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Archeological Excavations in Advance of the Historic Tour Trail Rehabilitation

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Introduction

Archaeological excavations were conducted by the University of Kentucky's Program for Archaeological Research in 2014 and 2015 in advance of rehabilitation of the Historic Tour Trail within Mammoth Cave. The purpose of the archaeological testing was to provide evaluations of the scientific significance and research potential of any archaeological deposits that will be impacted by the proposed trail rehabilitation. Mammoth Cave is an archaeological site (15ED1) that is listed on the National Register of Historic Places. Archaeological and paleontological testing conducted in 2003 (Trader, in progress) and 2008 (Ahler 2012) documented intact and scientifically significant prehistoric archaeological deposits. Because portions of the Historic Tour Trail are eligible for listing on the National Register of Historic Places, the National Park Service was required to evaluate the impact that trail rehabilitation activities will have on the archaeological deposits.

The 2008 excavations produced maps that provided general guidance to the Park Service regarding the potential for encountering either archaeological or paleontological deposits along the various tourism trails within the cave. However, only relatively gross categories of nil, low, medium, and high potential could be developed. Following up on this coarse-grained evaluation, the current project involved excavation of additional test units in segments of the Historic Tour Trail that had been evaluated as having medium or high potential for containing archaeological deposits. (There was no potential for intact paleontological deposits.)

Field and Laboratory Methods

UK-PAR followed field methods established through earlier archaeological excavations along the historic trails. All test units were 3-x-3 feet in area and were excavated in natural stratigraphic zones whenever possible. The first level removed the

sediment and rock fill that comprises the current trail (Stratum 1), constructed by the Civilian Conservation Corps in the mid-1930s. Subsequent levels removed either arbitrary or natural zones within underlying prehistoric deposits, designated as Stratum 2. Stratum 2 is composed largely of rock, with ashy sediment and artifacts filling interstices. Stratum 3 is basal cave sediment. Excavation units were confined to existing trails and to areas immediately adjacent to trails that might be disturbed during trail rehabilitation activities. Specific excavation unit placement was based on local conditions such as slope, width of the trail, evidence of previous disturbance, and thickness of the trail deposits.

All rock removed during excavation was examined for evidence of human modification. Soft sediment was screened in-cave through ½-inch mesh, and a 25% sample of the < ½-inch fraction from Stratum 2 was retained as a bulk sediment sample that was size-graded and analyzed in

the laboratory. When excavation was halted, unit walls were drawn at 1:12 scale and photographed. All units were backfilled to approximate original contour and conditions.

The primary goal of the artifact analyses has been to identify the range of prehistoric activities conducted at the investigated areas along the Historic Tour Trail. Nearly all activities required illumination, resulting in accumulation of abundant torch debris and torch ties. The most common activities conducted in the cave passages are apparently related to mineral mining, which took place mainly during the Early Woodland period, between about 2400 and 3000 years ago, based on previous radiocarbon assays. However, other artifact classes suggest additional activities were carried out in some locations, including cave exploration, storage of subsistence remains, processing of mined minerals, ritual activities related to ingestion of cathartic minerals (see Crothers 1997), and maintenance of staging areas (Ahler 2012). Laboratory analyses focused on 1) documentation of variation in the densities of prehistoric cultural material and 2) identification of artifacts indicative of

specific types of activities that took place in the cave, in addition to the commonplace activity of illumination.

Results of Field Investigations and Laboratory Work (Ongoing)

A total of 20 test units were excavated in five investigation areas along the Historic Tour Trail. A single unit in Vanderbilt Hall produced few prehistoric remains, but a probable 19th century flagstone trail was documented. A unit at Darnells Way near Washington Pit was minimally productive, though cane charcoal suggests that this area was explored prehistorically. A unit placed at the transition from Giants Coffin to the Acute Angle also revealed a portion of an earlier historic trail, along with low numbers of prehistoric artifacts. Eight units were excavated in the Audubon Avenue segment (Figure 1), and nine units comprising a single continuous block were excavated at Giants Coffin (Figure 2). A total of about 367 cubic feet of sediment (10.4 m³) was excavated. The following discussion focuses on results from Audubon Avenue and Giants Coffin areas, which were the most informative.

