Emerging Models of Clovis Settlement Organization at the Mueller-Keck Site Complex in Southwestern Illinois

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INTRODUCTION

This paper focuses on the topic of mobility and settlement of Clovis people at the Mueller-Keck site complex in order to explore research questions about site function. Cultural components at these sites include two of the largest Clovis assemblages in the eastern prairie (Amick and Koldehoff 2005; Koldehoff and Walthall 2004). Information gathered from these sites is relevant to issues of colonization of the New World, since the exact date, point of entry, and rate of spread across the Americas are still areas of contention among archaeologists. The presently accepted Clovis chronology is estimated at 11,200 to 10,900 radiocarbon years before present (rcybp) (Haynes, 1992, 1993; Haynes et al., 1984; cited in Fiedel 2000). When calibrated, these dates coincide approximately with 13,200 to 12,900 calendar years ago. Paleoindian colonization of the Americas has been characterized as a rapid expansion of people following herds of large migratory game—however, it is also possible Early Paleoindian economic strategies did not rely on megafauna, but centered on generalized foraging (Meltzer 1993). Subsistence strategies can be hypothesized from the types of tools composing an assemblage; like many Paleoindian sites, the Mueller-Keck collection is dominated by hideworking and butchery tools indicative of game procurement as opposed to plant utilization.

The Mueller-Keck complex could reflect the traditional notion of swift travel across the landscape because the predominant raw material found at Mueller-Keck is Attica chert, located 350 km from the site in west-central Indiana. Utilization of non-local material leads to investigation of Clovis patterns of movement, since "[Paleoindian] extensive use of exotic raw materials has been interpreted as evidence of high

mobility" (Seeman 1994). What happened at Mueller and Keck once people got there is key to understanding these issues. This research focuses on one main question: do Mueller and Keck represent functionally distinct settlement types? In this paper I further investigate the hypothesis that Keck served as a satellite hunting camp subsidiary to Mueller, which functioned as a base camp. The Mueller assemblage is roughly three times the size of the Keck assemblage, and Keck's location on an upland ridge provided a good vantage point to intercept game in the basin below. Based on data obtained by lithic analysis focusing on raw material, tool type, and debitage type, the variety of tools indicative of maintenance at Mueller suggests classification as a base camp. These data imply more daily maintenance tasks occurred at Mueller because of the high percentage of flake tools, whereas more late-stage biface production debris exists at Keck suggesting manufacture of hunting tools. However, the overall similarities between the tool assemblages cannot functionally distinguish Keck from Mueller. Taking into consideration the difficulty in categorizing sites into distinct settlement types, this paper ventures into the related notion of settlement organization and occupational history: 1) do Mueller and Keck represent a single occupation by many people or incidents of reoccupation?; and 2) were they occupied at the same time? This paper explores several possibilities of site function and patterns of occupation at Mueller and Keck in relation to the conditions Clovis people faced while settling the Midwest.

Previous Research and Environmental Context

The Mueller-Keck site complex is located between the Illinois and Kaskasia drainage basins on an escarpment in southwestern Illinois, consisting of plowed field and an undisturbed woodlot. Mueller and Keck are situated 1 km apart and, though they are separated by a creek, appear to be affiliated sites on a shared landform (Amick and Koldehoff 2005). Archaic, Woodland and Clovis artifacts have been collected from Mueller and Keck, but the Clovis components are spatially discrete and easily distinguished because of their reliance on exotic Attica and Holland chert sources from Indiana. Keck sits on an upland ridge not far from an extensive Pleistocene wetland in the American Bottom. Beneficial environmental factors could have lured people to this area as a prospective hunting ground. Figure 1 depicts the location of Mueller-Keck and the Attica quarry area. Movement from Attica, the source of lithic procurement, to Mueller-Keck would have taken Clovis people through present-day Illinois over an expansive terrain of low relief with limited food and lithic resources. The GIS model in Figure 1 demonstrates the difference in elevation between the Mueller and Keck sites, with Keck at a higher elevation on a ridge and Mueller below near the bluffs of the American Bottom. The Keck family has been collecting artifacts in this area for generations, but the Clovis component did not begin to surface until the 1970s, attributed to soil erosion and the effects of the plow bringing artifacts to the plow zone (Koldehoff and Walthall 2004).

In 1974, Paul Keck began unsystematically collecting Clovis artifacts he found on the surface of Mueller and Keck until 2004 when he started piece-plotting artifacts.

Between 2000 and 2005, the field school at Loyola University Chicago spent four field seasons at Mueller and Keck conducting survey over 40 acres, excavating 46 square meters, and surface mapping. Research in the lab has focused on Paul Keck's surface collections made from 1974 to 2003, and data for this paper were obtained from this analysis. A variety of Clovis artifacts make up the collections, with the Mueller assemblage (n=599) much larger than the size of the Keck assemblage (n=177). In her honors thesis, Colleen Maroney (2006) intensively explored the possible functionality of Mueller and Keck, reaching the conclusion that data support the hypothesis of Mueller as a base camp, but do not reinforce the notion of Keck as a hunting site. If anything, Keck could be considered a base camp similar in function to Mueller (Maroney 2006). This paper augments Maroney's research and delves further into questions of occupation and mobility, which are closely related to site typology.

Research Questions

Archaeologists are unsure of Clovis peoples' subsistence patterns although big game hunting is a popular claim. Meltzer (1993) has argued that this bias is because smaller fauna and plants are either not preserved as well or not as well recognized in the archaeological record in comparison to large mammal bones. We do know Clovis people were highly mobile hunter-gatherers and the Muller-Keck Clovis group was no exception. Attica chert, located in west-central Indiana 350 km from the site complex, is the predominant raw material, comprising 87.4% of the Mueller assemblage and 97.7% of the Keck assemblage (Table 1). The table indicates exotic Holland chert, also from

Indiana, plays a supplementary role in the toolkit of these Clovis people. However, the single local material that was utilized (Salem chert) only appears at Mueller and does so in minute quantities. Despite the availability of local lithic raw materials near these sites that is superior in quality to Attica, the inhabitants of Mueller-Keck relied almost solely on the exotic material and must have brought tools and preforms with them to the sites (Koldehoff and Walthall 2004:56). Why did Clovis groups decide to travel such a long distance with their material, perhaps multiple times? They could have been drawn to the area to intercept migrating game or utilize other resources in the fertile wetlands of the American Bottom. According to Seeman (1994), Paleoindians were not necessarily interested in seeking out the highest-quality raw material; more energy was spent focusing on obtaining food in order to survive. For the Clovis people inhabiting Mueller and Keck, being near the selected raw material source appears to have been less critical than locating a camp near food resources. Maybe Attica was abundant and easily extracted from the quarry, allowing Clovis people to procure it and prepare for seasonal movement across a known landscape. Alternatively, this group of Clovis could have been pioneers, the first to arrive in this region, in search of resources in a completely unknown geographic and ecological zone (Dincauze 1993). The copious amount of Attica at Mueller-Keck and significant lack of local material suggests this Clovis group was unfamiliar with the area at their arrival and perhaps did not occupy these sites for a prolonged period of time.

