A New Look at an Old Collection: A Preliminary Analysis of Lithic Debitage from the Bluff Crest of Starved Rock

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A common problem in archaeology is the constant shortage of time, money, and personnel necessary to process the extraordinary amount of artifacts that accompanies the excavation of heavily occupied prehistoric sites such as Cahokia and Koster. The debitage excavated during the 1974 University of Illinois-Chicago field school on the bluff crest of Starved Rock, 11LS12, has been sitting in storage awaiting analysis for nearly 40 years. Through the use of popular analysis strategies including mass analysis (Ahler 1989), attribute analysis (Andrefsky 2005), and raw material identification (Ferguson 1995) questions regarding raw material preference, core reduction strategies, and site disturbance can be answered. The results indicate that there are two local raw materials that were used proportionally more than others, and that bifacial core reduction was the primary reduction strategy. Due to the limitations on sample size only a small portion of the excavated area can be discussed with any validity, necessitating future investment of time, money and personnel to this task.

Introduction

The type and amount of debitage recovered from a site can be useful for interpreting the site's history and prior uses because debitage is often discarded where it is created, and can represent a palimpsest of manufacturing activities unique to that location (Jeske and Lurie 1993). Debitage provides an excellent means of examining patterns of manufacture and repair and a proper analysis can provide evidence about specific site activity patterns (Jeske and Lurie 1993; Koldehoff and Carr 2001), relationships between technology and society (Dobres and Hoffman 1994: 237), and economy (Jeske 1989; Torrence 1989). Ideally the entire debitage assemblage should be analyzed for the most accurate interpretation, however, with over 100,000 flakes recovered at 11LS12 that was not possible within the required time frame. For the purpose of providing information about change over time as well as space, two excavation units were selected for their relatively uniform stratigraphy and density of material. The following report details the findings of the analysis and relevance to larger archaeological problems.

Site Location and Description

Starved Rock is located in the Grand Prairie section of the Grand Prairie division, on the south side of the Illinois River, eleven miles west of Ottawa, Illinois. The surface geology on the south bank of the Illinois River is dominated by St. Peter Sandstone, which has been significantly eroded by glacial activity

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and subsequent flooding episodes creating the bluff and canyon system unique to the region. The area contains several econiches such as upland forests, floodplain, rapids, and prairie that support a variety of floral and faunal

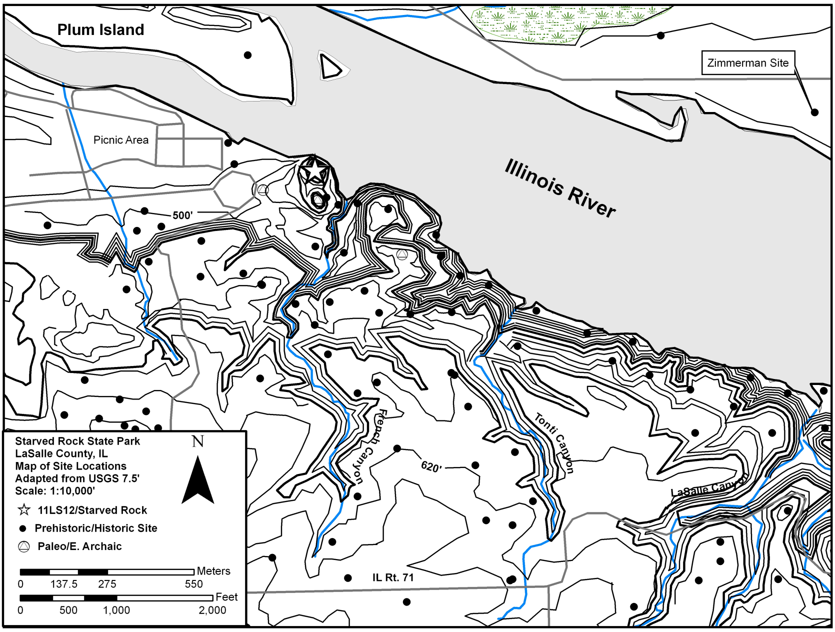

Figure 1: Map Created Using ESRI ArcMap with Data from USGS 7.5' Topographic Map and the IAS Site Files

resources including starchy and oily seeds, small game, White-tail deer, and Bison (Ferguson 1997). A topographic map illustrates the relationship between Starved Rock and other recorded prehistoric sites to the surrounding canyons, small streams, and floodplain (Figure 1).

