



Teacher's Guide to Archaeology at Meadowcroft Rockshelter

A Component of First Peoples: Archaeology at Meadowcroft Rockshelter

This program is generously funded by the Claude Worthington Benedum Foundation

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Teaching Archaeology at Meadowcroft Rockshelter

When planning the revisions for *First Peoples: Archaeology at Meadowcroft Rockshelter*, the Advisory team met their greatest challenge in determining how to proceed with the theme of **Archaeology**. The primary audience for the project was K-12 students, but **archaeology** is not a discipline that is directly defined by any set of academic standards. Most often it is approached as an elective course for secondary classes, or taught in social studies classes for elementary students. However, Meadowcroft is known first and foremost as an archaeological site. How then to make the archaeological aspects of the site relevant and interesting for school students?

The first challenge in answering this question was to determine what students should know about **archaeology** at Meadowcroft, followed by how to “teach” it. The following points proved useful in determining how to develop programming and resources for the **Archaeology** theme:

- **Archaeology** is the science of studying material **evidence** left behind by people in the past. **Archaeology** is a branch of the subject **anthropology**, the scientific study of all people and what they do, throughout the world and at all times. **Anthropology** studies the entire human experience, including our biology, ways of life, languages, and objects. **Anthropology** draws upon the humanities, social sciences, and natural sciences.
- **Archaeology** is used to refer to the process used for excavating a site to acquire **evidence** of past **cultures**, but also as the term applied to interpretations of what **cultural evidence** might mean.
- Archaeology borrows **methodologies** from numerous disciplines. In particular, **archaeology** at Meadowcroft would draw on more than 30 disciplines. Generally, the **excavation** process and the analysis of retrieved data are approached using scientific methods. Interpretations of the **evidence** uses methods from social studies.
- At Meadowcroft, exacting scientific **methodologies** resulted in the retrieval of data from 11 natural **strata** supported by radio carbon dates exceeding 16,000 years. The **stratigraphy** revealed a continuous but intermittent human occupation over those 16,000 years, indicating the presence of all major cultural groups commonly associated with Pennsylvania. However, material **evidence** and **radiocarbon dates** indicated the presence of pre-Clovis Paleo-Indian groups, disrupting previously accepted information about the identity of the first **prehistoric** North Americans.

Meadowcroft staff compiled several ideas for **archaeology** programming based on suggestions by the Advisory team. In talks with pilot teachers, the need for dividing the **archaeology** theme into a process/methods program and a findings program gained credence for several reasons. First, pilot teachers felt the division emphasized the scientific process, explaining why scientific **methodology** and inquiry is so

significant to discussions of Meadowcroft. Second, teachers felt that explorations of cultural significance were enhanced when students could explain the process behind data acquisition. Third, splitting the theme ensured better program flow and timing for on-site programming.

As a result, the information in this guide explores the archaeological process, from the discovery of the site, to its preparation and **excavation**. The closing section of this guide explores the **stratigraphy** of the site and the **evidences** contained in each layer. Interpretations of what the **evidence** means and the significance of the Pre-Clovis **radiocarbon dates** and **artifacts** are detailed in the *Cultural Findings Teacher Guide*.

Intersection of Archaeology Theme and Disciplines

The table below summarizes how the Archaeology theme of the *First Peoples: Archaeology at Meadowcroft Rockshelter* curriculum can be used to explore various academic disciplines.

<i>Archaeology Inquiry in First Peoples</i>					
	Science	History	Environment and Ecology	Geography	Technology and Engineering
Archaeology	<p>Although often grouped with social sciences, archaeology uses scientific methodology and procedures to understand the lives of humans in the past.</p> <p>Attrition of the sandstone cliff and deposition of sediments created the stratigraphy of Meadowcroft Rockshelter (geology).</p> <p>Radiocarbon assay was used to scientifically date cultural evidence at the site.</p>	<p>The purpose of archaeological investigation is to reveal patterns about human culture over periods of time.</p>	<p>Geofacts and ecofacts contribute evidence to the study of archaeology, particularly regarding the availability of natural resources and human response to environmental conditions.</p>	<p>Geography contributes evidence about the movement of humans through the landscape, resource distribution, human characteristics of the landscape, and the interactions between people and the environment.</p>	<p>Archaeological evidence and stratigraphy can be used to demonstrate how prehistoric technologies and practices changed over time at Meadowcroft.</p> <p>Field Schools at Meadowcroft in the 1970s utilized early computer technologies in the systematic organization of data during the excavation.</p>
Cultural Findings (<i>addressed in the Cultural Findings Curriculum</i>)	<p>Eleven naturally occurring strata (geology) and 52 Radiocarbon assays indicate a continuous human presence at Meadowcroft over 16,000 years.</p>	<p>All known New-World cultural periods are represented at Meadowcroft. Archaeological evidence explains how these cultures changed over time and the significance of the changes.</p>	<p>The abundant natural resources and a relatively stable climate resulted in continuous but intermittent human use of Meadowcroft over 16,000 years. Prehistoric peoples adapted to minor climatic episodes and modified their activity at the site based on the seasons.</p>	<p>Throughout 16,000 years, humans have modified the Cross Creek watershed to meet their evolving needs in response to the changing environments.</p>	<p>Prehistoric people adapted new technologies and practices in response to natural and cultural evolution.</p>

Archaeology GigaPan Inquiry

The First Peoples Archaeology GigaPan inquiry addresses the following points of inquiry with students.

Objectives Students will . . .	Grade Bands	Indicators of Mastery Students will be able to . . .
<ul style="list-style-type: none"> Define archaeology Identify and define the two categories of cultural evidence: artifacts and features Explore how archaeologists use a grid system to document the context of artifacts and features Explore how archaeologists create a chronology for the site using relative dating (stratigraphy and the Law of Superposition) and scientific dating (radiocarbon assay) Discover the purpose of the field school and field lab Recognize the archaeological methodologies and excavation process as state-of-the-art 	11 th - 12 th Grade	<ul style="list-style-type: none"> Analyze the archaeological methodologies employed at Meadowcroft Rockshelter Differentiate between artifacts and features and evaluate why context is crucial to interpreting them Analyze and Evaluate relative and scientific dating methods that are used to construct a chronology of the site Evaluate the role and function of a field school in archaeological training Analyze the methodologies used at Meadowcroft and describe how these helped to advance archaeological thinking
	8 th - 10 th Grade	<ul style="list-style-type: none"> Explain the archaeological methodologies employed at Meadowcroft Rockshelter Differentiate between artifacts and features and evaluate why context is crucial to interpreting them Evaluate relative and scientific dating methods that are used to construct a chronology of the site Evaluate the role and function of a field school in archaeological training Explain the methodologies used at Meadowcroft and describe how these helped to advance archaeological thinking
	5 th - 7 th Grade	<ul style="list-style-type: none"> Explain the goals, process and evidence of archaeology at Meadowcroft Describe artifact, feature and context and explain how they contribute to an understanding of life at a site Explain how archaeologists use relative and scientific dating to establish chronology; write an example of each using data from Meadowcroft Explain why archaeologists participate in field schools Explain why Meadowcroft is considered to be state-of-the-art

	K- 4 th Grade	<ul style="list-style-type: none"> • Recognize the Meadowcroft is an archaeological site • Explain that archaeologists study artifacts and features; give examples of each • Explain what chronology is • Describe a field school • Describe what it means to be a “state-of-the-art” excavation
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Major Terms and Concepts

Scattered throughout the curriculum guide and GigaPan exploration are terms highlighted in bold. These include key vocabulary terms, concepts, and items of significance. Teachers can incorporate the terms in vocabulary and spelling lists

Terms	Concepts	Identification Significance
Archaeology Artifact Closed-Site Context Cultural evidence Cultural features Datum Dripline Excavation Feature Field Designation Tags Field Lab Field School Geoarchaeology Grid System Methodology Multi-disciplinary Strata	Stratigraphy/ Law of Superposition Relative Dating Scientific Dating	Identification Significance Albert Miller Meadowcroft Rockshelter Meadowcroft Village Dr. James Adovasio

Archaeology at Meadowcroft

Thousands of years ago small groups of people traveled the Cross Creek Valley looking for food and shelter. These people did not use written language and we cannot read about what they thought or how they lived so we study **archaeology**. **Archaeology** is the science of studying material **evidence** left behind by people in the past.