Mueller and Keck's association over the terrain and the comparable raw material choices comprising the tool assemblages has led Loyola's research to focus on two basic questions: 1) do Mueller and Keck represent functionally distinct settlement types; and 2)

is more than one episode of occupation of represented? Previous studies of the Muller-Keck collection has led to at least three emerging interpretations: 1) Mueller and Keck represent repeated occupations of a related group of people coming from the Attica quarry area; 2) Mueller and Keck represent a single occupation that was discontinuously spread across the landscape; and/or 3) Keck is a functionally distinct satellite hunting camp that may be associated with the larger camp at Mueller. This paper builds on this research and explores further what people were doing once they arrived at Mueller and Keck, as well as how this information can be applied to conjectures about Clovis life ways.

ANALYSIS METHODS AND DISCUSSION

The Clovis component (N=776) from Paul Keck's unsystematic surface collections was analyzed in the lab from 2003 to 2005. Artifacts were classified as Clovis based on diagnostic tool forms recognized at other North American Clovis sites. Artifacts were cataloged with a trinomial site number (Mueller: 11-S-593, Keck: 11-S-1319) and a specimen number. All Clovis artifacts were classified and described based on a comprehensive lithic artifact coding format established for this project, with emphasis placed on raw material, tool type, and debitage type (see Appendix). Bifaces were categorized based on Callahan's methodology that outlines a description of how Clovis bifaces are produced in successive stages: Stage 1: Edged Blank; Stage 2: Overshot Blank; Stage 3: Thinned Blank; Stage 5: Fluted Preform; and Stage 6: Fluted

Point all appear in the Mueller-Keck collection (Callahan 1979). Since the majority of tools from the Mueller-Keck Clovis component were made from Attica and Holland cherts from Indiana, debitage that did not display distinct Clovis features but was made from these materials was classified as Clovis.

The Mueller collection displayed four artifacts made from Salem chert, which is local to the region. One endscraper manufactured from non-local Cobden chert, and two scrapers (one endscraper and one sidescraper) made from non-local Moline chert were also included in the Clovis assemblage. The four Salem pieces were retained with the collection mainly because of the technological and morphological criteria used for assigning artifact type; 1 Salem channel flake, 1 Salem graver, and 2 Salem bifaces remain in the Mueller assemblage. Since Attica chert comprises an overwhelming amount of the collections, discussion focuses on this material, with consideration of the implications of Holland chert with respect to mobility and organization of this Clovis group.

Due to the fact the pieces were collected from the surface of a plowed field, it was sometimes difficult to distinguish intentional modification from plow damage on flakes. While plow damage has likely fragmented and damaged many other artifacts, it did not impede classifying tool forms from the Mueller-Keck collection, nor did it affect assemblage analysis. Occasionally, patterns were noticed on flakes that could have resulted either from the plow or by human retouch. The patterns produced from these activities usually differ, with plow-damaged flakes displaying irregular scars or V-shaped notches on the margin due to plow impact (Odell 2003:70-71). However, flakes exhibiting ambiguous alteration from the Mueller and Keck assemblages were classified

as “edge-damaged flakes” so as not to assume human intentional modification. Classification was based solely on macroscopic analysis with categories including artifact type, fragment type, screen size, weight, raw material type, thermal alteration, and cortex.

Results

Tankersley (1998) has proposed three distinct site types among Early Paleoindian sites in eastern North America based on function: quarries, base camps, and food procurement locations. The abundance of nonlocal material at Mueller and Keck indicates neither site served as an area of stone procurement, so this analysis focuses on the other two categories. Generally, a base camp displays tools used for a variety of tasks, including maintenance, processing, and tool manufacture, whereas a food procurement site exhibits tools associated with extractive activities. The variation of lithic formal categories between Mueller and Keck Clovis assemblages can be seen in Table 2. Keck displays a larger percentage of debitage, which implies proportionally more tool manufacturing there than at Mueller. However, since there is a larger percentage of flake tools at Mueller, it becomes apparent that more tools were brought in finished form to Mueller, which explains the lower proportion of debitage at that site. This figure also shows a greater proportion of projectile points occurring at Keck, which could indicate greater emphasis on hunting and butchering extractive tasks. The data support the possibility of Mueller as a base camp because of the wide diversity and function of tools in the assemblage (Table 2). When categorized by artifact subclass, it is obvious Mueller displays more types of tools: indeterminate and Callahan Stage 1

bifaces, several types of cores, and knives are found only at Mueller. However, this diversity could be due to the much larger sample size at Mueller, increasing the odds of finding less-common tool types. In addition, according to this figure, the Keck assemblage consists of more late-stage bifaces while Mueller exhibits a far greater percentage of endscrapers. Evidence indicates a larger amount of processing was occurring at Mueller: nearly 32% of the Clovis assemblage consists of endscrapers, sidescrapers, and scraper fragments. Additionally, Binford (1980) implies the lack of processing tools indicates low-bulk procurement of resources; since the Mueller collection is almost one third hideworking tools, it appears the Clovis group at Mueller was processing a high quantity of animal hides.