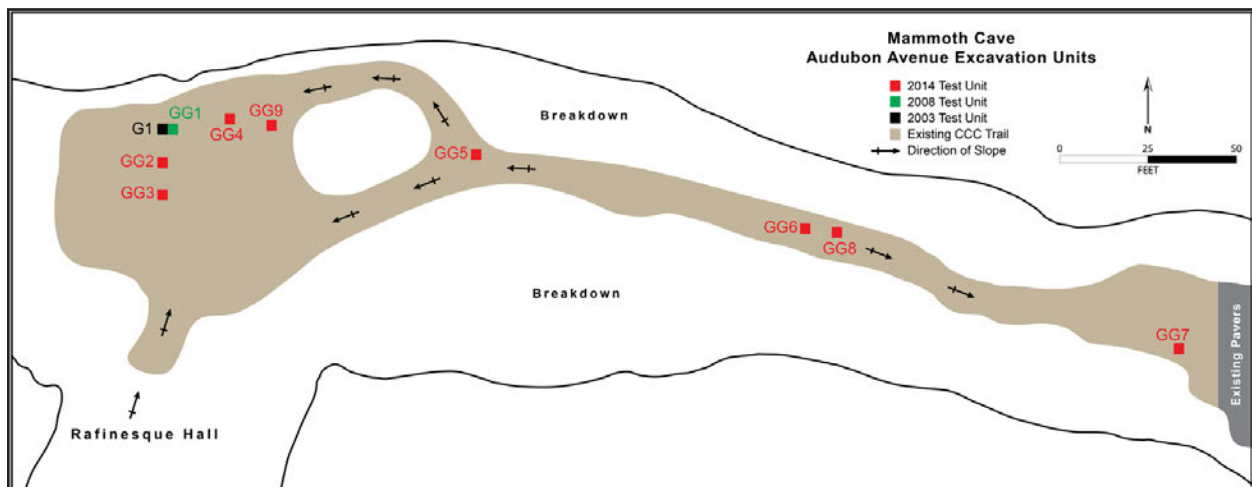


Figure 1: General plan of Audubon Avenue showing 2003, 2008, and 2014 Unit Locations.

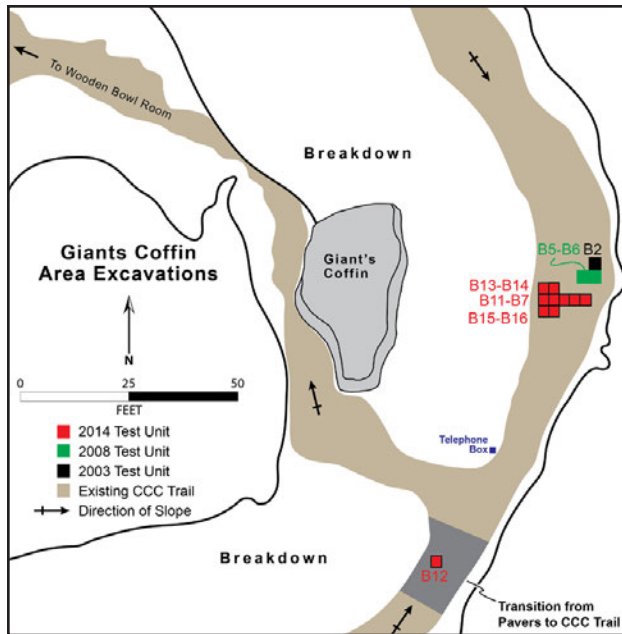


Figure 2: General Plan of Giants Coffin Area showing 2003, 2008, and 2014 Unit Locations.

In all excavation units, the most common cultural materials encountered in Stratum 1 were historic artifacts such as match sticks and paper, but prehistoric materials were often mixed with the trail fill. Prehistoric botanical remains were by far the most common materials in Stratum 2, though some historic artifacts were present, even in the lowest excavation levels. Historic materials sift down into the stratigraphic column because there are many voids in the rocky fill of Stratum 2.

Audubon Avenue Units

Eight units were placed along the Audubon Avenue section of trail that extends about 380 feet west of the end of the current pavers (Figure 1). Continuing west from the present terminus of the pavers, the CCC trail is relatively wide and flat, then narrows and slopes upward between large rocks to a long crest, then slopes downward to a broad (north-south) area at Rafinesque Hall. Earlier excavations in Audubon Avenue included

Units G1 and G2 in 2003 and Unit GG1 in 2008 (Ahler 2012). Both G1 and GG1 were placed about 5 feet south of the north cave wall near the west end of Audubon Avenue (Figure 1). Unit G1 had produced a moderate amount of carbonized and uncarbonized remains, mainly torch debris that was highly fragmented. A sample of wood charcoal and nutshell fragments below a large boulder was radiocarbon dated to 4170 ± 70 BP (Beta-183329), which is one of the earliest dates from the dark zone of Mammoth Cave (Trader, in progress). Testing conducted in 2008 in the adjacent Unit GG1 produced subsistence remains and gourd fragments. Audubon Avenue in general was considered to have moderate archaeological potential (Ahler 2012).