Archaeology is a branch of the subject **anthropology**, the scientific study of all people and what they do, throughout the world and at all times. **Anthropology** studies the entire human experience, including our biology, ways of life, languages, and objects. These objects made or modified by humans are the **artifacts** studied by archaeologists. **Artifacts** are objects produced or shaped by human craft in the past. Most archaeological **artifacts** are buried under ground. These clues are recovered through **archaeological excavations**.

Archaeological sites occur throughout the world. Many modern cities, roads, and other structures are built directly on top of old sites. Archaeologists can often predict where these sites are because human behavior patterns today are not very different than the settlement patterns exhibited by **prehistoric** people. Archaeological sites, like modern sites, are often where people can find the resources to meet their basic needs, including water, shelter, and food. Meadowcroft Rockshelter is a predictable archaeological site because it meets these basic needs.

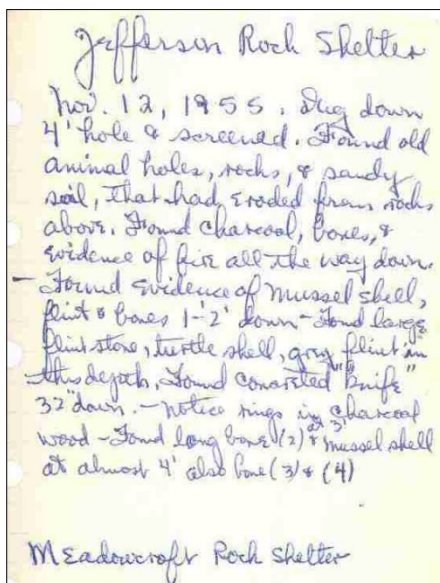


Figure 1 Albert Miller's Journal noting his discovery of the Rockshelter

Read More About the Discovery of Meadowcroft Rockshelter:

[40 years of Archaeology at the Meadowcroft Rockshelter](#) discusses Albert Miller's discovery of Meadowcroft Rockshelter, his search for an archaeologist to excavate the site, and the University of Pittsburgh field schools headed by Dr. James Adovasio. The piece would be useful as content for reading activities that introduce students to Meadowcroft Rockshelter (2 pages)

[Legacy of the Land](#) explores the roles of Delvin and Albert Miller in establishing Meadowcroft Museum on a portion of their family's farm. Includes a lengthy quote from Albert Miller that details his discovery and investigation of a groundhog hole at Meadowcroft Rockshelter which eventually resulted in the professional archaeological investigation of the site. The article is useful for discussions of preservation and conservation and for Albert Miller's first-person explanation of his exploration of the Rockshelter (6 pages)

On November 15, 1955, Albert Miller walked along Cross Creek on his family's farm just west of the town of Avella. His family had owned and farmed nearly 800 acres there since 1795. Albert intended to investigate the Rockshelter near the farm's boundary because many teenagers would hang out and camp there. Scattered under the Rockshelter were bottles and the remains of campfires. Then Miller stumbled upon a groundhog hole containing bits of charcoal and worked flint. He enlarged the hole and found additional charcoal and a projectile point. He realized that these findings and the ideal location of the site as a camp probably meant that more **artifacts** were beneath his feet. Albert knew that the hidden story required careful **excavation** if the parts of the story were to make sense. He waited to cross

paths with a professional archaeologist who would bring the proper **methodology** to an **excavation** of the Rockshelter.

Finding a Field School

In 1972, Dr. James Adovasio, an archaeologist at the University of Pittsburgh, was challenged to locate a site located within working distance of Pittsburgh to use as a **field school** for students in the Archaeological Research Program. The site was to serve as the focal point of a multi-year research enterprise. The site's requirements included accessibility, manageable size (under 50,000 acres), potential long-term **prehistoric** occupation, and the absence of any previous extensive research activities in the area. Most importantly, the site was to have at least one relatively undisturbed **closed-site**, either a cave or a **rockshelter**. Dr. Adovasio's previous research was in **closed-site contexts**, which allow for better preservation of organic materials. Such sites are often occupied and reoccupied intermittently for thousands of years and can be used as chronological anchor points for given areas.

Throughout the winter of 1972-1973, word circulated throughout southwestern Pennsylvania that the University of Pittsburgh was looking for a **rockshelter** or cave site to conduct a **field school**. A professor at California State College (now California University of Pennsylvania) informed Dr. Adovasio of a Rockshelter at Meadowcroft Village, a reconstructed nineteenth-century style "village" developed by Albert and Delvin Miller on a portion of their family farm. After viewing the site, Dr. Adovasio determined that Meadowcroft could serve as an excellent **field school** because of its proximity to Pittsburgh, the intact nature of the site, the presence of the **rockshelter** and ample abundant resources, and the property's situation and operation as Meadowcroft Village.

Read More About Dr. Adovasio and the Meadowcroft Field School

[The Great Journey](#)

is an autobiographical account of how Dr. James Adovasio came to be involved with the two most highly contested pre-Clovis New World archaeological sites: Meadowcroft Rockshelter and Monte Verde in Chile. Adovasio details his work with closed-site methodologies and perishable technologies. The article is of great use in explaining the twisting paths of a career in academia; students thinking of pursuing secondary and post-secondary education will benefit from reading Adovasio's experience. The article is useful for career exploration and presents a human face to archaeology.

Preparing for a Field School

The investigation at Meadowcroft Rockshelter started prior to breaking ground. First the archaeological team conducted surveys of the local **flora** and **fauna** then mapped the site **topography**. All vegetation in and around the Rockshelter, on the **talus** (broken rock debris) **slope** in front of the shelter, and on the contiguous **upland slope** was inventoried. Then they cleared the land in and around the Rockshelter, stripping all vegetation within 20m (65.6 feet) east and west of the mid-point on the modern-day Rockshelter overhang was stripped to ground level.

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View looking west of Meadowcroft Rockshelter prior to excavation (Photography by Dr. James Adovasio, May 1972)

With the physical **excavation** space readied, archaeologists established a **grid system** to enable the reckoning of all horizontal coordinates. The **grid system** originally consisted of 2 m (6.6 ft.) square units, which was later modified into 1 m (3.3 ft.) square units during the 1974 and later field seasons. In addition, 0.5m and 0.25 m (1.6 and 0.8 ft.) square units were employed when required for more precise recording. Last, a permanent elevation **datum** and subsidiary data were affixed to the north wall of the Rockshelter from which all vertical measurements were taken. Archaeologists would record the location of all excavated data by using the **grid system** coordinates and the vertical data within the site.