While the data support the hypothesis of Mueller as a base camp, the results regarding Keck's functional type remain unclear. The data do not support the hypothesis of Keck as a satellite hunting camp subsidiary to Mueller (Morgan et al 2008). Little difference exists between the two assemblages; however, it appears greater emphasis could have been placed on hunting activities at Keck when comparing the late-stage bifaces (Callahan Stage 5: Fluted Preforms and Callahan Stage 6: Fluted Points). Table 3 indicates Callahan Stage 1: Edged Blanks, Callahan Stage 2: Overshot Blanks, and Callahan Stage 3: Thinned Blanks are all more prevalent in the Mueller assemblage, while the late-stage bifaces are more concentrated to Keck. Out of all the Clovis bifaces present at Mueller, 55% (n=43) are late-stage, while late-stage bifaces comprise 72% (n=18) of the biface collection from Keck. Although this seems like a considerable distinction, no statistically significant difference exists between the prevalence of early-stage (Callahan Stages 1-3) versus late-stage bifaces (Callahan Stages 5-6) between thes

assemblages (χ^2=3.44, df=1, p=0.064). If Keck displayed characteristics of a hunting camp, a statistical difference in the frequency of early-stage versus late-stage bifaces would be expected, since late-stage bifaces would be more appropriate hunting and extractive tools. Although projectile points are found more frequently in the Keck assemblage, as indicated in Table 3, less than 10% of the Clovis collection from Keck consists of these projectile points—this seems unusually low for a supposed hunting camp (Maroney 2006). However, statistical comparison of frequency of late-stage bifaces versus endscrapers corroborates the idea of hunting activities taking place at Keck because this toolkit contains a significantly greater frequency of hunting related tools versus hideworking equipment (χ^2=8.86, df=1, p=0.003) (Morgan et al. 2008). The abundance of fluted preforms and fluted points at Keck implies hunting activities are taking place—to what extent is unknown.

The differences between the Mueller and Keck assemblages are illustrated in Table 4. The term "proportionally" appears before each characteristic as a result of calculating the expected value at Keck, based on the knowledge that Mueller is three times its size. If the sites served a similar function and these samples are representative of that, Mueller should exhibit three times the amount of Keck in each tool type; however, this was not the case, as evident from the table. These data suggest more maintenance activities occurring at Mueller than at Keck because of the higher proportion of processing tools. It also appears more hunting activities are taking place at Keck than at Mueller as evident from the higher proportion of late-stage bifaces.

The ratio of tools to waste flakes at both Mueller and Keck is extremely high, with debitage comprising only 44% of the Mueller assemblage and 55% of the Keck

collection. This implies these people either brought the tools they needed with them on their journey or did not inhabit the sites for an extended period of time. Statistical analysis shows there is a significant difference in frequency of flake tools and debitage between the assemblages, with Mueller displaying a higher proportion of flake tools and Keck exhibiting greater prevalence of debitage (χ^2=8.58, df=1, p=0.003). This is noteworthy because it implies the inhabitants of Mueller brought tools with them either completely finished or in almost finished form, while more tools were manufactured at Keck. However, this difference in frequency of waste flakes could be spurious and due to bias on the part of the collector. Since Mueller artifacts were collected prior to those from Keck, it is possible Paul Keck first neglected debitage at Mueller then became more systematic when collecting Keck artifacts after learning the significance of debitage. This error would cause an appearance in more debitage occurring at Keck than at Mueller, though this may in fact not be representative of the sites. Similar patterns of low debitage prevalence and higher proportion of complete flake tools indicating tool manufacture at the procurement area as opposed to the residential site have been observed at other Clovis sites in the Midwest, such as at the Nobles Pond Paleoindian site in northeastern Ohio (Seeman 1994). The general lack of waste flakes shows these people are not making all the tools once they arrive at Mueller and Keck; they brought a great number of partially or completely worked artifacts with them on their journey.

Table 5 illustrates the percentages of various forms of debitage found at Mueller-Keck. A higher proportion of biface thinning flakes were found at Keck, implying production of late-stage bifaces with greater frequency than at Mueller. A larger percentage of core reduction debitage occurs at Mueller than at Keck, signifying earlier

production stage manufacture. Bifacial retouch debitage turns up more frequently at Mueller; this could indicate sharpening tools and upholds the notion of people performing maintenance tasks at Mueller. Related to this is the marginally higher frequency of unifacial retouch debitage from Mueller, which supports the idea of more unifacial flake tools (such as scrapers) modified there (Odell 2003). If this Clovis group came to the area as pioneers, they could have used either Mueller or Keck as a home base from which they sent out scouts to explore the unfamiliar terrain; scouts could return with reports of better hunting locations or easily procured lithic material, allowing the Clovis people to disperse from Mueller-Keck while leaving unexhausted tools behind (Dincauze 1993).

While these Clovis people are bringing some finished tools with them from the Attica quarry, there are also a good number of unfinished tools, such as early-stage bifaces. These unfinished tools are also large in size: 67.6% of Callahan Stages 1-3 bifaces from Mueller measure greater than 2.54 cm square mesh. This suggests an uncertainty in the route of travel and anticipated activities both during the journey and upon the group's arrival at Mueller-Keck. They may be expecting a need to use their toolkit once they reached the site, as indicated by the low proportion of debitage and the high ratio of completed tools. However, the large unfinished early-stage bifaces signify this Clovis group could be unaware of the demands on their toolkit and what they might encounter during their movement pattern and eventual settlement. Furthermore, the ratio of cortex is relatively high considering the distance from the source. In the Attica pieces from Mueller, 22.8% show evidence of cortex, either in the form of internal fracture, water-worn cobble, or primary (residuum). Similarly, 22.5% of Keck Attica artifacts exhibit cortex, though only as internal fracture or primary (residuum). These lithics have

not been reduced to the point where the outer weathered layer is completely obliterated. Interestingly, the data indicate tools were made similarly at both Mueller and Keck. If people at Keck were fashioning hunting tools, we would expect to see a lower percentage of cortex because they would be further reducing the lithics when manufacturing projectile points. While these Clovis people were manufacturing the mainstays of their toolkit before they reached Mueller-Keck, they also produced unfinished tool forms that would allow them to respond to unknown factors as they moved from the Attica quarry to the American Bottom. Alternatively, the observation of such a substantial proportion of relatively large artifacts could be due to bias by the collector—since this was not a systematic collection, Paul Keck probably took greater notice of larger pieces on the surface of the field. Also, smaller pieces are able to work their way down through the soil due to post-depositional processes like bioturbation (which has been observed at the Keck site), whereas the larger artifacts would remain at the surface. These factors have the ability of skewing the data, causing the number of smaller artifacts to be disproportionately low in the assemblages and indicating these may not be accurate representative samples from the sites. While the data do not provide a discrete answer to the research question, they suggest Mueller and Keck are highly similar in their assemblage content and illuminate a difficulty in categorizing sites into distinct functional typologies. I return now to the issue of settlement organization: how were Clovis people fitting Attica chert into their pattern of movement and what did they do once they reached Mueller and Keck?