Site History

Best known as the location of Fort St. Louis, an outpost commissioned by Robert Cavelier, Sieur de LaSalle in 1678, Starved rock is a multi-component site with evidence of continuous occupation since Paleoindian times (Ferguson 1995). It has been the subject of excavations for the past sixty years by the University of Chicago and Illinois State Museum (1947-1949), Public Works (1949-1950), and University of Illinois-Chicago (1974). In addition to the hundreds of smaller sites that have been found within the current parks limits, the Zimmerman site (J. Brown 1961, M. Brown 1975), and the LaSalle County Home site (Jeske 2003) two very important late prehistoric and multi-component sites are within just a few kilometers of Starved Rock.

The first professional excavations of the bluff crest of Starved Rock occurred in the 1940s and 1950s by the University of Chicago and Illinois State

Museum under Professor Kenneth Orr and Dr. John McGregor, respectively. From those excavations archaeologists were able establish significant occupations extending back into the Archaic period and earlier (Ferguson 1995; Mayer-Oakes 1951). In 1974 Dr. Robert Hall from the University of Illinois-Chicago directed excavations aimed at discovering evidence of warfare between the native inhabitants. He established a grid and placed eleven five foot by five foot test units on the center of the bluff. While he did not find any direct evidence of warfare, he did uncover evidence of occupation ranging from the Archaic to Mississippian times. Debitage from each level of two test units excavated by Hall in 1974 are the focus of the following study.

Methods

A combination of analyses including mass-aggregate analysis, (Ahler 1989), attribute analysis (Andrefsky 2001; Cotterell and Kaminga 1987; Jeske and Lurie 1993), and raw-material analysis (Ferguson and Warren 1992; Luedtke 1992) were used to create a more complete picture of how the people at Starved Rock were manufacturing and repairing their tools. The material excavated in 1974 was originally excavated and bagged by six-inch level as well as wall scrapes and floor scrapes at the completion of each level. This analysis began by placing each bag individually through a series of nested screens separating the debitage from these proveniences into size classes of 1" ¾", ½", and ¼". The vast amount of debitage present in each unit (10,000 plus pieces) demanded that we take a ten percent blind sample from the most populous size classes (½" and ¼").

After size grading, the material was further sorted into raw material classes. Raw material identification was crucial in this analysis, as the availability of quality lithic materials and the amount of effort it takes to obtain them will directly influence the technology and site use (Andrefsky 1994; Bamforth 1986; Jeske and Lurie 1993). Raw material was identified using a strategy similar to that of Ferguson and Warren (1992); macroscopic characteristics of the chert such as color, texture, inclusions, and cortex were identified and compared to geologic samples available in the lab.

The debitage was also sorted into technological categories including the overall size, percentage of cortex, and platform size, angle and preparation. Because flint knapping is a reductive or subtractive process, the size of debitage produced from the process generally becomes progressively smaller and the average weight will decrease providing insight into stage of reduction (Andrefsky 2005). Similarly, presence of cortex, a chemical or mechanical weathered surface on the rock, diminishes as flakes are removed also indicating the stage of reduction that took place. Platform angle and preparation were used to determine how a flake was removed while size determined what stage of the sequence it was removed. Using such attributes, flakes with intact platforms were examined and placed into one of the following categories: Core Reduction, Biface thinning flake (BTF), Tool retouch, and Bipolar Core Reduction, while flakes with no platform were placed into the flake fragment category. The Core

Reduction category includes decortication flakes as well as tertiary flake removals that have flat, relatively unmodified platforms with large bulbs of percussion. Biface thinning flakes have a characteristic lipped and abraded platform, thin cross section, little or no bulb of percussion, and previous flake scars of the dorsal surface (Andrefsky 2005; Evans 1999). Tool Retouch flakes are recognized by polish on the dorsal surface, faceted platform, and worn, rounded battered intersection of the platform and dorsal surface (Evans 1999). Bipolar Core reduction flakes have a number of damaged edges, pronounced compression rings, step and hinge fracture terminations, flat platforms, and are short, thick, and narrow (Jeske and Lurie 1993).

