

# THE CHRONOLOGY OF EARLY AGRICULTURE AND INTENSIVE MINERAL MINING IN THE SALTS CAVE AND MAMMOTH CAVE REGION, MAMMOTH CAVE NATIONAL PARK, KENTUCKY

MARY C. KENNEDY AND PATTY JO WATSON

*Department of Anthropology, C.B. 1114, Washington University, St. Louis, MO 63130-4899 USA*

*During the past 30 years, 57 radiocarbon determinations have been obtained from Salts and Mammoth Caves in Mammoth Cave National Park, Kentucky. These range from 4120 ±70 BP to 1920 ±160 BP, thus falling within the Late Archaic and Woodland periods of North American prehistory. We discuss the patterning of the dates, which cluster in two groups (Late Archaic, ca. 4200 BP to 3000 BP) and Early Woodland (ca. 2800 BP to 2200 BP). We also address the implications of those patterns for the history of aboriginal cave exploration and cave mineral mining in the Salts Cave and Mammoth Cave portions of the world's longest cave system, and for the development of early agriculture in Eastern North America.*

The Cave Research Foundation Archeological Project began work in 1963 in Salts Cave, expanding activities to Mammoth and other caves in Mammoth Cave National Park during subsequent years. From the inception of the project to the present time, we have concentrated primarily upon two research themes:

- 1) the specifics of when, how, and where prehistoric exploration took place in what is now known to be the world's longest cave system;
- 2) the information serendipitously provided by the ancient cavers about prehistoric agricultural origins and development in the Eastern Woodlands.

In this paper, we present the latest data and our interpretations of those data for both issues, emphasizing their chronological aspects.

## PREHISTORIC EXPLORATION AND MINING OF THE WORLD'S LONGEST CAVE: CHRONOLOGY

During the past decade, sufficient radiocarbon determinations have accumulated to enable us to define fairly clear patterning within the total date scatter (Kennedy, 1990, 1996; Kennedy & Watson, 1994). There are 57 determinations for the two caves from a variety of substances: soot, charred wood, uncharred wood and cane, weed stalks, bark, vegetable fiber fabrics, cane basketry, human gut tissue, and human paleofecal deposits. The oldest date is 4120 ±70 BP (2170 BC ±70 years), which is about the same as the only date currently available for prehistoric exploration of Lee Cave in nearby Joppa Ridge: 4100 ±65 BP (2150 BC ±65; Freeman et al., 1973).

The youngest date is 1920 ±160 BP (a.d. 130 ±160) years; this date is on internal tissue from the Salts Cave mummy (Watson ed., 1969, 1974). Two other mummy tissue dates are also young relative to the rest of the date sequence: intestinal tissue from the Mammoth Cave mummy (1965 ±65 BP, which

is 15 BC ±65) and a second determination on the Salts Cave mummy (1960 ±160 BP; 10 BC ±160). A fabric fragment closely associated with the Mammoth Cave mummy (a portion of his clothing, or of a bag he was carrying) yielded a determination of 2395 ±75 BP (445 BC ±75).

Nearly all the other Salts Cave/Mammoth Cave dates cluster in the mid-third millennium BC, i.e., ca. 500 BC ±200 to 300 years. There seem to be two fairly discrete episodes of cave use. We think the 1000 BC and earlier people (Late Archaic in archaeological terminology) were exploring, reconnoitering, or just caving for sport. The later people, ca. 500 BC, were intensively mining the cave's resources, systematically removing a variety of sulphate minerals in upper-level and some lower-level passages.

What specific substances were they seeking, and what did they do with the minerals they collected from the cave?

We think it highly likely that the prehistoric miners wanted gypsum in powdered form (which is what results if you pound gypsum crust off the cave walls) as a pigment base (just add water or grease and you have white paint), and in crystalline form (satinspar and selenite) probably for ritual use. We assume they also knew about the medicinal properties of mirabilite and epsomite (both of which are cathartic, and both of which occur naturally in various parts of the two caves, mirabilite being especially abundant), and made good use of them; and we assume further that they traded some of these substances outside the immediate region. We think we know a good deal about how the procuring of the various minerals was done (Munson et al., 1989).