Patterns of Clovis Mobility

In order to understand settlement organization, it is also useful to investigate whether Mueller and Keck were reoccupied by Clovis groups. An absolute determination of reoccupation can occur if a site includes distinct layers of strata. After conducting extensive excavations at both sites (Amick and Koldehoff 2005) it is impossible to distinguish any evidence of stratigraphic layering of repeated occupations because plowing and erosion have thoroughly mixed these archaeological materials within a plow zone deposit. I want to consider the first interpretation that has surfaced from Loyola's previous research: Mueller and Keck represent repeated occupations of a related group of people coming from the Attica quarry area. Why would people move over such a large landscape that separates the stone source from the food source? One possibility is that large game seasonally migrated through Illinois. When the game moved from the Mueller-Keck area, Clovis folks likely followed their food source. The migrating game may have led them right past the Attica quarry again and they proceeded to make their seasonal rounds to Mueller-Keck with a new batch of lithic raw material. This interpretation builds on the notion of this group of Clovis displaying organization in their movement characteristic of the forager-collector combination: they are moving based on their resources, but their movement is also intentional (Binford 1980). Food was probably the main factor governing the organization of the movement, but if Mueller and Keck were reoccupied, this was part of the peoples' routine and a pre-planned pattern of movement.

Another related proposition is known as lithic tethering, where a Paleoindian group's seasonal movement would intentionally take them past the site of lithic procurement in order to refresh their toolkit (Gardner 1974, 1979; cited in Fiedel 2000). Because stone tool technology was of extreme importance to hunter-gatherers, they would choose to follow migrating herds that also moved near the Attica quarry. However, multiple occupations seem improbable based on the overall uniform collection of raw material and the knowledge that many of the complete tools were abandoned at these sites (50.3% of tools from Mueller and 39.4% of those from Keck are complete). Even if the group did pass by the Attica quarry multiple times, we would expect to see other material they picked up along the way in these assemblages, since use of raw material transported long-distance from the source of previous extraction is unlikely; "instead, there should be significant amounts of materials indicative of arrival from several directions, as would be likely for episodic reuse of the location in an unstable environment" (Dincauze 1993:49). Surely this Clovis group would have also become familiar with the chert resources in the area of Mueller-Keck as well, such as at the Bull Brook site in New England where "there is evidence of a broad knowledge of regional lithic sources. The region likely had been thoroughly investigated by scouting parties before the entire social unit moved in *en masse*" (Fiedel 2000:83). Lack of diversity in lithic sources could indicate people are not spending an extended amount of time at Mueller-Keck before moving on, possibly scattering themselves among the rich resources of the Central Mississippi Valley and abandoning their Attica tools in favor of local chert such as Salem.

The second suggestion formed by Loyola research is that Mueller and Keck represent a single occupation that was discontinuously spread across the landscape. The distribution of artifacts across the landscape supports the inference of occupation at separate times. If this notion is true, which site was occupied first? Assuming Clovis people are arriving to the area from the northeast (the direction of the Attica quarry), Keck is the first of the two areas they would have encountered. It could have been chosen by the group as they tracked game; Keck's overlook into the adjacent drainage way provides a good vantage point for watching prey. It is also possible that the hunters stayed at this site for a period of time while the rest of the group moved on to settle at Mueller. Perhaps a scouting group left the Attica area to explore, then settled at Keck for a short period of time, after which they returned to Attica to share their discovery. A larger group of people could then have traveled to the American Bottom but for some reason (or by accident) chose to settle at Mueller rather than Keck. A further indication of single occupation is the almost homogeneous collection of Attica chert. Fiedel (2000:77) explains the presence of low-quality chert artifacts in an area with available high-quality stone suggests occupation by pioneers: "if a Clovis assemblage at a site does not contain artifacts made of lithic material from a high-quality source located a short distance away, this may indicate that it represents a camp of the initial explorers in the area, who had not yet discovered the source." If people are revisiting Mueller-Keck, we would expect to see a greater diversity of raw material indicative of movement from many directions since they would be more familiar with the landscape and availability of resources despite a changing environment. If the source of raw material is located at such a great distance from Mueller and Keck, why would people return to the quarry and then

trek back to these sites? A lower number of unfinished tools, as well as tools exhibiting cortex, would also be expected than the ratios present at Mueller and Keck since after occupying the sites once, the inhabitants would not be as unsure of what they would encounter upon arrival. Furthermore, despite efforts during analysis, no broken artifacts from Mueller were able to be refit to those from Keck (and vice versa), suggesting the sites were not occupied by the same group of people at the same time.

Another possibility is that only Mueller was reoccupied and Keck was not. A much larger assemblage comes from Mueller, as well as high tool diversity. At Keck, on the other hand, it appears people were not discarding their tools nor staying for very long: the assemblage is very small, displays less diversity in comparison with Mueller, and only covers an area of about 100 square meters. Although Mueller displays higher variety of tool types, this could just be due to the larger sample size. As the sample size increases, the number of types of tools is expected to increase also.