The 2014 Audubon Avenue units (GG2 through GG9) all showed the expected stratigraphic sequence of Stratum 1 CCC trail fill overlying Stratum 2 containing rocks mixed with prehistoric anthropogenic ashy sediment. However, the thickness of Strata 1 and 2 varied considerably among units, as did the amount of prehistoric cultural material recovered.

Units GG2 and GG3 were placed south of GG1 to provide data for a north-south cross-section of west end of the trail area. These units showed increasingly deep Stratum 1B deposits to the south, indicating that the west end of Audubon had been a broad depression that was now filled with historic trail deposits. Units GG4, GG5, GG6, and GG7 were spaced along the trail, and Units GG8 and GG9 were placed near units that had higher artifact density. These units documented high variability in artifact density.

Figure 3 shows the density of selected material classes for various excavation units. The Audubon Avenue units (GG2 through

GG9) have low densities of cane torch debris (measured in grams/excavated liter), indicating relatively low-intensity prehistoric usage of this part of the cave (Figure 3a). However, raw numbers of recovered cane torch debris are highly variable, ranging from zero in Unit GG3 to more than 300 fragments in both Unit GG6 and GG8. Units GG4 and GG9, close together in the western part of Audubon Avenue, produced moderate amounts of cane. The density of torch ties/cordage (number per liter of bulk sediment) as expected mirrors the density of cane. The density of seeds (number per liter of bulk sediment) is a possible indicator of food consumption or storage. These density data (Figure 3b) show the highest densities in Units GG6, GG8, and GG9, which suggests that prehistoric activities in Audubon Avenue included food consumption or storage in the same general locations where illumination was required. Mineral mining is one of the prehistoric activities that has been documented within Mammoth Cave, and the density of gypsum/selenium crystals (measured in grams/liter of bulk sediment) recovered from the ¼-inch to ½-inch size grade was calculated as an index of this activity. These data (Figure 3c) show that in contrast to the high cane and seed densities, Units GG6 and GG8 produced no mineral fragments. Instead, Unit GG9 had high mineral density, followed by Unit GG7, which had very low densities of cane and seeds.

These artifact density data show three overall patterns for the Audubon Avenue segment of the Historic Tour Trail. First, the original characterization of Audubon Avenue as an area of moderate potential for prehistoric remains is generally supported, but might be refined as having

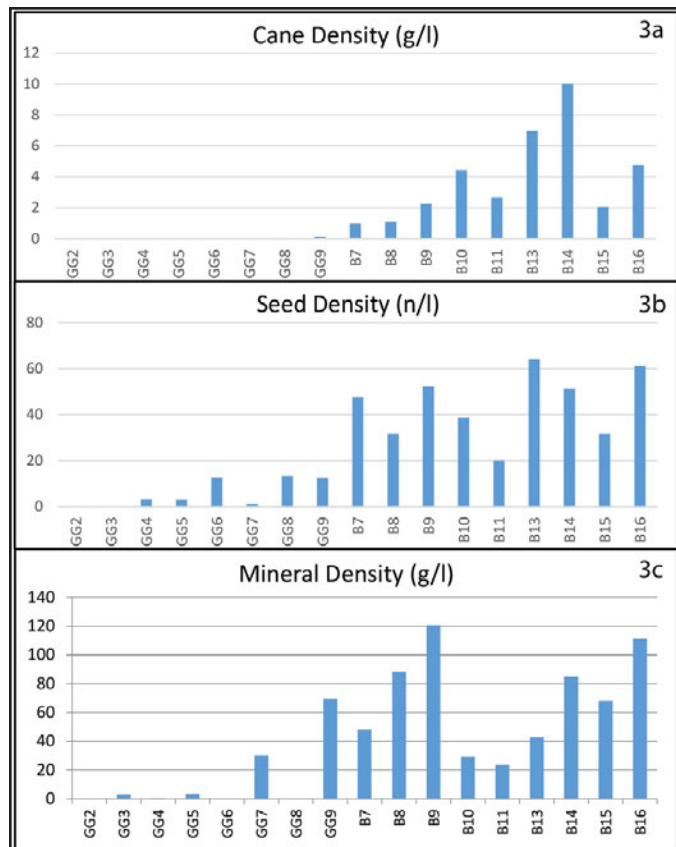


Figure 3: Densities of Selected Material Classes from 2014-2015 Excavations at Audubon Avenue and Giants Coffin.

low-to-moderate potential. Second, artifact density is highly variable along the trail, which is typical of cave and rock shelter deposits. Activity areas and preservation environments change rapidly depending on local conditions. Third, the types of artifacts recovered indicate that the major prehistoric activities in this part of the cave were mineral mining and possibly food storage/consumption. However, these activities did not necessarily take place in the same locations along the trail.