Cores, the objects that flakes are removed from, were classified as unidirectional, multi-directional, bidirectional or bipolar based on the direction of flake removals. Cores having only a few miscellaneous flake removals were considered tested cobbles. Bipolar cores are typically small and amorphous, display heavy compression rings and considerable crushing on opposite ends of an axis along which flakes are removed (Evans 1999).

The cores and debitage were also inspected for heat treatment, which was often conducted to change the material structure of the stone in order to make it more knapable (Andrefsky 2005). Heat-treatment was determined by the presence or absence of pot-lidding, crazing, cracking, brittle texture, and discoloration. Individual flake attributes were coded, then counted and weighed and data was inserted into an excel spreadsheet. The excel spreadsheet was then imported into the statistical software, SPSS. The statistical process allowed us to examine patterns of lithic reduction in relation to raw material, heat treatment, cortex, flake type, and excavation level.

Results

Raw Material

A few patterns in lithic raw material procurement and use emerged during the initial analysis. Two chert types dominated the debitage assemblage, Oneota (Starved Rock) and Platteville-Galena, which is not unexpected as both of these cherts are available in the immediate vicinity of the site. Oneota chert is located in the Oneota formation of the Prairie du Chien group of the Canadian series of the Ordovician system. Oneota chert is typically medium to fine-grained; color is white to gray and yellow to orange and color changes to a pink or red when heat-treated. Personal observations note that Oneota can resemble Platteville-Galena in its gray form, but use of a 10x magnification hand-lens reveals the characteristic oolites present in Oneota chert. According to Ferguson and Warren (1992), Oneota outcrops 40 km northeast of the park however Oneota also outcrops at a location on the north side of the Illinois River approximately 2 to 3 miles from the summit of Starved Rock in the town of Utica, (Thomas Loebel personal communication 2009).

Platteville-Galena was the second most popular parent material by count (32% of sample) and weight (25% of sample). Platteville-Galena is a catchall category that includes chert from the Pecatonica, Nachusa, and Dunleith formations of the Champlainian series of the Ordovician system. Platteville-Galena is typically fine-grained, dull to waxy in luster, gray to white in color, and often exhibits mottles or swirls. When heat-treated it becomes reddish-to-reddish brown and its luster will enhance. Chert from the Pecatonica formation outcrops within the park at one of its most popular tourist attractions French Canyon, while chert from the Nachusa formation outcrops south of the park near the town of Lowell on the Vermillion River (Ferguson and Warren 1992:6).

Other raw materials making up less than 20% of the entire assemblage include: Shakopee (10%), Excello-Shale (5.5%), and Burlington, Quartzite, Silurian, and Hixton Silicified Sandstone (all less than 1%). Shakopee and Excello-shale are local materials found in some of the same locations as the Oneota and Platteville-Galena materials. However Burlington outcrops many miles southwest of Starved Rock and Hixton Silicified Sandstone outcrops at the Silver Mounds Quarry site in northwestern Wisconsin (Ferguson 1997).

Raw Material by Size Class

Size sorting revealed the highest percentage of flakes and flake fragments were smaller than ¼", which totals to about 1100 flakes per unit or 81 percent of the sample. The ½" size class totaled to 17 percent of the sample, ¾" was two percent of the sample, and 1" was half of one percent of the sample. The two dominant raw material types, Oneota and Platteville-Galena, have very similar distributions, and are reflective of the sample as a whole. Shakopee and Excello-shale have a slightly different distribution; they have far fewer ¾" and 1" flakes than ½" and ¼" flakes.

Cortex by Raw Material

Out of the full sample, the majority of artifacts (63%) did not have any cortex on the dorsal surface. Cortex was only present on 33% of the debitage removed from cores of Oneota chert. The percentage of debitage with cortex reduced from Platteville-Galena cores is slightly more (40%). The raw materials that have the least amount of cortex are: Shakopee (18%), Excello-shale (3%), Hixton (0%), and Burlington (0%).