Because the Mueller-Keck Clovis assemblage is uniquely large to the American Bottom region, it is also useful to consider whether this could be one occupation of a large group of people or repeated occupations of smaller groups. While determining group size poses challenges, ethnographic accounts of caribou hunters with assemblages "technologically parallel to the quality flint knapping found at Paleo-Indian sites" provide a useful tool for estimating how many "man-days" were spent at a site (Speiss 1984:283). After observing discard and establishing the rate of 1 artifact per 3 man-days at a single-occupation site, Speiss (1984:283) applied this notion to the Vail, Debert, and Bull Brook sites in New England while assessing that "each site may represent a single season occupation by a large group of people, or at most several consecutive seasons of brief

repeat visits to the exact same activity areas". When the flake tools, bifaces, and projectile points from Mueller-Keck are tabulated, Mueller consists of 315 artifacts and Keck includes 74 artifacts. If Speiss's estimate of 1 artifact per 3 man-days is applied to the Mueller-Keck collection, then approximately 945 man-days were spent at Mueller and 222 man-days were spent at Keck. Various group sizes can be interpreted from this approximation, such as: 1) 9 people spending 3 months at Mueller; 2) 25 people spending 5 weeks at Mueller; 3) 6 people spending 5 weeks at Keck; 4) 14 people spending 2 weeks at Keck. These numbers are chosen somewhat arbitrarily simply to express the range of possibilities of group size and length of stay. With respect to Mueller, 25 people is on the lower cusp of accepted Paleoindian group size—if this number is taken as an acceptable estimate, this Clovis group's 5 weeks at Mueller reinforces the idea of rapidly moving people colonizing the interior of North America. Smaller numbers were chosen for Keck in light of the hypothesis that it could have served as a base camp for scouts; even so, it is hard to imagine a scouting posse of 6 people spending 5 weeks at Keck, then reuniting with the entire group (approximately 25 people total) and spending the same amount of time at Mueller before dispersing into the American Bottom or moving to the next area of encampment together.

Dincauze (1993) proposes that larger groups of Paleoindians could have assembled in order to pioneer an area, existing in aggregations greater than the generally accepted size of Paleoindian bands that would reduce risk for the majority. After using Spiess's formula to estimate the number of inhabitants for Mueller and Keck, it does not appear that smaller bands joined together to form an uncommonly large group. If Mueller-Keck did serve as a marshaling site from which people entered the previously

unknown American Bottom, they most likely did so without forming extensive aggregations. However, it is possible smaller group(s) joined the people moving from the Attica quarry area. When examining the frequency of raw materials, Holland chert (the source of which is located in southwestern Indiana) also played a role in the life of these Clovis people, despite the abundance of Attica (Table 1). Statistical analysis shows significantly more Holland at Mueller than at Keck (χ^2=14.46, df=1, p=0.000). This suggests the possibility that people moving from the Attica source area could have been joined by smaller group(s) moving from the Holland quarry to aggregate then settle at Mueller (Morgan et al. 2008).

Binford (1980) conjectures hunter-gatherers exist somewhere on a range between foragers and collectors, with the latter executing greater internal organization in terms of their resource acquisition. Foragers mainly exhibit the two site types previously discussed, but collectors show evidence of up to five areas of discrete function. The number of different site types represented in an area is directly related to the group's level of organization. In the case of collectors, special task forces may be sent to a location on the landscape for a short period of time in order to obtain food or raw material. This way, only a small number of the population dedicates itself to these extractive tasks, whereas the majority remains at the residential base camp and maintains life there. If, as the third interpretation postulated by Loyola research suggests, Keck is a functionally distinct satellite hunting camp that may be associated with the larger camp at Mueller, this group of Clovis may have sent out a small hunting party to Keck while the rest remained at Mueller. Because of the lack of tools manufactured from local material of superior quality, Seeman's (1994) suggestion of hunter-gatherers expending most of

their time and energy finding food and shelter, not necessarily the best quality lithic materials, seems applicable here. These few interpretations show the difficulty not only in determining site function, but how and when those sites were occupied, especially when lacking distinct stratigraphic layers at a disturbed complex such as Mueller-Keck.

Summary and Directions for Future Research

An unsystematic surface collection from the Mueller-Keck site complex in southwestern Illinois was analyzed in order to determine site function. No clear answer could be interpreted from the data, but evidence suggests Mueller served as a residential base camp because of the large assemblage size compared to Keck and diversity of tool types, which correlates with research done by Maroney (2006). The hypothesis that Keck functioned as a hunting camp subsidiary to Mueller was neither proved nor disproved. The data imply that more hunting activities were taking place at Keck due to the higher proportion of late-stage bifaces in comparison with Mueller. This paper explored three emerging interpretations regarding episodes of occupation based on previous research, including 1) Mueller and Keck represent multiple occupations by the same group of people traveling from the Attica quarry; 2) Mueller and Keck represent distinct single settlements spread across the landscape; and/or 3) Keck functioned as a satellite (hunting) camp supplementary to Mueller. The uniformity of low-quality exotic raw material in both assemblages, suspiciously low proportion of debitage, and comparison with other Early Paleoindian sites in North America suggests Mueller and Keck represent single occupation sites with short settlement duration that could have served as a marshaling

area for small Clovis aggregations moving into the Central Mississippi Valley from the Attica and Holland lithic quarries. Future research is necessary to further explore these interpretations and eliminate some variables, including possible underrepresentation of debitage and smaller artifacts in both assemblages, as well as whether these abandoned tools were ever used. It will be useful to add the systematic collections obtained by the Loyola University Chicago Field School in order to increase sample size and get an idea of spatial patterning. Increasing the sample size will help decrease the bias in artifact size because 1) all material from test pits was dry-screened in order to collect small pieces that otherwise may have been overlooked; and 2) larger artifacts are more likely to be observed on the surface, whereas the layers below the plow zone often yield smaller artifacts. Since all artifacts found in situ were piece-plotted, their provenience can be used to identify spatial patterns occurring within and between the sites. No spatial data could be determined from Paul Keck's unsystematic collection because no information regarding provenience is known except for site level.

Furthermore, analysis of the conditions of the tools within specific types, such as bifaces and scrapers, would aid in understanding the process of manufacture, use life, and abandonment. It is important to analyze the pieces at a macroscopic level—considering a range of characteristics such as size, breakage, damage, and blank type—but microscopic use-wear analysis of the assemblages will also provide insight to the life ways of Clovis people, especially when comparing the results of these analyses with outcomes from other Clovis sites. Presently, ten projectile points have undergone microscopic use-wear analysis by Dr. Marvin Kay at the University of Arkansas and eight sidescrapers have been sent to Dr. Kay for microscopic use-wear analysis. According to Dr. Kay's