Giants Coffin Units

Nine units were placed in the Giants Coffin area (Figure 2). Units B7 through B11 comprise an east-west trench that spans nearly the entire width of the existing trail.

After these units were completed, the west end of this trench was expanded into an excavation block of six contiguous units with the addition of B13 and B14 north of the trench and B15 and B16 south of the trench. The trench location was selected based on previous work in Giants Coffin. Unit B2 was excavated in 2003, and it produced abundant cultural material, including the only complete sunflower head recovered from Mammoth Cave. In 2008, Units B5 and B6 produced an additional fragmented sunflower head. The trench was placed three feet south of Units B5-B6 to further sample this area. Depth of deposits ranged from 2.5 to 3.5 feet and it became clear during excavation that the lower portion of the Stratum 2 deposits was producing a high proportion of the cultural material. Stratum 2 was subdivided into upper, middle, and lower levels, and eventually the lower portion with its higher amounts of material was designated Stratum 2C.

Cultural material was highly abundant in all of the Giants Coffin units. The density data in Figure 3 is based on material recovered from the lower portions of Stratum 2, which included the least amount of historic contaminants. Figure 3a shows that cane densities are generally between one and two orders of magnitude higher than the Audubon Avenue units (GG series). These data also show a generally increasing trend of cane density from east to west across the trench, decreasing slightly at the far west end (Unit B11). Cordage density mirrors the cane density in general. Density of gypsum in the ¼- to ½-inch size grade (Figure 3c) is more variable, but in general the values are consistently higher than for the Audubon Avenue units. This pattern indicates that this area was consistently used for gypsum crystal extraction. The density of seeds is consistently higher than

any of the Audubon Avenue units (Figure 3b), with density ranging from 1.5 to 5 times as high in the Giants Coffin units. This finding indicates that Giants Coffin was consistently a location where food consumption or storage took place. The seed identification is still under way, but there are abundant examples of sunflower in Units B7 and B8, as was expected based on proximity to units that produced sunflower heads. In addition, there are high numbers of marsh elder and chenopodium, which are two other native plant domesticates, and high numbers of wild plant foods such as blackberry/raspberry and thin-shelled hickory. In addition to seeds from these food sources, many examples of the stem and flower heads of false foxglove (*Agalinis purpurea*, formerly *Gerardia purpurea*) were recovered in the Giants Coffin units. False foxglove stems may have been used as torch material, and it is likely that the stem was stripped longitudinally to make simple cordage for torch ties. False foxglove was not recovered in any substantial quantities from any of the Audubon Avenue units. Recovery of high densities of this plant suggests that the Giants Coffin area may have been a location where torches were prepared and tied, and where torch tie raw materials may have been stored for future use.

Other indicators of the types of activities conducted in the Giants Coffin area are derived from specific artifact classes that were recovered here and which are either very rare or absent from other investigated areas within the cave (Table 1). Presence of human paleofeces is perhaps an index of the intensity of prehistoric use in this part of the cave. In addition, human paleofeces suggest that the function of the Giants Coffin area may have changed through time. It might not be considered acceptable behavior to defecate near an area that was

actively occupied or visited, but it might be acceptable in an area had been abandoned and was no longer actively used. Of considerable interest is the recovery of chert debitage from Units B10 and B14, which are adjacent to each other (see Figure 2). Chert artifacts are extremely rare in the dark zone of Mammoth Cave, and excavation of 44 test units in 2008 produced no chert artifacts. Their presence in the Giants Coffin area indicates that other activities were taking place, possibly use of chert artifacts to manufacture or modify other materials, such as torches and torch ties. Use-wear analysis of the chert may help to identify specific tool functions, but this has not yet been accomplished. Gourd and mussel shell were both recovered in small quantities, and only from the Giants Coffin units. Gourds were probably used as storage containers, and mussel shell may have been used to collect minerals, especially soluble minerals such as epsomite and mirabilite. These classes of remains suggest that collection and processing of minerals may have been another activity conducted in Giants Coffin but not in most other portions of the cave.