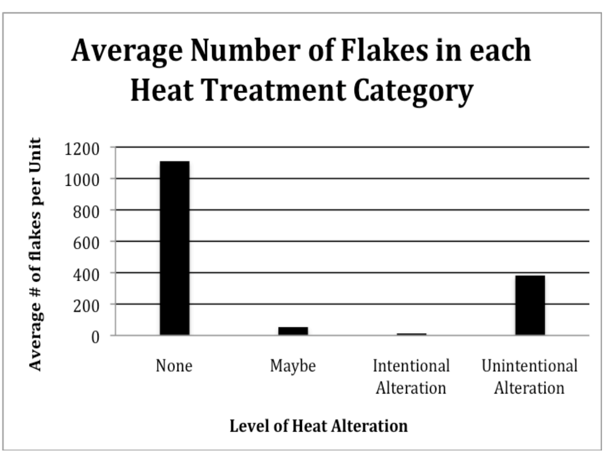

Figure 2: Average Number of Flakes in Each Heat Treatment Category for Both Units

Heat Treatment

Less than 1% of artifacts were intentionally altered by heat, the rest were either not altered at all (69%) or unintentionally altered (28%) (Figure 2). Although it is difficult to recognize intentionally heat-treated debitage, it is rather easy to recognize unintentionally heat-treated chert because it begins to burn, crack, explode, and disintegrate when temperature and time are not controlled. The result is pieces of debitage that are blocky, fragmented, cracked, crazed, and have small divots on the surface called potlids where flakes have spontaneously spalled off. Due to the controlled nature of intentionally heat-treating materials the result is typically a waxy and lustrous finished product that is easy to knap (Ferguson 1995). The only raw material that shows that there might have been intentionally heat altered is the Oneota chert. Other materials did not have a significant amount of intentional heating.

Flake Type

The results of the material analysis revealed four dominant flake types: flake fragments, core reduction flakes, bifacial thinning flakes, and blocky fragments (Figure 3). Flake fragments, flakes with no platform or distal termination, make up a substantial portion of flakes analyzed (40%); outnumbering other flake types by two-to-one. Approximately 25% of the flakes analyzed displayed traits of early-stage reduction including flat, pristine platforms, significant cortex cover, and prominent bulbs of percussion. Bifacial thinning flakes have a slightly lower frequency than core reduction flakes in this sample (21%) however without the 1/8" size class it is difficult to determine the actual amount. Lastly, blocky fragments totaled to one percent of examined debitage. Other flake types were all less than 1% of the total aggregate. Due to the mixed nature of the assemblage it was difficult to identify true bipolar debitage (Jeske and Lurie 1993), but with the presence of at least one bipolar core there is surely a bipolar component to this assemblage.

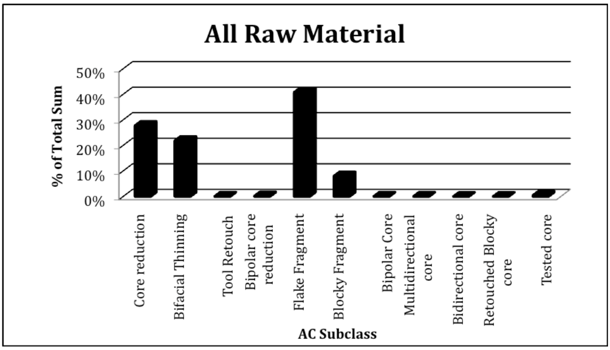

Figure 3: Total Percent of Flakes in Each Artifact Subclass for Both Units.

Flake Type by Raw Material

Cross tabulations of flake type and raw material type were conducted in order to see if any materials were being reduced differently. What the cross-tabulations show is that the flake type distribution for the entire sample (Figure

3) mirrors the distribution within the Platteville-Galena, Oneota, and Shakopee chert categories (i.e. high percentages of flake fragments, core reduction and biface thinning flakes). In the material classes with very few flakes such as Excello-shale, Burlington, Quartzite, and Hixton there were very few to no blocky fragments and most flakes were biface thinning flakes, tool retouch flakes, or core reduction flakes. Four cores and three tested cobbles were made from Oneota chert, the most out of any raw material. Two cores (one bipolar and one multidirectional) and 5 tested cobbles were made from Platteville-Galena. No cores of any other raw material were found in the sample.

