the Wisconsin, La Crosse, Trempealeau, Chippewa, Red Cedar, and Black Rivers. Since a fair amount of quartzite of this type is found in an unmodified state, it would appear that conservation of it, as with the oolitic chert, was not necessary.

The remaining materials in the unmodified assemblage would probably have been easily obtainable in the area of the Cambria site. In the vicinity of New Ulm and slightly more than a mile upstream from the exposures of quartzites, there is a low ridge of coarse quartzitic conglomerate as pebbles varying in size from small fragments to boulders. These boulders consist almost entirely of quartz. As Schwartz notes, this source of quartz could have been easily accessible to the inhabitants of the Cambria village.

Granite has its most southerly exposures near the conglomerate exposures mentioned above. Small knobs of granite outcrop on the floor of the valley. About fifteen miles upstream from New Ulm, there are exposures of pre-Cambrian granites, gneisses, and related rocks. As with quartz, these granite materials could have been collected easily, Schwartz comments.

Limestone would have been available in the limestone outcrops along the Minnesota River. Pebbles of this material could have also been easy to find in the drift material itself. The drift also would have produced the small amounts of limonite, iron concentrations, hematite, and slate.

Sandstone is another raw material that would have been easily obtainable at or near the site, probably just west of Mankato at Minneopa Falls in the lower valley of Minneopa Creek. As the creek nears the Minnesota River, it has cut through the drift material into the underlying Cambrian sandstone and shales. The escarpment of the falls is produced by the creek falling over thoroughly cemented and erosion-resistant layers of the Jordan Sandstone. This type of well-cemented sandstone would have been highly suited to the production of sandstone abraders such as those found at Cambria.

One copper artifact was noted during the analysis. Although actual quarries are known from Isle Royale, Michigan; Keweenaw Peninsula, Michigan; and from Douglas County, Wisconsin, a closer source for the Cambria material would seem more likely. As Berg states, many copper nuggets are known to have been found in the glacial drift in Wisconsin. Winchell also notes a number of localities in Minnesota where copper has been found in the drift. He states that these copper nuggets “are most numerous in the eastern part of the state in the area of the red till, which was derived from the region of Lake Superior.” Professor Leland R. Cooper has stated that there are copper source areas along the Saint Croix River, especially in the vicinity of the Kettle and Snake Rivers.

**Discrepancies Considered**

When comparing the percentages of the unmodified stone materials and the percentages of raw materials used in the artifacts themselves in Table 1, it is apparent that certain discrepancies appear. Several tentative hypotheses are offered to account for these differences.

*Journal of, Volume Thirty-five, No. 1, 1968*
port conclusions (made on formal artifact analysis alone) concerning the nature of the Cambria site.

These results seem, in part, to support strongly Cambria’s relationships to Over Focus manifestations in South Dakota, to village sites in southeastern Minnesota, and to Old Village Middle Mississippian manifestations in Wisconsin and possibly Illinois.

References


COOPER, L. R. 1967. Personal communication.


WRIGHT, HERBERT. 1967. Personal communication.

Learned Societies Around the World

Japan

Japanese Academy (Nippon Gakushiin), Tokyo, an honorary society. Persons who have made outstanding contributions to the advancement of learning and science may be nominated as members. Does not undertake research work. Publications: "Proceedings."

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