One of the most informative aspects of the excavation was the opportunity to expose a contiguous 6-x-9-foot block in the west end of the excavation area (see Figure 2). Figure 4 shows a composite drawing of the remains encountered just above basal cave deposits in this excavation block. A sample of powdery sediment was recovered from the deeply concave surface of the large rock in Unit B11. This sediment had a different texture than the general ashy Stratum 2 deposits and was confined to the concave surface. A portion of this sample was sent to the Kentucky Geological Survey for X-ray diffraction analysis. That technique identified a suite of minerals, including gypsum (calcium sulfate) in appreciable quantities. Presence of gypsum in the sample provides support for our in-field speculation that this concave rock surface had been used for processing and grinding of gypsum crystals collected from the cave walls. Gypsum processing was also apparently an activity that was conducted in this part of the cave. Additional quantitative analyses of samples are planned but have not been completed. Three rocks that were observed and mapped at this excavation level had polished upper surfaces.

All of these rocks were loose and all were found on top of a thin but dense deposit of cane and charcoal. These polished rocks suggest that the location was an area of repeated prehistoric activities, or perhaps part of a prehistoric trail, with use of the area frequent enough to modify the rock surfaces. A small patch on an adjacent large breakdown rock is also polished, possibly from sitting while conducting other activities.

These excavations clearly demonstrate that the Giants Coffin area is qualitatively different from

Unit	Human Paleofeces	Gourd Fragments	Shell Fragments	Lithics
GG4		1 (0.07 g)		
B7	9 (78 g)			
B8	2 (48.34 g)			
B9	2 (40.89 g)	2 (0.45 g)		
B10	6 (65.1 g)	3 (2.98 g)		2 (42.77 g)
B11	13 (5.42 g)	3 (1.18 g)	1 (0.93 g)	
B13		3 (1.5 g)	1 (1.9 g)	
B14				1 (25.8 g)
B15				
B16		1 (<0.1 g)		

Table 1: Locations of Recovery of Selected Artifact Classes from 2014-2015 Excavations at Audubon Avenue (GG4) and Giants Coffin (B series).

other portions of Mammoth Cave. Gypsum mining took place, which also has been documented in many locations throughout the upper-level passages. Other activities inferred from the artifacts recovered include grinding/processing of gypsum, storage or consumption of food, and manufacture or storage of torches. These latter activities suggest that the Giants Coffin was probably a staging area for exploration or mining activities that extended farther into the cave. This inference is supported by the fact that several large and small upper-level passages come together at or very near the Giants Coffin.

One of the results of the field work is that the University of Kentucky was able to provide more specific evaluations to the Park Service regarding the archaeological significance of the Giants Coffin. We found that this part of the cave was unique in the diversity and intensity of activities conducted, and

we recommended either additional major excavations or avoidance and preservation of this area. However, the Historic Tour Trail still needed rehabilitation, and the Park Service created a compromise by stipulating that the construction activities not impact the significant Stratum 2 deposits in this section of the trail, and that archaeological monitoring be conducted during construction work.

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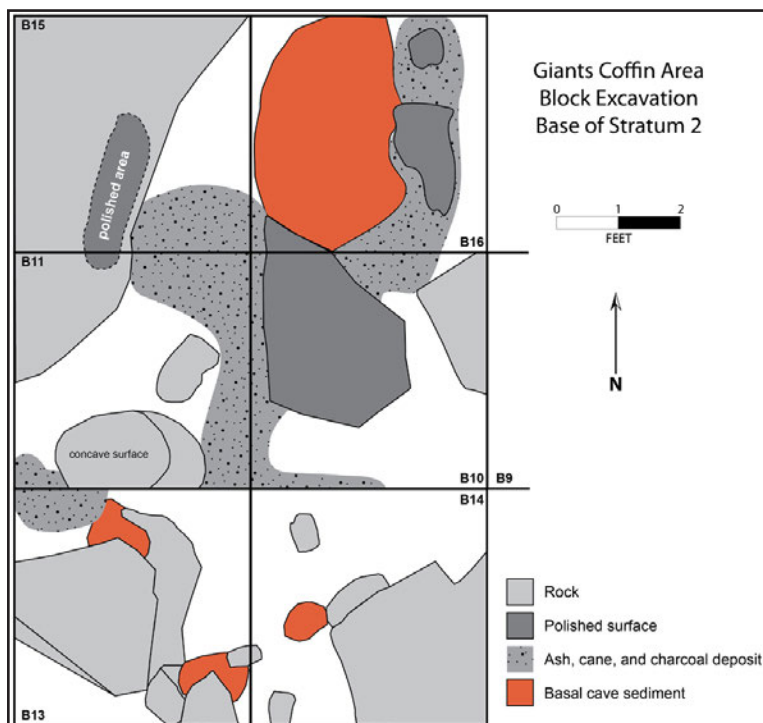


Figure 4: Plan view of 2015 Giants Coffin Excavation Block (Units B10, B11, B13-B16) at the Base of Stratum 2 Deposits.