

SOME THOUGHTS ON THE COLLECTION OF RADIOCARBON SAMPLES

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The radiocarbon sample collection protocols discussed below were initially developed and implemented at Meadowcroft Rockshelter. Meadowcroft Rockshelter (36WH297) is a deeply stratified, multicomponent, closed site located on an unglaciated portion of the Allegheny Plateau, approximately 46 km southwest of Pittsburgh, Pennsylvania (Figures 1 and 2). From 1973 to the present, this locality and the contiguous Cross Creek drainage of Washington County, Pennsylvania, have been the focal point of an intensive multi-disciplinary research project which has generated hundreds of publications and technical papers. Though long famous or infamous for its early occupational components, the site is equally well known, albeit in generally smaller circles, for the extreme rigor and great precision of the excavation, analytical, and documentary methodologies employed there. Unlike the age of the earliest deposits, these protocols have *never* been the subject of any serious debate.

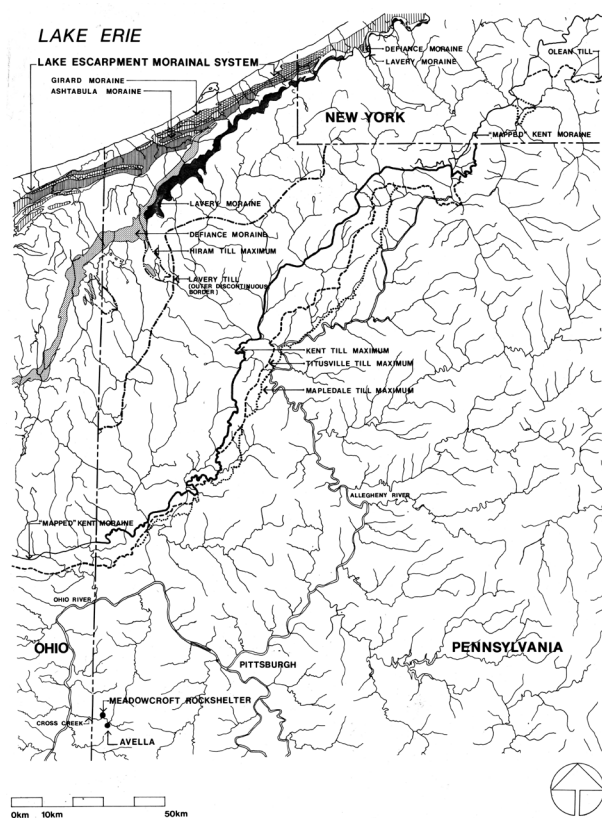


Figure 1. Location of Meadowcroft Rockshelter.

The ca. 4+ meter deep depositional sequence at Meadowcroft contains 11 major strata labeled in ascending order from deepest/oldest (Stratum I) to uppermost/youngest (Stratum XI). All but the deepest stratum contain cultural materials. Each stratum varies in thickness and composition particularly in terms of percentage of roof spalls present as well as in relative combinations of gravel, sand, silt, and clay-sized matrix. These differences, in turn, reflect the relative contributions of various depositional media or vehicles of emplacement which include grain-by-grain attrition from the sandstone roof and walls of the rockshelter, colluvial downslope movement by gravity and sheet wash, and various combinations of these sedimentation sources. The major strata are often subdivided into many microstrata (Figure 3) which differ, often subtly, from one another in terms of relative frequencies of gravel, sand, silt, and clay-sized components. Thinner, in some cases, than the edge of a trowel blade (ca. 1.35 mm), these microstrata were often tediously excavated with single-edged razor blades

(Figure 4). Moreover, they represent, in depositional terms, literal moments in time.

Additionally, many of these microstrata were subjected to a battery of macro- and micro-sedimentological analyses involving both conventional (i.e., sieve-based) grain-size study, and rigorous, instrumental, compositional analyses. These notably included Coulter Counter-based quantification of silt-sized materials (n.b. the first use of this technique in North American closed site archaeology), a wide variety of geochemical assays, and even scanning electron microscopy of individual sand grains for diagenetic studies.

The original purposes of these analyses were to provide objective, quantitative verification of the subjectively perceived—principally texture-based—differences between the various identified microstrata and strata in order to elucidate the subtle and nuanced changes in the depositional



Figure 2. General view of the new protective structure and visitors' platform at Meadowcroft Rockshelter. The multi-year project here directly led to the development of the radiocarbon protocols discussed in this commentary.



Figure 3. General view of microstratigraphy at Meadowcroft Rockshelter.



Figure 4. The use of single edged razor blades in the excavation of very thin microstrata at Meadowcroft Rockshelter.

history of the site. Put simply, each stratum and microstratum exhibited a distinctive suite of geochemical attributes—or in other words, a unique microsedimentary signature.

Radiocarbon Sample Collection Protocols

The success of this differentiation process ultimately resulted in not only a remarkably detailed stratigraphic record but also provided a basis, albeit fortuitously, for the development of the geoarchaeological subfield of forensic sedimentology (Adovasio 2017). To chronologically order the stratigraphic record at Meadowcroft, it was decided in 1973 to collect radiocarbon samples, where possible, within the following parameters.

1. Because the various depositional units identified at the site were accretional—that is, they had accumulated over varying segments of time—it was decided to bracket all interfaces or contacts with ^{14}C samples. Put another way, samples were collected, where possible, from *both* sides of the interfaces between discrete depositional units. This provided the ability to not only detect any depositional hiatuses or disconformities which may have existed at the site (n.b. there were none) but also to simultaneously mark the initiation and termination of each depositional event.
2. Within strata or microstrata greater than ca. 5 cm in thickness which did *not* exhibit internal compositional diversity, ^{14}C samples were collected at fixed intervals to document the duration of particular depositional moments.
3. As a matter of course, if cultural features (e.g., fire or trash pits) exhibited internal stratification, the same ^{14}C collection protocols detailed above were employed within the fill of those features.

4. If a given occupation surface or “floor” exhibited multiple anthropogenic features, *all* features were sampled for potential radiocarbon assay. The logic operational here was that any given surface *may* have been exposed for human use for variable lengths of time, hence, it was critical to attempt to delineate the “life span” of such surfaces.
5. All organic objects of suspected anthropogenic origin (e.g. charred basketry) were also sampled for potential ^{14}C assay—even if such objects were contextually enigmatic (n.b. none where). The rationale here is that the resultant date(s) of objects of anthropogenic origin do, in fact, document human agency in the form of construction, use, and/or discard independent of *any* stratigraphic position.
6. While the sampling techniques articulated previously address the chronometric delineation of stratigraphy from visible stratification, they do *not* resolve issues of association. If association is defined as the penecontemporaneous emplacement of two or more artifactual or ecofactual items as a result of a synchronous process, such a relationship cannot usually be demonstrated by C-14 assay alone. Instead, demonstration of association requires in addition to control of context (place in horizontal and vertical space), a multi-faceted assessment of depositional mechanisms and spatial relationships in which C-14 dates can provide but one piece of the associational “puzzle.”

The radiocarbon sample protocols employed at Meadowcroft have subsequently been implemented at more than 100 open and closed sites throughout North America and in several foreign countries. Indeed, they are currently being employed on the Old Vero Site excavations in central Florida (Figure 5). I stress that the ultimate success of any of these sampling protocols rests on the ability of the excavators to accurately define the stratification of any archaeological locus—open or closed—without which *all* sampling procedures are useless.



Figure 5. General view of Old Vero Site profile. Note multiple buried paleosols and other depositional units.

Reference Cited

Adovasio, J. M.

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