analysis, there is only evidence of use on the fluted points (Callahan Stage 6), whereas the fluted preforms (Callahan Stage 5) do not appear to have been used, suggesting that the lithic toolkit was carefully conserved before arriving at Mueller-Keck. This supports the hypothesis that Clovis groups were uncertain about what they might find in terms of lithic resources in the American Bottom. The sidescrapers are presently undergoing analysis, so results are unknown at this time. Finally, another interpretation regarding hunter-gatherer settlement is the colonization model proposed by Simons (1998) and Storck (2004). This model suggests different groups of hunter-gatherers settled in an area at similar times—this could be why this group of Clovis decided to inhabit Mueller and Keck. Future research should explore this model by comparing the Mueller-Keck data with other Clovis sites in the area, some of which are described by Koldehoff and Walthall (2004) in their paper regarding hunter-gatherers in the Central Mississippi Valley. The Lincoln Hills, Bostrom, Route 3, and Dugan Airfield sites all have some Attica comprising their assemblages; this could mean that "groups traveling west out of the Wabash Valley may have moved south on the Kaskasia Trail, likely after first stopping at the Mueller site" (Koldehoff and Walthall 2004:56). In this way, Mueller may have served as a marshaling site for people colonizing the region, which would explain the occurrence of Attica at other sites in the area. Future research based on these suggestions could add to knowledge of Clovis sites and occupation in the Midwest, as well as provide useful information for considering patterns of settlement organization of Early Paleoindians in eastern North America.

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Appendix I:

Figures and Tables*

***please see attached .ppt file for figures**

Table 1. Cross-tabulation of artifact class by raw material in the Keck Clovis collection.

CODE * RAW * SITE Crosstabulation

Count

SITE			RAW					Total
			Moline	Cobden	Salem	Attica	Holland	
11-S-593 Mueller	CODE	Debitage	0	0	1	236	26	263
		Cores	0	0	0	17	2	19
		Flake Tools	2	1	1	204	31	239
		Bifaces	0	0	2	43	4	49
		Projectile Points	0	0	0	27	2	29
	Total		2	1	4	527	65	599
11-S-1319 Keck	CODE	Debitage				95	3	98
		Cores				6	0	6
		Flake Tools				47	0	47
		Bifaces				14	0	14
		Projectile Points				11	0	11
	Total					173	3	176

Table 2. Cross-tabulation of artifact type by raw material in the Keck Clovis collection.

SUB * RAW * SITE Crosstabulation

Count

SITE			RAW					Total
			Moline	Cobden	Salem	Attica	Holland	
11-S-593 Mueller	SUB	Unclassifiable Biface Fragment	0	0	0	1	0	1
		Biface: Stage 1 Edged Blank	0	0	0	1	1	2
		Biface: Stage 2 Overshot Blank	0	0	0	12	0	12
		Biface: Stage 3 Thinned Blank	0	0	1	16	3	20
		Biface: Stage 5 Fluted Preform	0	0	1	13	0	14
		Biface: Stage 6 Fluted Point	0	0	0	27	2	29
		Core: Bipolar	0	0	0	12	0	12
		Core: Multidirectional	0	0	0	2	2	4
		Core: Bidirectional	0	0	0	1	0	1
		Core: Blocky Fragment	0	0	0	2	0	2
		Core: Uniface Core/Scraper	0	0	0	2	0	2
		Uniface: Scraper Fragment	0	0	0	26	5	31
		Uniface: Endscraper	1	0	0	60	6	67
		Uniface: Spurred Endscraper	0	1	0	36	1	38
		Uniface: Sidescraper	1	0	0	33	12	46
		Uniface: Spurred Sidescraper	0	0	0	1	1	2
		Uniface: End-and-side Scraper	0	0	0	3	0	3
		Flake Knife	0	0	0	1	2	3
		Gravers and Perforators	0	0	1	12	1	14
		Edge Damaged Flakes	0	0	0	30	3	33
		Debitage: No Platform	0	0	0	81	15	96
		Debitage: Crushed Platform	0	0	0	10	1	11
		Debitage: Core Reduction	0	0	0	38	2	40
		Debitage: Biface Thinning	0	0	0	62	5	67
		Debitage: Bifacial Retouch	0	0	0	18	1	19
		Debitage: Channel Flake	0	0	1	7	0	8
		Debitage: Bipolar Reduction	0	0	0	7	1	8
		Debitage: Uniface Retouch	0	0	0	13	1	14
	Total		2	1	4	527	65	599
11-S-1319 Keck	SUB	Biface: Stage 2 Overshot Blank				1	0	1
		Biface: Stage 3 Thinned Blank				6	0	6
		Biface: Stage 5 Fluted Preform				8	0	8
		Biface: Stage 6 Fluted Point				10	0	10
		Core: Bipolar				2	0	2
		Core: Multidirectional				1	0	1
		Uniface: Scraper Fragment				11	0	11
		Uniface: Endscraper				6	0	6
		Uniface: Spurred Endscraper				9	0	9
		Uniface: Sidescraper				10	0	10
		Uniface: Spurred Sidescraper				1	0	1
		Uniface: End-and-side Scraper				1	0	1
		Gravers and Perforators				4	0	4
		Edge Damaged Flakes				8	0	8
		Debitage: No Platform				38	2	40
		Debitage: Crushed Platform				4	0	4
		Debitage: Core Reduction				13	0	13
		Debitage: Biface Thinning				33	0	33
		Debitage: Bifacial Retouch				2	0	2
		Debitage: Uniface Retouch				5	1	6
	Total					173	3	176

Table 3. Cross-tabulation of biface stage by raw material in the Keck Clovis collection.

SUB * RAW * SITE Crosstabulation

SITE				RAW			
				Salem	Attica	Holland	Total
11-S-593 Mueller	SUB	Unclassifiable Biface Fragment	Count	0	1	0	1
			% within RAW	.0%	1.4%	.0%	1.3%
		Biface: Stage 1 Edged Blank	Count	0	1	1	2
			% within RAW	.0%	1.4%	16.7%	2.6%
		Biface: Stage 2 Overshot Blank	Count	0	12	0	12
			% within RAW	.0%	17.1%	.0%	15.4%
		Biface: Stage 3 Thinned Blank	Count	1	16	3	20
			% within RAW	50.0%	22.9%	50.0%	25.6%
		Biface: Stage 5 Fluted Preform	Count	1	13	0	14
			% within RAW	50.0%	18.6%	.0%	17.9%
		Biface: Stage 6 Fluted Point	Count	0	27	2	29
			% within RAW	.0%	38.6%	33.3%	37.2%
	Total		Count	2	70	6	78
			% within RAW	100.0%	100.0%	100.0%	100.0%
11-S-1319 Keck	SUB	Biface: Stage 2 Overshot Blank	Count		1		1
			% within RAW		4.0%		4.0%
		Biface: Stage 3 Thinned Blank	Count		6		6
			% within RAW		24.0%		24.0%
		Biface: Stage 5 Fluted Preform	Count		8		8
			% within RAW		32.0%		32.0%
		Biface: Stage 6 Fluted Point	Count		10		10
			% within RAW		40.0%		40.0%
	Total		Count		25		25
			% within RAW		100.0%		100.0%

Table 4. Comparison between sites based on expected value since Mueller is three times larger than Keck.