## EARLY AGRICULTURE IN THE EASTERN WOODLANDS: CHRONOLOGY

As regards the early agriculture issue, we can be fairly certain that all the dietary and nutritional information in the

human paleofeces dates to about 800 to 200 BC. Although this data corpus provides the most detailed and best preserved such evidence available anywhere in the world for a prehistoric human group, it post-dates the earliest stages of plant domestication, which—at present—are best documented in upland locales of eastern Kentucky and central Tennessee.

Briefly summarized, the currently available archeobotanical record indicates the presence of *Cucurbita pepo* gourd (presumably wild) by 10,500 BC in Florida (Newsom, 1993); bottle gourd (*Lagenaria siceraria*, possibly domestic) by 5000 BC, also in Florida (Doran & Newsom, 1990, Newsom et al., 1993); *pepo* gourd (wild or domestic?) between 5000 and 4000 BC in Illinois (Conard et al., 1984); *pepo* gourd (probably domestic) in western Missouri (Kay et al., 1980), eastern Kentucky, and western Kentucky (Cowan et al., 1981, Crawford, 1982) ca. 2500 BC; domestic sunflower (*Helianthus annuus*) at 2300 BC in Tennessee (Crites, 1993); domestic sumpweed (*Iva annua* at 1800 BC in Illinois (Conard et al., 1984); domestic chenopod (*Chenopodium berlandieri*) in southern Ohio and eastern Kentucky at 1500 BC (Smith & Cowan, 1987); and domestic sunflower, sumpweed, chenopod, and maygrass about 1000 BC in eastern Kentucky, in the Arkansas Ozarks, and in several places in Tennessee (Chapman & Shea, 1981; Crites, 1978; Fritz, 1990, 1997; Gremillion, 1993, 1994; Watson, 1989). Then between 1000 BC and 500 BC, the full Early Woodland agricultural system exemplified in the Salts Cave/Mammoth Cave paleofeces appeared in eastern and western Kentucky.

Since the publication of the Salts Cave report (Watson ed., 1969), there has been a tendency to downplay or set aside—because of the unusual nature of the data base—Yarnell's calculations indicating that two-thirds of the plant foods in the Salts Cave feces were from cultivated and semi-cultivated or encouraged plants (Yarnell, 1969, 1974). We think, however, that the diet represented in the Salts Cave and Mammoth Cave paleofeces is a faithful indication of what the Early Woodland cave dwellers were eating above ground as well as below. Certainly this data corpus (paleofeces) is somewhat unusual for the Eastern Woodlands, and the archaeological site (deep cave interior) containing it is also out of the ordinary, but the accident of preservation that these caves represent is not necessarily the record of anomalous behavior in an anomalous site. Rather, we think the data derive from the fortuitous preservation of normal dietary intake, at least seasonally, for people in the region around Salts Cave and Mammoth Cave between 800 BC and 200 BC.

Some support for our contention is available from evidence elsewhere in Kentucky, in Tennessee, and in Arkansas (Fritz, 1986, 1997; Crites, 1993; Gremillion, 1994, 1997). These data considered as a whole imply quite strongly that various forms of pre-maize, upland agriculture were being practiced rather intensively in some places in the Midwest and Midsouth by and probably before 3000 BP.

#### NEW RESEARCH TRAJECTORIES: THE PALEOFECAL PROJECT

In September, 1992, in collaboration with Mammoth Cave National Park officials, we collected 12 paleofecal samples, six from Mammoth Cave and six from Salts Cave; an additional specimen was collected in 1993 from Mammoth Cave. This new project is actually the realization of a long deferred research strategy to date 20 paleofecal deposits, proposed over 30 years ago by Joe Caldwell (then Curator of Archaeology at the Illinois State Museum) and P.J. Watson. In the current version of this research, which was originally dubbed "Twenty Dated Dinners" by Caldwell, we seek to establish an AMS date and an analysis of the contents of a baker's dozen fecal samples. Our aim is a more complete understanding of the transition to agriculture in the Eastern Woodlands. Although more than 100 fecal specimens have been analyzed for dietary content (Marquardt, 1974; Stewart, 1974; Yarnell, 1969, 1974), only five had been directly dated by the radiocarbon technique (Kennedy, 1990; Watson ed., 1969: 69) before this latest set of fecal samples was collected.