Archaeologists arrived at Meadowcroft on June 15, 1973 for the first summer **field school**. During the next six field seasons (spring and summer), a **multi-disciplinary** team of experts worked side-by-side with college students for a total of 417 **excavation** days of 12 to 14 hours. Additional work was conducted under Dr. Adovasio with the Mercyhurst Archaeological Institute, Mercyhurst College in the 1990s as site maintenance.

Excavation Process

Dr. Adovasio's team designed the **excavation** at Meadowcroft to gather all possible data. Every step of the process was planned and documented to preserve the **context** of any recovered data. **Context** is the three-dimensional location of an **artifact** or **feature** in relation to all the other **artifacts**, **features**, **geofacts**, or **ecofacts** around it, including soil. The **excavation** process is tedious because once the soil is removed from a site, it cannot be replaced. **Archaeology** is a destructive science: **evidence** once removed cannot be recreated. Great care is necessary to ensure that all information is recorded and recorded accurately since there are no second chances.

Excavations began by opening a south to north trench that started outside the **dripline** and worked into the dry portion of the shelter. The **dripline** is a small but distinct pattern in the soil that forms when rainwater is focused to drip in certain places; in this case, it is the line of where water drips off the Rockshelter overhang. This **trench profile** revealed the various **strata** and provided a baseline site profile that spanned the exterior and interior portions of the shelter relative to the **dripline**. The trench was expanded as the situation dictated in 1973, and subsequent field seasons into its present configuration.

Archaeologists excavated each square of the **grid** using trowels, dental picks or other small utensils as needed, while following the natural **stratigraphy** and, when possible, microstratigraphy of the shelter. When a natural **stratum** was sufficiently thick, it was subdivided into arbitrary 5 or 10 cm **excavation** levels. **Strata** and micro-strata were initially defined by subjective criteria including texture, apparent

composition, friability, degree of compaction and, on a more limited basis, color. Objective, quantifiable verifications of the integrity of these units was later provided by chemical, grain size, and compositional analysis.

Standardized **field forms** were used to map and make notes about each level within each square at the site. The data were codified and computerized either on site (1974 and later) or in the archaeological laboratory at the University of Pittsburgh. At the beginning of the 1974 season, phone lines were strung into the shelter and a TTY computer terminal (teletype: a desk sized keyboard with computer paper feed that printed out all commands and responses, it had no visual monitor display) was set up in the shelter. The TTY terminal was connected to the University of Pittsburgh mainframe over the phone line using a 300-baud acoustical modem. The TTY terminal was used to input data as it was generated on the site for faster processing and analysis, which in turn aided in determining how the **excavations** would proceed. In addition to standardized field forms, archaeologists kept extensive **field notes**, to record their observations, thoughts and non-standardized information.

All fill from the **strata** except the deepest occupational unit, Stratum IIa, was dry-processed through ¼ inch (0.6 cm) mesh hardware cloth. Fill from Stratum IIa was wet processed with water through 1/8-inch (0.3 cm) mesh hardware cloth. If the fill was from **stratum** fill or from a **feature** unrelated to firing (i.e. not a hearth or fire-floor), it was processed using water flotation through graded sieves. If a sample was derived from a fire **feature**, it was also processed through graded sieves using hydrogen peroxide flotation. The combination of **dry/wet screening** and **flotation** procedures resulted in the recovery of over two million separate items from Meadowcroft Rockshelter. These items can be sorted into several categories, including **artifacts**, **geofacts**, and **ecofacts**.

Cultural Features, or areas of human activity, were quartered or cross-sectioned and mapped in three dimensions. **Features** include fire pits, garbage pits, work spaces, etc. These areas cannot be removed from the field because they must be destroyed to be understood. Archaeologists carefully documented each **cultural feature**. **Excavation** profiles were drawn every 1 m or 0.5 m (3.3 or 1.6 ft.) intervals throughout the **excavation**. The distribution of rock spalls from the shelter roof also determined the amount of floor space available to **prehistoric** occupants through time, and special care was made to map virtually all spalls that were larger than 4 squared centimeters (1.6 square inches). The recording and computerization of the coordinates for roof spalls, **cultural features**, other cultural and noncultural remains, permitted later production of large-scale “floor” maps for the **strata** and microstate of the shelter. These maps helped archaeologists “draw” the human and geological activity at the site at any given time.

In addition to excavating **cultural materials**, archaeologists searched for clues about the natural **environment** surrounding the Rockshelter. These **ecofacts** are data that reveals information about past **environments** and sources including pollen, plant remains (including charcoal from burned plants), and animal bones. Much of the **ecological** data from Meadowcroft was recovered using the floatation process mentioned above. During the flotation process, excavated soil was placed in a tub with a screen bottom. Standing in flowing water, archaeologists submerged the bottom of the tub in the water within

a few inches of the rim. Fine grained soil passed through the sieve bottom with water. Floating materials were skimmed and put in a pan to dry. Any heavy materials sank to the bottom and were removed for analysis. When the skimmed materials were dry, they were carefully sorted into categories that included seeds, grains of pollen, and other fragments of plants (including charcoal from burned plants). The heavier materials, which include animal bones and mollusk shells, went through a similar sorting and classification process. The data gathered from flotation helped archaeologists understand the plants and animals that lived around pre-historic Meadowcroft.

Archaeologists collected numerous samples to gain insight about the composition of geologic materials inside and surrounding the Rockshelter. These **geofacts** helped archaeologists understand how the Rockshelter **stratigraphy** formed. **Geofacts** are data that reveals information about the age and formation of landforms. One group of samples cut from selected areas across the site, revealed the composition of all major **strata**. These samples were also analyzed for geochemical composition, trace element analysis, and micro-faunal study. Another sample collected year-round beginning in 1974 and continuing through 1978 established the type, character and volume of modern sedimentation at the site. These findings were compared with the temperature, humidity, **precipitation** and other factors to gain insight into modern sedimentation at the Rockshelter. A third study measured the sheet wash affecting the site, providing a gauge by which to examine the colluvial pile at the Rockshelter. The final geological sampling studied the **erosion** at the Rockshelter face.

At the end of each field season at Meadowcroft, archaeologists constructed a wooden shelter over the **excavation**. The **enclosure** protected the dig from weather and from vandalism. All excavated materials from the season, including **artifacts, floral, faunal**, geological samples, field notes, film of the **excavations**, and the TTY terminal were transported to the University of Pittsburgh or project affiliated institutions and universities for analysis by the appropriate specialists.

An archaeological site like Meadowcroft generates a lot of information. However, much of the information is of little use to non-specialists without some interpretation. Archaeologists published a series of interim reports on the data derived from the 1970s era **excavations**. The materials in these reports are more comprehensive than most final reports and provide most of the data and source material for this curriculum and other educational programs about the Meadowcroft Rockshelter. While some archaeologists contested the results of the **excavation** (read more in the *Cultural Findings Resources*), all reviewers agreed that the **methodology** and processes employed on the Meadowcroft project were state-of-the-art and reflected best practices for **closed archaeological sites**.