Raw Material Preference over Time

A rough picture of change in raw material preference overtime is evident in the overall weight of raw material type in each six-inch layer grouped into sorting levels created by Dr. Hall (Robert Hall personal communication:2006) (Figure 4). The total number of artifacts grew as the depth increased except for level 3 where a slight drop in debitage occurred. An apex was reached at sorting level 6 or three feet below the surface, after which the amount of artifacts plummeted to almost nothing at level 9. At level six there is an overwhelming preference for Oneota over Platteville-Galena, a small spike in Shakopee use, which could represent a period in time that the higher quality Platteville-Galena was not preferred or the source was not easily accessible. According to Ferguson (1997) the only time that Oneota was preferred over Platteville-Galena in is during the Middle Archaic, however this data does not support Ferguson's data. Rather, this study found Oneota outnumbers and outweighs Platteville-Galena by 20% in every level except level 4 indicating the reduction of Oneota or Starved Rock chert was more frequent during earlier occupation, but as time went on Platteville-Galena became just as prevalent. Excello-shale was not a dominant raw material, however it has been identified at the Home site across the river in a Mississippian context (Jeske 2003), further analysis on the use of this material at

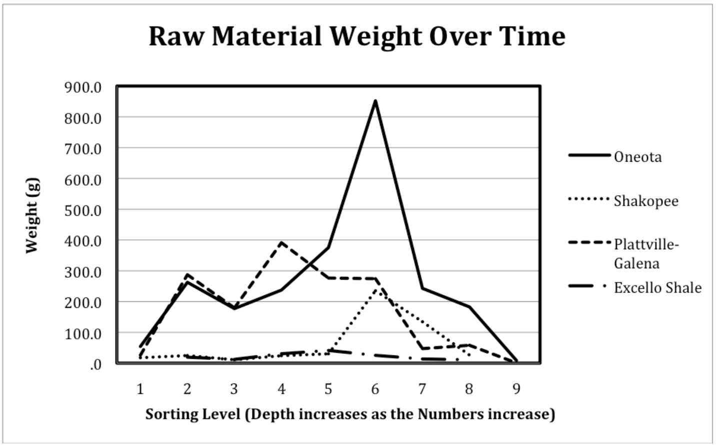

Figure 4: Total Weight of Each Raw Material per Arbitrary Six-Inch Excavation Level.

the Starved Rock site may prove useful to see if there is any temporal correlation.

Summary

A basic method of analysis was established to determine what types of flakes were present at the site, what material they were made from, and to what extent these flakes were present. The results have shown that there was a clear preference for two local raw materials, Oneota and Platteville-Galena, both Ordovician in origin. This preference is also identified at the Zimmerman Site across the river (Park 2004), and other sites within the park (Ferguson 1997). There is also a lack of cortex and early stage flake removals, suggesting that material coming into the site having already undergone early stages of reduction. There is little evidence for intentional heat alteration, but many flakes were unintentionally burned, probably the result of repeated occupation and excavation of hearths into former middens and trash pits. The most common flake types were core reduction and biface reduction with high levels of flake fragments and blocky fragments, again reflecting the reduction of partially reduced cores on site. The only historical trend discernible from the sorting levels is a preference for Oneota early in time and a gradual increase of Platteville-Galena over time otherwise the debitage distribution was relatively homogenous. Therefore, in the assemblage that was analyzed there seems to be continuity in the core technology over time, with a moderate fluctuation in raw material preference.

Future Research

The goal of this project was to provide a preliminary assessment of the debitage assemblage from the 1974 University of Illinois-Chicago field school. Many questions are still left unanswered and must be addressed in subsequent studies however the basic nature of this debitage assemblage is now apparent. Using this study as a template to study the debitage from feature contexts will help clarify questions regarding patterns of raw material use over time and space while stone tool and ceramic analysis will provide chronological information as well as group identity, subsistence strategies, and site use. What this study has proven is that valuable information can be gained from old data while also renewing the interest and involvement of the public; that is why it is necessary to invest the time and money to these efforts.

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