In addition to clarifying the chronological relations between the fecal material and the entire span of Early Woodland cave use, we wished to address a number of other research problems recently noted by Kennedy (1990, 1996). One of these is to obtain dates from areas of the caves that had not previously been dated. Another is to attempt to locate feces that date to the Late Archaic period. Yet another is a range of issues related to accuracy and precision of these new dates, as well as those obtained previously. Finally, we thought it highly desirable to apply a state-of-the-science analysis to each specimen from macrobotanical, palynological, parasitological, and biochemical perspectives.

The radiocarbon determinations have been returned by the NSF-Arizona AMS Facility. As can be seen in Figures 1 and 2, these dates consistently cover the same general time period as do the nonfecal dates, and are unequivocally centered in the midst of the Early Woodland period. We were unsuccessful in locating any Archaic age samples, however. Portions of the samples are now being analyzed by several researchers: Kristen Grimillion, Ohio State University, for macrobotanical remains; Kristin Sobolik, University of Maine, for pollen remains; Charles T. Faulkner, University of Tennessee, for parasitological information; and Patricia Whitten, Emory University, for hormonal residues enabling sex determination (this type of work has been done for living non-human primates, but to our knowledge this is the first attempt to sex human paleofeces). Some reports of results have begun to appear: see Gremillion & Sobolik, 1996; Whitten, 1994.

#### NEW RESEARCH TRAJECTORIES: LEE CAVE AND LOWER SALTS CAVE

On March 19, 1994, a three-person Cave Research Foundation Archeological Project crew entered Lee Cave in Joppa Ridge, a southerly part of the Mammoth Cave system, in

# Radiocarbon Age Determinations

## from Mammoth Cave and Salts Cave, Kentucky

All representations are two-standard-deviation ranges

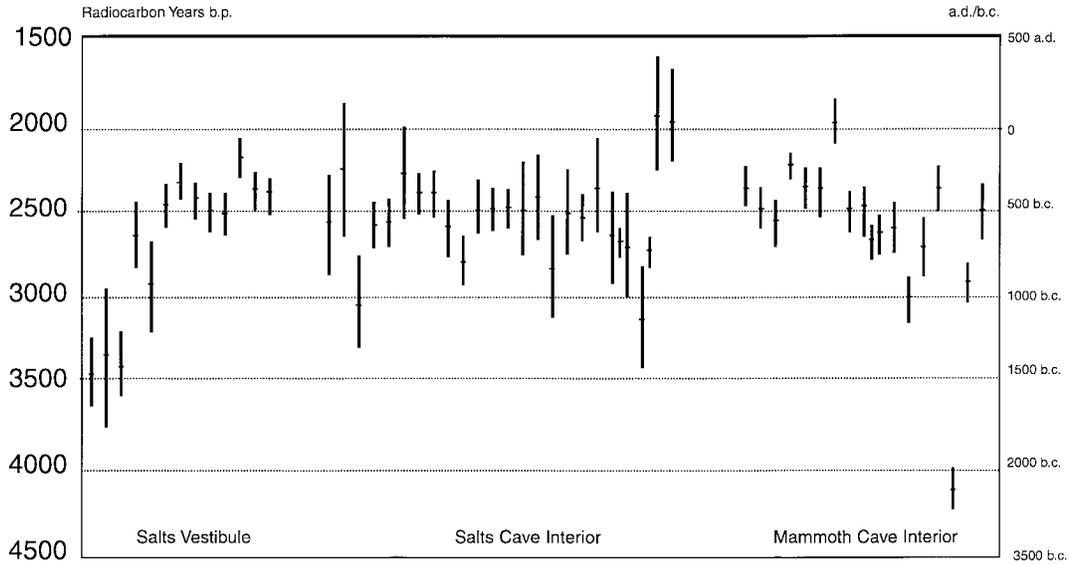


Figure 1.