Dating Meadowcroft Rockshelter

Native American Cultural Periods at Meadowcroft Rockshelter

Archaeologists at Meadowcroft use five designators to explain the changes between cultural groups at Meadowcroft. They are:

Historic or Contact (1550-1750 AD)

Woodland (1550-2700 BP)

Transitional (2700-4300 BP)

Archaic (4300-10,000 BP)

Paleoindian (10,000-16,500 BP)

The Woodland and Archaic periods are subdivided into Early, Middle and Late. Each cultural period has a unique set of characteristics that differentiate it from the other periods. Most of the characteristics relate to technology as evidences in material culture: distinctions in tools, ceramics, basketry and other artifacts.

Meadowcroft Rockshelter's story covers a long period of time: the earliest geologic dates go back nearly 300 million years. Individual archaeological, geological or **ecological** facts are interesting and important, but they often represent a single moment in time. To gain understanding of how and why things changed, archaeologists and other specialists must look for patterns that occur over broad spans of time. Geologic history of the Meadowcroft Rockshelter and Cross Creek **watershed** occurred slowly over millions of years. By contrast, the cultural story of the site is condensed in the past 16,000 years. These are vast amounts of time that entail different methods of reporting. The discussion below is offered to help explain the different terms for expressing the passage of time and the reasons for doing so in discussions of Meadowcroft Rockshelter.

Assigning Time Terms for Time Before the Written Word

Meadowcroft Rockshelter is primarily a **prehistoric** archaeological site. Meadowcroft spans 16,000 years of human occupation; only about the last 300 years can be corroborated with the written record. Most of human **history** is similarly **prehistoric**, or occurring before the advent of written language. **Archaeology** is therefore the only means we have of understanding the lives of people prior to written **history**.

Since **prehistory** occurred before written language, archaeologists must find ways to designate the passage of time. Initially, at the turn of the nineteenth to the twentieth century, the passage of time at archaeological sites was based on the Christian calendar. Time was recorded based on the life of Christ: A.D. referred to *Anno Domini* (After Christ), while B.C. referred to events that happened Before Christ. Similarly, all **artifacts**, regardless of origin, were identified by comparisons with those of Old World **archaeology** pertaining to ancient Greece, Rome and Egypt. However, with an increase in professional **anthropological** study, the old standards for dating proved inadequate and culturally biased.

Archaeology has come a long way from the nineteenth-century techniques used for dating **artifacts** and sites. Today, determining the

age of **artifacts** and **archaeological** sites remains an important step in interpreting the significance of a site. Fortunately, methods for assigning dates are increasingly accurate: since 1950, advances in atomic science have made it possible to assign precise dates derived by measuring the passage of time it takes for radio-carbon 14 to decay. Similarly, **archaeologists** have developed new sets of diagnostic **artifacts** that apply to the New World. By reporting time in relative and scientific ways, **archaeologists** are better equipped to communicate the passage of time at **excavations**.

Relative Dating

Meadowcroft Rockshelter Stratigraphy	
Strata	Cultural Period
XI	Historic
X	Late Pre-historic
IX	Late Pre-historic
VIII	Late Pre-historic
VII	Late Woodland
VI	Late/ Middle Woodland
V	Early/ Middle Woodland
IV	Early Woodland
III	Terminal/ Early Woodland
II b	Middle Archaic
IIa upper	Early Archaic
IIa middle	Paleoindian
IIa lower	Paleoindian
I	Culturally sterile

The basic method for assigning age to **archaeological** sites is through **stratigraphy**, the layering of rock and soil in an **archaeological** site. The principle behind **stratigraphy** is the **Law of Superposition**. The **Law of Superposition** indicates that **artifacts** closest to the surface are newest, while deeper **artifacts** are older. As **archaeologists** excavate, the **stratigraphy** of the site reveals itself, with layers of **cultural activity** stacked on top of one another. As **strata** are uncovered, they are carefully documented since the act of **excavation** removes the layers. **Archaeologists** use **stratigraphy** and the **Law of Superposition** to assign **relative dates** to a site. The dates do not tell a specific time, but instead demonstrate that object #1 is older than object #2 because #1 was found in a lower layer.

At Meadowcroft Rockshelter, stratigraphic **excavation** entailed sifting through eleven layers of information to determine the relative ages of each cultural layer as they relate to one another. There are eleven natural **strata** at Meadowcroft, assigned numerical designators beginning with the oldest Stratum (I) and proceeding to the latest (XI). Stratum I is the oldest and deepest layer, while Stratum XI is the uppermost and newest layer. One **strata**, Stratum II is further subdivided into Stratum IIa and Stratum IIb by a rockfall.

The first people visited Meadowcroft Rockshelter when Stratum II was the surface floor underneath the overhanging roof. These people used Paleo-technologies, including large spear points like the Miller lanceolate. They stayed at the Rockshelter for short periods of time before moving on. Slowly, other groups of people came to the site, stayed and then moved on. Each time people came to the site, they left **evidence** of their activities in the forms of charcoal from fires, bones and seeds from food, or tools that were forgotten.

Over a long period of time, geological activity around the Rockshelter caused sediment to enter the overhang and bury **evidence** of human activity. It took 13,000 years for the 40-130 inches of sediment that make up Strata II to be deposited on the floor of the Rockshelter. Each stratigraphic layer formed in a similar fashion: sediment would enter the Rockshelter, gradually covering the previous floor and burying any **cultural artifacts** in the process.

Relative Dating is based on **stratigraphy**. As mentioned above, Stratum II is lower and therefore older than Stratum III. **Stratigraphy** does not tell us the age of **artifacts** in years, but it does help us to understand which **artifacts** are older based on their vertical location within an **excavation** site.

Absolute Dating

In contrast to **relative dating**, **absolute dating** assigns a highly accurate date range, measured in years before the present, to an **artifact**. This date, or range of dates, is derived from careful laboratory analysis that has origins in nuclear research during World War II. Since 1950, advances in this technology have enabled scientists to more accurately measure the passage of time experienced by an object. This common type of **absolute dating** is referred to as **carbon-14 (C14)** or **radiocarbon dating**.

Archaeologists use **Carbon-14 dating** to determine how old an organic substance is. All living things contain and absorb carbon, both C12 and C14, the unstable, radioactive isotope. As soon as something dies, the unstable C14 begins to decay into nitrogen. When half (50%) of the normal amount of C14 in a living thing has decayed into nitrogen, one half-life of carbon-14 had elapsed. Scientists know that the half-life of carbon-14 is 5730 years. By measuring the percentage of the remaining of carbon-14, we can calculate the age of an **artifact**. Carbon dates from the Meadowcroft Rockshelter place the earliest **cultural evidence** at around 16,000 years old. While highly accurate, the carbon-14 dates can only measure the age of organic substances up to about 50,000 years old. Fortunately, human occupation at Meadowcroft falls within that span of time and all the **cultural artifacts** at the site are related to **cultural features** containing charcoal derived from wood.

Carbon-14 dates are recorded as a number followed by the letters “YBP” or just “BP”. These letters stand for “Years Before Present” or “Before Present”. The year 1950 is used as the present. Therefore, something with the carbon date 10,000 BP would date back to 10,000 years before 1950. As seen above, Carbon-14 dates are not really dates. Instead they are numbers that reflect the passage of time since an organic object died. This number can vary because the amount of C-14 in the atmosphere changes year to year. To account for the deviation, Carbon-14 dates must be calibrated, or corrected, using dendrochronological (tree-ring) records or computer software programs. Most Carbon-14 dates are therefore reported as a number \pm a number, for instance, 10850 \pm 870 BP.