Mueller (11-S-593)	**Keck (11-S-1319)**
Proportionally more early stage bifaces.	Proportionally more late stage bifaces.
Proportionally more cores.	Proportionally more debitage.
Proportionally more endscrapers and sidescrapers.	
Proportionally more edge-damaged flakes.	

Table 5. Cross-tabulation of debitage type by raw material in the Keck Clovis collection.

SUB * RAW * SITE Crosstabulation

SITE				RAW			Total
				Salem	Attica	Holland	
11-S-593 Mueller	SUB	Debitage: No Platform	Count	0	81	15	96
			% within RAW	.0%	34.3%	57.7%	36.5%
		Debitage: Crushed Platform	Count	0	10	1	11
			% within RAW	.0%	4.2%	3.8%	4.2%
		Debitage: Core Reduction	Count	0	38	2	40
			% within RAW	.0%	16.1%	7.7%	15.2%
		Debitage: Biface Thinning	Count	0	62	5	67
			% within RAW	.0%	26.3%	19.2%	25.5%
		Debitage: Bifacial Retouch	Count	0	18	1	19
			% within RAW	.0%	7.6%	3.8%	7.2%
		Debitage: Channel Flake	Count	1	7	0	8
			% within RAW	100.0%	3.0%	.0%	3.0%
		Debitage: Bipolar Reduction	Count	0	7	1	8
			% within RAW	.0%	3.0%	3.8%	3.0%
		Debitage: Uniface Retouch	Count	0	13	1	14
			% within RAW	.0%	5.5%	3.8%	5.3%
	Total		Count	1	236	26	263
			% within RAW	100.0%	100.0%	100.0%	100.0%
11-S-1319 Keck	SUB	Debitage: No Platform	Count		38	2	40
			% within RAW		40.0%	66.7%	40.8%
		Debitage: Crushed Platform	Count		4	0	4
			% within RAW		4.2%	.0%	4.1%
		Debitage: Core Reduction	Count		13	0	13
			% within RAW		13.7%	.0%	13.3%
		Debitage: Biface Thinning	Count		33	0	33
			% within RAW		34.7%	.0%	33.7%
		Debitage: Bifacial Retouch	Count		2	0	2
			% within RAW		2.1%	.0%	2.0%
		Debitage: Uniface Retouch	Count		5	1	6
			% within RAW		5.3%	33.3%	6.1%
	Total		Count		95	3	98
			% within RAW		100.0%	100.0%	100.0%

Appendix II:

Comprehensive Lithic Artifact Coding Format for the Mueller-Keck Project

COMPREHENSIVE LITHIC ARTIFACT CODING FORMAT
MUELLER-KECK PROJECT
Loyola University Chicago
Last Updated: December 18, 2007 (DSA)
NOTE: not all variables recorded for all data sets.

SITE: (11-S-xxxx)
593 = Mueller (11-S-593)
1319 = Keck (11-S-1319)

CATALOG = P-series catalog number from original inventory records of Brad Koldehoff and appended by Loyola University Chicago

FS = (Loyola Field Specimen number – linked to EDM records and FS sample logs = equivalent to CATALOG)

INTERVAL = collection period
1 = before Nov. 1977
2 = after Nov. 1977 and before 1979
3 = after 1979 and before 1981 (undated)
4 = after 1979 (dated)

COLLECTION DATE: blank if unknown
DAY (only if given, usually not provided)
MONTH (only if given, listed numerically, e.g., Jan=1, Feb=2, etc.)
YEAR (only if given and list completely, e.g., 1981 -- not 81)

SITE AREA: leave blank if not known (used for non-piece plotted collections)
1 = north lobe near Dave Keck's trailer
2 = north slope

NORTH (from EDM records or SW corner of excavation unit)
EAST (from EDM records or SW corner of excavation unit)
ELEVATION (from EDM records – some missing values caused by operator error)

ST = shovel test number according to field assignments and field notes at Mueller
LEVEL = arbitrary sequence of excavated levels (0=surface, 1=first level; 2=second level, etc.)
TOP_DEPTH = depth below surface for top of excavated level (in cm)
BOTTOM_DEPTH = depth below surface for bottom of excavated level (in cm)

HORIZON = highest soil horizon represented (for excavated samples)
0 = surface
1 = O/A
2 = A
3 = Ap (plowzone)

4 = A/B (transition or mixed)
5 = B (may contain top of C)

RECOVERY = recovery technique used
0 = surface collection
1 = 1/4” dry screen
2 = 1/8” dry screen
3 = 1/16” wet screen (called “flotation sample” in log and field notes)

SCREEN SIZE (sorted with nested screens made from standard hardware cloth)
1 = 1 inch mesh
2 = 3/4 inch mesh
3 = 1/2 inch mesh
4 = 1/4 inch mesh
5 = 1/8 inch mesh
6 = 1/16 inch mesh

ARTIFACT CODE:
0 = unmodified rocks (may include road gravel or manuports) – NCR (non-cultural rock)
1 = fire-cracked rocks (FCR)
2 = hematite
3 = debitage (and mixed aggregates) – positive attributes of removal, no subsequent modification
4 = cores (nuclei with flakes removed – not for tool use but bifacial/bipolar forms are included)
5 = flake tools (flakes modified for use or damaged from use)
6 = bifaces (intentional shaping to create common bifacial margin and production of pp/k form)
7 = projectile points (show final modification, such as haft modification, edge abrasion, impact)
8 = ceramics (prehistoric)
9 = grinding stones
10 = hammerstones
11 = groundstone axes and celts
99 = historic materials (various)