# Paleofecal Dates

## From Mammoth and Salts Caves

in chronological order based on midpoint of range

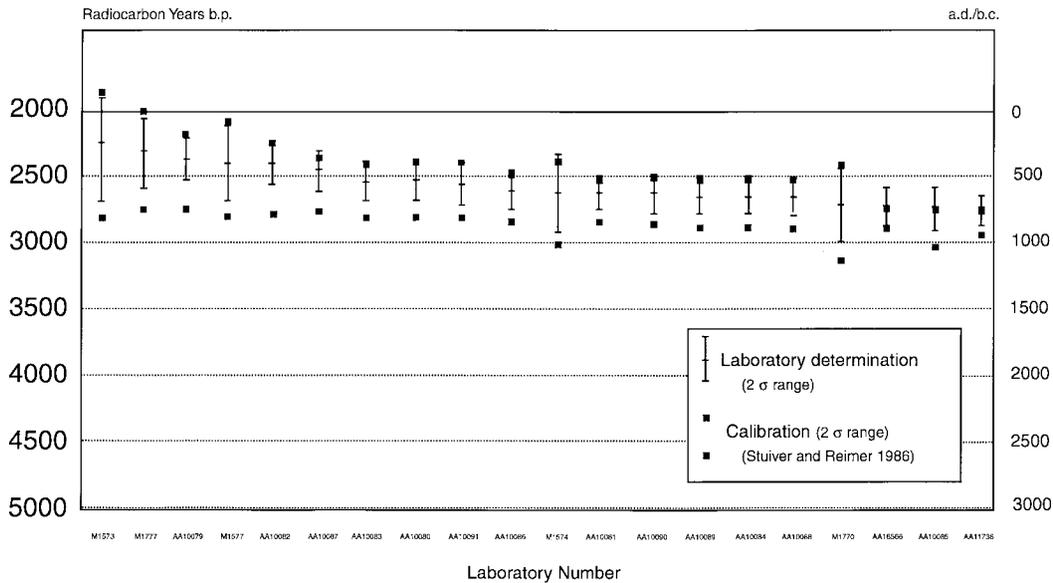


Figure 2.

search of paleofecal material potentially dating to the pre-1000 BC period. They succeeded in relocating a deposit noted during the late 1960s-early 1970s CRF documentation of Lee Cave (which was discovered by modern cavers in 1968, Freeman et al., 1973); and they also found four more deposits. At present, there are only two radiocarbon determinations for Lee Cave, one on cane from survey station K83 in Marshall Avenue (which is a 2 km long piece of trunk passage) and one on a log about 450 m west of K83 in Marshall Avenue, at survey station J25. The cane date is 2150 BC  $\pm$ 65, as noted at the beginning of this paper, and the log date is 4100 BC  $\pm$ 60. It has been assumed that the log arrived in the passage by natural means (a major flood, presumably), but that the cane determination dates the aboriginal exploration of Lee Cave. This date, one from Wyandotte Cave (Munson & Munson, 1990), and three others from Jaguar Cave in Tennessee (Robbins et al., 1981), make it clear that prehistoric cave exploration of the midcontinental karst region began before 2000 BC.

Had the Lee Cave paleofecal deposits turned out to be as old as the K83 cane torch material, then, in spite of our lack of success so far in securing Archaic specimens from Salts and Mammoth Caves, we would still have been able to obtain some detailed, Archaic-period data for comparison with the Salts Cave/Mammoth Cave dietary, nutritional, and agricultural information. Unfortunately, upon close examination, the Lee Cave specimens do not appear to be of human origin. Hence, we have returned our attention to Lower Salts Cave where two as-yet-undated paleofecal deposits remain in situ, and where many small intersecting passageways—some of which were entered prehistorically—are still unmapped and incompletely known. In January 1996 we obtained a radiocarbon determination on a climbing pole or scaling pole left by the aboriginal cavers at the north end of Indian Avenue, the main passage in this part of Lower Salts Cave: Beta-87915, 2760  $\pm$ 40 BP (810 BC  $\pm$ 40 years). Thus, it is possible that the two paleofecal samples on the floor of Indian Avenue may also date to the first part of the second (Early Woodland) period of cave use rather than the earlier (Late Archaic) horizon. But we cherish the hope that one or both may have been left on an earlier trip pre-dating the pole, and hence will provide at least a few clues to the information we have been seeking for a long time: what were the dietary and nutritional patterns in the Mammoth Cave area during the period prior to significant use of domestic food plants? By comparing Late Archaic dietary data (1500 to 2000 BC) with the agricultural complex so clearly documented in the Early Woodland Salts Cave/Mammoth Cave paleofeces, we can learn more about the foodways of the first prehistoric cave explorers in the region as well as those of the later cave miners, who were also superb cavers and some of the earliest farmers north of Mexico.

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