To achieve the dates assigned to Meadowcroft Rockshelter, **archaeologists** submitted one hundred (100) charcoal samples to the Radiation Biology Laboratory of the Smithsonian Institution. One additional sample was submitted to the Dicarb Radioisotope Company. All but two of the samples were

derived from fire pits or charcoal lenses within the deposits under the Rockshelter. The other two samples were **basketry** fragments. **Radio-carbon dating** ascribes the initial occupation of the Rockshelter to the fifteenth millennium B.C., and the most recent **radiocarbon dates** associated with aboriginal human materials is A.D. 1265 ± 80 (685 YBP).

Diagnostic Artifacts

Archaeologists have one additional tool that is commonly used for making sense of when humans created or used a specific **artifact**. This technique is the comparison of certain types of **cultural artifacts** with other **artifacts** of known age and origin. **Diagnostic artifacts** are objects that have stylistic traits that are distinctive during a certain period, usually these **artifacts** are **lithic** projectile points or **ceramics**.

The functions of **artifacts** remain the same over long periods of time and through diverse cultural groups: articles of clothing, vessels for food storage and cooking, tools for hunting, etc. However, as time passes, changes in style impact the appearance of **artifacts**. This is especially true for **artifacts** that survive in great numbers, such as **ceramics**, **lithics**, and, for later sites, glassware and metals.

Archaeologists use the stylistic characteristics of **artifacts** to understand the evolution of objects. They illustrate these findings on typology charts that demonstrate when certain technologies came into use and how they changed over time. The **history** of an **artifact** can be traced on the sequencing chart, with deviations indicating preferences between different groups of people or changes in available materials. When additional **artifacts** are unearthed at any **archaeological** site, they can be compared with known development dates on typology charts. Comparisons with known types allow **archaeologists** to make informed estimates about the age of an **artifact**.

Usually all the techniques are used to describe the age of an **artifact**. Usually all the techniques are used to assign a date to an **artifact**, rarely just one method is used. An object's place in the **stratigraphy** of a site can assign a relative date when compared with other objects within the site. The **context** of the **artifact** can also be used to explain how or when the **artifact** was used. For instance, an **archaeologist** may determine that a pot **sherd** found near an Early Woodland cooking hearth that is in Stratum IV at Meadowcroft must also date to the Early Woodland period because the shard is directly associated with the cooking hearth. The **Law of Stratigraphy** demonstrates that the **sherd** and the hearth must date to the same period since they are found in the same layer. Comparisons with the style of similar shards from Meadowcroft and other sites would help to verify the pot's manufacture in the Early Woodland Period. Finally, by **radiocarbon 14 dating** the charcoal associated with the shard, an **archaeologist** might find that the charcoal dates to 3050 YBP or 340±90 BC to 1100±85 BC. The scientifically derived **radiocarbon date** from a **cultural feature** sharing the same **context**, the association with other diagnostic **artifacts**, and the shard's placement within Meadowcroft's **stratigraphy** all suggest origins in the same period.

Reading Stratigraphy for Teachers

In the discussion below, both text and tables are used to summarize the stratigraphic findings at Meadowcroft Rockshelter. Teachers can use this information to provide data for classroom activities or to explain what students are seeing when they examine the GigaPan photographs of the interior of the Rockshelter.

The tables are organized to demonstrate stratigraphy through change over time: Radiocarbon (scientific) dates, diagnostic artifacts, and assigned cultural periods are noted. Archaeologists use the radiocarbon assays and diagnostic artifacts to compare with other known sites before assigning the cultural period.

The stratigraphic findings are interpreted in the Cultural Significance Teacher's Guide.

Reporting the Stratigraphy of Meadowcroft Rockshelter

This essay was compiled from several of the reports published in *Meadowcroft: Collected Papers on the Archaeology of Meadowcroft Rockshelter and the Cross Creek Drainage*. A bibliography of these works is listed at the end of this essay. All data is cited to the specific report in the text.

Chronology is the backbone of **archaeology**. **Archaeologists** have numerous tools for establishing the **chronology** of a site, but the single most basic tool is **stratigraphy**. **Stratigraphy** is the layering of materials in an **archaeological** site.

The **stratigraphy** of Meadowcroft Rockshelter formed over a long period of time as natural geological forces essentially filled the Rockshelter back in. By the end of the Pleistocene, Cross Creek had eroded down to the bedrock that would serve as Stratum I, leaving the Rockshelter high and dry above the **floodplain** of Cross Creek. Gradually, over thousands of years, sediments were deposited under the roof overhang - filling in the space to depths of over 15 feet in some areas - until the ground level was at the groundhog hole discovered by Albert Miller in 1955.

Stratigraphy at Meadowcroft is made up of **colluvium**, fill (sediment and soil) deposited by gravity or downslope movement. There are no abrupt demarcations in the colluvial fill to indicate to the naked eye where one **stratum** stops and another begins. Instead, each **stratum** is composed of various colluvial layers and interfaces. Each was meticulously excavated using the best stratigraphic **methodology** available in the 1970s. Precise geological analysis was necessary to distinguish the layers, some of which were so fine that they had to be removed with razor blades. These layers vary in thickness, **depositional** mode, force and rate. The geologic process of colluvial **deposition** is detailed in the *First Peoples Geology* materials.

Archaeologists excavated from the 1973 surface downward, assigning each **stratum** a numbered tag as they encountered it. The tags were mounted to the wall of the **excavation** site to help maintain the

context for any data retrieved from the layer. The tags are labeled with “F” + a number. The “F” stands for “field designation,” meaning a critical location within the **excavation**. Many **field designation tags** remain in the **excavation** site today: each white tag affixed to the wall is a **field designation tag**.

Meadowcroft’s **stratigraphy** proved to be exceptionally deep and intact: **archaeologists** ultimately found eleven well-defined stratigraphic units at the site. The **strata** are numbered from Stratum I (F99), the oldest and deepest unit, to Stratum XI (F3, F8), the uppermost and youngest. Each **stratum** represents the period of time when the layer was on the surface. Applying the **Law of Superposition** to the **stratigraphy**, **archaeologists** could determine that the deepest materials (Stratum IIa) were oldest. Their premise was substantiated by **radiocarbon assays** were run on samples from this and other **strata**, firmly dating the eleven **strata** and various occupations of the Rockshelter.

The Official Reports

The official reports on the **stratigraphy** of Meadowcroft Rockshelter, summarized below, explain three primary categories of information. First, the composition, thickness, continuity, and location of each **strata** suggests the geologic **stratigraphy** of the site. This information explains the geologic forces that filled the Rockshelter back in, creating the **stratigraphy**. Secondly, the ordering of the layers provides a general marker used for **relative dating**, called the **Law of Superposition**. Using the **Law of Superposition**, **archaeologists** could conclude that items in Stratum III are younger than those in Stratum II because those of Stratum III are found above Stratum II. This dating was then substantiated when possible through **radiocarbon assay**, **scientific dating** which when corrected, yields an approximate date for organic materials in a specific layer. Lastly, the reports focus on the appearance of cultural materials in each layer and the changes in diagnostic **artifacts** and site use at the site at a time when each layer was at the ground level.

The **stratigraphy** is here represented in descending order, as it would have been excavated. Stratum XI represents the surface of the ground when the Meadowcroft **field schools** commenced in 1973.