RAW MATERIAL (see comparative collection and published descriptions)
1 = St. David member chert (Carbondale Frm., Randolph Co., IL)
2 = Moline chert (Spoon Frm., Rock Island Co., IL)
3 = Kinkaid chert (southern IL)
4 = Yankeetown Frm. orthoquartzite (Monroe and St. Clair Co., IL)
5 = Ste. Genevieve Frm. chert (Monroe and St. Clair Co., IL)
6 = St. Louis Frm. chert (Monroe Co., IL)
7 = Cobden/Dongola chert (St. Louis Frm., Union Co., IL)
8 = Salem Frm. chert (Monroe Co., IL)
9 = glacial till chert (may include desilicified Burlington)

10 = Attica chert (Borden group, Edwardsville Frm., Boone Co., IN)
11 = Keokuk Frm. chert
12 = Burlington Frm. chert
13 = Crescent chert (Burlington Frm., St. Louis, MO)
14 = Fern Glen Frm. chert (Valmeyer, Monroe Co., IL)
15 = Chouteau Frm, chert (Calhoun Co., IL)
16 = Kaolin chert (Clear Creek, Union Co., IL)
17 = Galena chert (S. Wisconsin, N. Illinois, W. Iowa)
18 = Bailey chert (Olive Branch, IL)
19 = Mill Creek chert (Union Co., IL)
20 = Holland chert (southern IN)

RAW MATERIAL CODES (mostly for FCR AND GROUNDSTONE use)
90 = miscellaneous chert
91 = chert-limestone or limestone-chert
92 = chert-sandstone or sandstone-chert
93 = quartzite
94 = quartzite-sandstone
95 = sandstone
96 = limestone
97 = granite
98 = chlorite schist (greenstone)
99 = igneous/metamorphic miscellaneous

THERMAL ALTERATION
0 = None evident
1 = Maybe (some color change possible; lustrous and waxy on interior and exterior)
2 = Definitely – probably intentional alteration (overlapping flake scars with differential luster)
3 = Burned – probably unintentional burning (pot-lids, crazing, smoked)

CORTEX (weathered and mineral-stained surfaces, classified by weathering context)
0 = None present
1 = Mineral stained, unflaked surfaces (usually internal fissures but sometimes exterior)
2 = Water-worn abrasion from secondary transport (rounded by tumbling and usually brown)
3 = Matrix/residual from eroded bedrock or residuum deposits (chalky)

ARTIFACT CLASS (sorting of manufacture process and tools vs. technological by-products)
0 = UNMODIFIED (NCR) when combined with AS code considered “possible groundstone”
1 = GROUNDSTONE TOOLS (verified wear damage)
2 = Chipped-stone TOOLS AND CORES (nuclei with negative flake scars)
3 = Chipped-stone DEBITAGE (waste flakes -- unused and unmodified positive spalls)

ARTIFACT SUBCLASS (note these categories are dependent on ARTIFACT CLASS)

Artifact Subclasses for AC=2 CHIPPED-STONE TOOLS AND CORES

Artifact Subclasses for AC=2 BIFACES (stages from Callahan 1979)
(bifacial margin with evidence of intentional efforts at shaping)
00 = Unknown stage (too fragmentary)
01 = Stage 1 biface (edging)
02 = Stage 2 biface (shaping - tabular core with overshot flakes and cone fractures)
03 = Stage 3 biface (thinning)
04 = Stage 4 biface (preform w/ fluting nipple and guide flakes established)
05 = Stage 5 biface (fluted preform)
06 = Stage 6 biface (margin abrasion - finished point)
08 = bifacial drill with haft modification
09 = bifacial wedge or adze/chisel tool

Artifact Subclasses for AC=2 CORES
(contain platforms with negative bulbs from flake removals)
10 = Unknown core type (non-orientable fragment)
11 = Bifacial core (very large, Stage 2-3 biface)
12 = Bipolar core (scalar core, pieces esquilles)
13 = Multidirectional core (common, unsystematic form)
14 = Bidirectional core (usually opposing platforms)
15 = Retouched blocky fragment (minimal working)
16 = Prismatic blade core (extremely rare cases)

Artifact Subclasses for AC=2 FLAKE TOOLS
(flakes with evidence of deliberate shaping for implied tool use)
20 = Miscellaneous retouched scraper (too fragmentary to classify)
21 = Endscraper without spur
22 = Endscraper with spur
23 = Beaked (keeled) scraper
24 = Sidescraper without spur
25 = Sidescraper with spur
26 = End and side-scraper
27 = End and side-scraper with spur
28 = Knife (bifacial margin but not continuous)
29 = Graver (delicate projections that include perforators)
30 = Edge damaged flake (possible utilized flake)
40 = Radial break tool (edge polished)
41 = Radial break tool (tip or point use)

Artifact Subclasses for AC=1 GROUNDSTONE
61 = Hammer

62 = Anvil
63 = Abrader (facetted stone)
64 = Axe/Adze/Celt
65 = Mano
66 = Metate

Artifact Subclasses for AC=3 DEBITAGE
(waste flakes without evidence of further shaping)
90 = No platform (if "nonorientable shatter" then FRAG=0; if else then "broken flake")
91 = Collapsed/crushed platform (platform area is damaged limited type assignment)
92 = Core reduction (formal multdimensional attribute states defined in appendix)
93 = Biface thinning (formal multdimensional attribute states defined in appendix)
94 = Retouch from bifacial tool (point or biface)
95 = Channel flake (formal multdimensional attribute states defined in appendix)
96 = Bipolar core reduction (formal multdimensional attribute states defined in appendix)
97 = Biface edge collapse (failed biface thinning – also defined in appendix)
98 = Retouch from unifacial tool (scraper)

FRAGMENT (oriented to standard American "anatomical" designations - Andrefsky 1998)
0 = Complete (or nearly complete with minor damage that does not limit standard measurements)
1 = Proximal fragment (includes "split flakes")
2 = Medial fragment
3 = Lateral fragment
4 = Distal fragment
5 = One lateral edge missing (used for tools only, not for debitage)

WEIGHT (to the nearest 0.1 gram – all artifacts less than 0.1 gram are rounded up to 0.1 gram)

COMMENTS (narrative comments)