Stratum XI

Stratum XI was found at the top of every excavated unit and is considered continuous across the site. It overlies Stratum X inside the **dripline** and Stratum IX outside the **dripline** and inside the **dripline** where Stratum X does not occur. It ranges in thickness from 12 to 15 cm (4.7 to 5.9 in) and is mostly silty clay with some larger particles brought in by sheetwash. A

Summary for Stratum XI (F3, F8)		
Radiocarbon Date Range	Diagnostic Artifacts	Cultural Period
175 B.P. ± 50 years (A.D. 1775, uncorrected; SI 3013)	<p>Lithic (Fitzgibbons 1982:102): 2 Chesser Notched points</p> <p>Ceramics (Johnson 1982:146): Watson Ware sherds Monongahela ware sherds</p>	Historic

single **radiocarbon date** was obtained on charcoal from a **feature** in this level. Four fire pits/hearths and one dog burial were recorded in Stratum XI (Stuckenrath et al., 1982:79).

The cultural materials from Stratum XI were assigned primarily to the Historic Euroamerican Period. However, a few **prehistoric artifacts** were also recovered (Stuckenrath et al, 1982:78). Watson ware and Monongahela ware **sherds** were recovered from **slumped matrix** from levels VIII-XI (**depositions** that moved from their original position because of natural settling actions). **Perishable remains** included one quadrilateral unpointed wooden twig, one square cut one quarter round wooden twig, one beveled wood chip, two awl tips and one utilized antler tine (Stile 1982:138). The largest amounts of nutshell, in terms of gross weight, were recovered from Stratum XI. Walnut/butternut, hickory and acorn shells were recovered along with seeds from *Cercis* sp. (rebud) and *Arctium* sp. (burdock).

Stratum X

Stratum X is only found in the western 3/4s of the excavated units inside the **dripline** and does not occur outside the **dripline**. It lies above Stratum IX and below Stratum XI inside the **dripline**. Stratum X varies in thickness from 1 to 5 cm (0.4 to 2.0 in) and is composed primarily of coarser particles (>0.4 mm) with some silt and clay. No radiocarbon dates were obtained for this **stratum** since charcoal samples were too small to process. It should be younger than 600 B.P and has a terminal date possibly during the Historic Period. Only one fireplace/hearth was recorded in this level (Stuckenrath et al, 1982:79).

Summary for Stratum X (F25)		
Radiocarbon Date Range	Diagnostic artifacts	Cultural Period
none	<u>Lithics:</u> None <u>Ceramics</u> (Johnson 1982:146): Watson Ware sherds Monongahela ware sherds	Late Woodland Historic

Chipped and ground stone **artifacts** from Stratum X were assigned to the Late Woodland Period and there also were some Historic Euro-American **artifacts** (Stuckenrath et al, 1982:77). The later historic **artifacts** were considered intrusive into the **stratum**. No diagnostic projectile points were recovered from this **stratum**. As

previously noted, a slump from Strata VIII to XI produced Watson Ware and Monongahela ware **sherds**. **Perishable artifacts** recovered included one quadrilateral unpointed wooden twig, one wooden cube, one beveled wood chip, seven irregularly cut wood chips and one bone awl tip (Stile 1982:138).

Stratum IX

Stratum IX was found in all units excavated and is presumed to be continuous across the site. It is found over Stratum VIII inside the **dripline** and Stratum VII outside the **dripline** and in those units inside the **dripline** where Stratum VIII does not exist. It underlies Stratum X inside the **dripline** and Stratum XI outside the **dripline**. Coarser particles (>0.4 mm) compose most of the **matrix** inside the **dripline** with some silt- and clay-sized particles. Outside the **dripline**, the amount of silt- and sand-sized particles exceeds that of the coarser materials. One radiocarbon date was obtained on charcoal from this

stratum. It represents one of the four date reversals noted in the Meadowcroft **radiocarbon sequence** as it is older than the date from Stratum VIII. Two fire pits/hearths were recorded in this unit.

Cultural materials from Stratum IX were assigned to the Late Woodland period. Diagnostic **Ceramics**

Summary for Stratum IX (F9)		
Radiocarbon Date Range	Diagnostic Artifacts	Cultural Period
685 B.P. ± 80 years (A.D. 1265, uncorrected; SI-2363)	<p><u>Lithic</u> (Fitzgibbon 1982:102): 1 Steubenville Stemmed-like, 1 Bennington Corner-Notched, 3 Jacks Reef Corner-Notched, 4 Levanna Triangular, 1 Madison Triangular forms</p> <p><u>Ceramics</u> (Johnson 1982:146): Watson Ware sherds Monongahela ware sherds</p>	Late Woodland

were recovered from a slump outside of the **dripline** that included materials from Strata VIII to XI. No **perishable artifacts** and no identified **floral** remains have been identified from this unit.

Stratum VIII

Stratum VIII was encountered only in about 3/4s of the units on the western side of the shelter inside the **dripline**. It also was found in a few units outside the **dripline**, but it pinches out outside the **dripline**. It is not a particularly thick **stratum** ranging in thickness from 0.5 to 5.0 (0.2 to 2.0 in). The **matrix** is primarily larger-sized particles (> 0.4 mm) with smaller quantities of sand present. The **stratum** represents spalling and attrition from the shelter roof that occurred after the "New Roof Fall". One radiocarbon date was obtained from charcoal recovered in a **feature** in the **stratum** and one fire pit/hearth was recorded in Stratum VIII.

Stratum VIII Summary (F12)		
Radiocarbon Date for Stratum VIII	Diagnostic Artifacts	Cultural Period
was 630 B.P. ± 100 years (A.D. 1320, uncorrected; SI-3023)	<p><u>Lithic</u> (Fitzgibbon 1982:102): 1 untyped</p> <p><u>Ceramics</u>: none</p>	Late Woodland

Cultural remains from this **stratum** were sparse and were assigned to the Late Woodland Period. No **ceramics** were recovered from unequivocal Stratum VIII **contexts**. One piece of unidentifiable cordage and one bone beamer were found in the unit (Stile 1982:138). **Floral** remains were surprisingly common in this unit with walnut/butternut shells exceeding all the other nuts combined based on weight of the nutshells. There also were significant amounts of *Amaranthus* sp. (amaranth) and *Crataegus* sp. (hawthorn) (Cushman 1982: 215-317).

Stratum VII

Stratum VII Summary (F13)		
Radiocarbon Date Range	Diagnostic Artifacts	Cultural Period
1290 B.P. \pm 60 years (A.D. 660, uncorrected; SI-3026) and 925 B.P. \pm 65 years (A.D. 1024, uncorrected; SI-2047).	<u>Lithics</u> (Fitzgibbons 1982:102): 3 untyped <u>Ceramics</u> (Johnson 1982:146): 23 Watson ware sherds	Late Woodland

Stratum VII was encountered in all units excavated and is presumed to be continuous across the site. It overlaid Stratum V outside the **dripline** and Stratum VI inside the **dripline** and was under Stratum VIII inside the **dripline** and Stratum IX outside the **dripline**. It ranged in thickness from 20 to 40

cm (7.9 to 15.7 in) and the **matrix** was a sandy loam. **Cultural features** from this **stratum** included nine fire pits/hearths, one fire floor, two ash/charcoal lenses, and one specialized activity area (Stuckenrath et al., 1982:79).

Cultural materials from Stratum VII were assigned to the Late Woodland occupation of Meadowcroft. **Perishable artifacts** found included five fragmentary bone awls and one bone punch (Stile 1982:138). Wild nuts and seeds recovered from this unit included walnut/butternut, hickory, acorn, *Rubus* sp., *Amaranthus* sp. and *Vaccinium* sp.

Stratum VI

Stratum VI was encountered only in units located within the drip line of the shelter. It overlaid Stratum V and was under Stratum VII. The massive "New Roof Fall" (Fig. 19) on the eastern side of the shelter is contemporary with the base of Stratum VI. Larger particles (>4mm) make up a majority of the **matrix** with silts and clays, composing the rest of the **matrix**. The thickness of

Stratum VI Summary (F63, F129)		
Radiocarbon Date Range	Diagnostic Artifacts	Cultural Period
None	<u>Lithic</u> (Fitzgibbons 1982:102): 1 Levanna Triangular point <u>Ceramics</u> : None found	Middle to Late Woodland

this unit ranges from 60 to 140 cm (23.6 to 55.1 in). No radiocarbon dates were obtained from this **stratum** because the charcoal samples from the **features** were too small to process. However, it should date between the ending date for Stratum V of 1665 B.P and the early date (which will be cited below) from Stratum VII of 1290 B.P. **Cultural features** encountered were classified as nine fire pits/hearths, one fire floor and two ash/charcoal lenses (Stuckenrath et al., 1982:79).

Cultural materials from Stratum VI were rather sparse, but were assigned to the late Middle to early Late Woodland periods. **Perishable artifacts** included one bone awl tip and one bone bead blank (Stile 1982:138). Few **floral** remains were recovered from Stratum VI that could be assigned to human use at the shelter.

Stratum V

Stratum V was encountered in all excavated units and is presumed to be continuous across the site. Stratum V overlays Stratum IV and is under Stratum VI inside the **dripline** and Stratum VII outside the **dripline**. The **matrix** was a sandy loam that ranged in thickness from 20 to 40 cm (7.9 to 15.7 in).

Cultural features encountered in Stratum V included twenty fire pits/hearths, one refuse/storage pit, one roasting pit, two fire floors, six ash/charcoal lenses and four specialized activity areas (Stuckenrath, et al. 1982:79).

Cultural remains were assigned primarily to the Early Woodland or Middle Woodland occupation of the site. **Perishable artifacts** recovered were classified as one simple plaited **basketry** fragment, one grooved and rounded wooden twig, one complete and two fragmentary bone awls, one piece of a modified turtle carapace and one grooved and snapped piece of bone (Stile 1982:138).

Wild **floral** remains predominate in this **stratum** with

Walnut/Butternut the most common nutshell recovered along with lesser amounts of hickory and acorn. The most common seed remains were from

Rubus sp. (blackberry) followed by *Amaranthus* sp. (amaranth) and Chenopodiaceae (goosefoot) (Cushman 1982:215-217).

Stratum V Summary (F14)		
Radiocarbon Date Range	Diagnostic Artifacts	Cultural Period
2155 B.P. ± 65 years (205 B.C., SI-2487) near its base to 1665 B.P. ± 65 years (A.D. 285, uncorrected; SI-3024) at the top of the stratum	<p><u>Lithics</u> (Fitzgibbons 1982:102):</p> 1 Adena Ovate Base, 1 Bennington Corner-Notched 1 Chesser Notched	Early Woodland and Middle Woodland
	<p><u>Ceramics</u> (Johnson 1982:146): 5 Watson ware sherds, 1 Monongahela ware sherd</p>	

Stratum IV

Stratum IV was present in all units excavated and is presumed to be continuous across the site. It overlies Stratum III and is overlain by Stratum V. It varies in thickness from 30 to 70 cm (11.8 to 27.6 in).

Matrix is composed of a sandy loam. There were thirty-five fire pits/hearths, nine refuse/storage pits, three roasting pits, thirteen fire floors, fifteen ash/charcoal lenses and three specialized activity areas found in Stratum IV (Stuckenrath, et. al. 1982:79).

Stratum IV Summary (F16)			
	Radiocarbon Date Range	Diagnostic Artifacts	Cultural Period
Most of the cultural remains from Stratum IV were assigned to the Early Woodland Period Perishable artifacts recovered	3050 B.P. ± 85 years (1100 B.C., uncorrected; SI-2049) to 2290 B.P. ± 90 years (340 B.C., uncorrected; SI-SI-2051)	<u>Lithics</u> (Fitzgibbons 1982:102): 2 Steubenville Stemmed-like, 1 Burnsville Notched, 1 Adena Ovale Base, 1 Jack's Reef Corner-Notched <u>Ceramics</u> (Johnson 1982:146): 44 Half Moon ware sherds, 2 Watson ware sherds, 1 Monongahela ware sherd	Early Woodland

included six fragments of simple plaited **basketry**, one wooden snare trigger, two cut twigs, one wooden ring, one beveled wood chip, one complete and one fragmentary bone awl, one bone punch, one bone snare trigger, one utilized antler tine, one bone fishhook, one fragment of a bone flute, 5 pieces of modified turtle carapaces, one piece of bone bead stock and one bone beamer (Stile 1982:138). The most notable **floral** remains recovered from the stratum were squash (*Cucurbita* sp.) remains associated with radiocarbon dates of 2820 B.P. ± 75 years (870 B.C., uncorrected; SI-1668) and 2815 B.P. ± 80 years (865 B.C., uncorrected; SI-1665) and a specimen of sixteen row popcorn in association with radiocarbon dates of 2325 B.P. ± 75 years (375 B.C., uncorrected; SI-1634) and 2290 B.P. ± 90 years (340 B.C., uncorrected; SI-2051; Cushman 1982:216). None of these cultivated plant specimens were directly dated.

Stratum III

Stratum III was found in all excavated units and is presumed to be continuous across the site. It varies in thickness from 30 to 110 cm (11.8 to 43.3 in) and lies over Stratum IIb and below Stratum IV. Silt and clay are the predominant **matrix** materials composing stratum III with some sand also present. Six radiocarbon dates on charcoal samples from **features** in Stratum III ranged in age from. **Cultural features** found in the **stratum** included twenty-six fire pits/hearths, two refuse/storage pits, eight fire floors, seventeen ash/charcoal lenses and one specialized activity area (Stuckenrath, et al., 1982:79).

Cultural remains from Stratum III were assigned primarily to the **Terminal Archaic/Transitional or Early Woodland** periods. **Perishable artifacts** recovered included one fragment of simple plaited **basketry**, one complete and five fragmentary bone awls, two utilized antler tines and one flaked long bone. The

Summary of Stratum III (F18)

first domesticated plant remains came from Stratum III. Specimens of squash (*Cucurbita* sp.) were recovered from the top of the stratum in association with a radiocarbon date of 3065 B.P. \pm 80 years (1115

Radiocarbon Date Range	Diagnostic Artifacts	Cultural Period
3255 B.P. \pm 115 years (1305 B.C., uncorrected; SI-1679) to 2930 B.P. \pm 75 years (980 B.C., uncorrected; SI- 2066)	<p><u>Lithics</u> (Fitzgibbons 1982:102)</p> <p>2 Big Sandy-like, 2 Brewerton Side-Notched, 3 Brewerton Corner-Notched, 3 Buffalo Stemmed, 1 Lehigh Broad-like, 3 Merom-like, 3 Trimble-like, 1 Adena Ovate Base, 1 Levanna Triangular, 1 Koster Corner-Notched-like</p> <p><u>Ceramics</u> (Johnson 1982:146): 5 Half-Moon ware sherds 1 Watson Cord-Marked sherd</p>	Terminal Archaic/ Transitional or Early Woodland

B.C., uncorrected; SI-1664; Cushman 1982:216). The quantity of wild nuts, seeds and fruit pits also increased in Stratum III (Cushman 1982:215-217).

Stratum II

Stratum II was composed of sand and silt derived largely from the rock shelter walls and contained some larger roof spalls. It was continuous across the site and varied in thickness from 40 to 130 cm (15.7 to 51.2 in). Stratum II lies directly above the Stratum I-II interface and below Stratum III. A major roof spalling episode permitted separation of Stratum II into a lower Stratum IIa and upper Stratum IIb. Stratum IIa is in turn subdivided into lower, middle and upper sections based on additional roof spalling episodes. Stratum IIb primarily represents the upper 46 to 50 cm of Stratum II.

A total of thirty-eight **cultural features** were identified in Stratum IIa. They were classified as twenty-six fire pits/hearths, five refuse/storage pits, one roasting pit, one fire floor, one ash/charcoal lens and four specialized activity areas (Stuckenrath, et al. 1982:79). There were one hundred and twenty-three chipped stone **artifacts** recovered from lower and middle Stratum IIa including one unfluted **lanceolate point** named the Miller Lanceolate (Figs. 8-9), several unhafted bifaces (Fig. 17), unifaces (including two “Mungai Knives”, Fig. 12 rightmost **artifact** and Fig. 13), prismatic blades (Figs. 15-16) and fragments of prismatic blade cores (Fig. 14), utilized flakes and **debitage** flakes (Fig. 18) (Fitzgibbons 1982).

Lower Stratum IIa

Summary for Stratum IIa Lower (F46)

Radiocarbon Dates in Lower Stratum IIa	Diagnostic artifacts	Cultural Period
16,175 B.P. \pm 975 years (14,225 B.C., uncorrected; SI-2354) to 13,240 B.P. \pm 1010 (11,290 B.C., uncorrected; SI-2065).	1 Miller lanceolate 1 Mungai Knife	Pre-Clovis Paleo-Indian

The earliest cultural remains, **Pre-Clovis** Paleo-Indian materials, were recovered from lower Stratum IIa. A series of five radiocarbon dates were obtained from indisputable **cultural features**

(i.e., hearths or fire floor **features**) found in the **stratum** ranging from 16,175 B.P. \pm 975 years (14,225 B.C., uncorrected; SI-2354) to 13,240 B.P. \pm 1010 (11,290 B.C., uncorrected; SI-2065). A 19,600 B.P. date was obtained on a piece of bark that appeared to have been cut and which might have been part of a bark basket. Alternatively, it may have been charred bark from an ancient forest fire.

The Miller Lanceolate point, one Mungai Knife and most of the other chipped stone specimens were recovered from lower Stratum IIa. The oldest bone tool from the shelter was from lower Stratum IIa and is a cut and charred fragment from a white-tailed deer antler base (Stile 1982:137). It was recovered in a fire pit/hearth that also provided a radiocarbon sample dated to 16,175 B.P. \pm 975 years (14,225 B.C., uncorrected; SI-2354). A bipoint wooden tool was recovered from lower Stratum IIa (Stiles 1982:35). It resembles a foreshaft for a compound dart or spear shaft.

Faunal remains were not well represented from lower Stratum IIa. Only eleven bone fragments were recovered from these levels. **Species** identified included white-tailed deer, eastern chipmunk, southern flying squirrel, deer mouse, passenger pigeon, toad and colubrid snake (Guilday and Parmalee 1982:171). The chipmunk and possibly the deer mouse probably burrowed down into these levels. All identified **species** are usually found in **temperate climates** today. **Floral** remains from the earliest levels are sparse, but generally are representative of **temperate climate species**. Walnut and oak wood charcoal and walnut nutshells were identified from lower Stratum IIa (Cushman 1982:214).

Middle Stratum IIa

A roof spalling episode separates lower Stratum IIa from Middle Stratum IIa. Middle Stratum IIa represents additional **Paleo-Indian** (i.e., Clovis and later) levels at the Rockshelter. A second Mungai Knife and two gravers were recovered from middle Stratum IIa.

Summary for Stratum IIa Middle (F46)		
Radiocarbon dates	Diagnostic Artifacts	Cultural Period
12,800 B.P. \pm 870 years (10,850 B.C., uncorrected; SI-2489) to 11,300 B.P. \pm 700 years (9350 B.C., uncorrected; SI-2491)	1 Mungai knife	Paleo-Indian (Clovis and later)

Upper Stratum IIa

Upper Stratum IIa is separated from middle Stratum IIa by a roof spalling episode. The latter date below was from a **feature** found immediately below the roof fall episode that separates upper Stratum IIa from Stratum IIb.

Summary for Stratum IIa Upper (F46)		
Radiocarbon Dates	Diagnostic Artifacts	Cultural Period
9075 B.P. \pm 115 years (7125 B.C., uncorrected; SI-2061) to 8010 B.P. \pm 110 years (6060 B.C., uncorrected; SI-2064)	None found	Early Archaic

Remains from upper Stratum IIa represent the **Early Archaic** occupations of the shelter, based primarily on the radiocarbon dates. No diagnostic points were recovered from this unit. However, non-diagnostic **lithic** remains were associated with these hearths, and an early Middle Archaic point style, a Kanawha Stemmed point, was found in a level above these **features**. Thus, assignation of upper Stratum IIa remains and **features** to the Early Archaic Period is supported by their location below

diagnostic early Middle Archaic **lithics**.

Stratum IIb

Stratum IIb is found above upper Stratum IIa across the entire site. Twelve radiocarbon dates were taken for this level. The remains from Stratum IIb are assigned to the Middle and Late Archaic. Six fire pits/hearth, three refuse/storage pits, six

Summary of Stratum IIb (F46)		
Radiocarbon Date Range	Diagnostic Artifacts	Cultural Period
6670 B.P. \pm 140 years (4720 B.C., uncorrected; SI-2055) near its base to 3210 B.P. \pm 95 years (1260 B.C., uncorrected; SI-1681) at the top of the stratum	<u>Lithic</u> (Fitzgibbons 1982:102): 1 Kanawha Stemmed, 1 Kirk serrated-like, 1 Morrow Mountain-like, 1 Hansford Notched-like, 1 Brewerton Corner Notched-like, 2 Buffalo Stemmed, 1 Steubenville Stemmed-like, 1 Merom-like	Middle and Late Archaic

fire floors, eight ash/charcoal lenses and two specialized activity areas were found in Stratum IIb (Stuckenrath, et al, 1982:79). **Perishable artifacts** recovered included three pieces of simple plaited **basketry**, one pointed wooden twig, one complete and one tip of bone awls and one bone weaving implement (Stile 1982:138). Hickory, walnut/butternut and oak nutshell were recovered from **features** and levels in Stratum IIb along with seeds from *Amaranthus* sp., *Chenopodium* sp., Polygonaceae, *Prunus* sp., *Rubus* sp. and *Vaccinium* sp. (Cushman 1982:215-217). **Faunal** remains were recovered from Stratum IIb and all later **strata**, but quantification by **stratum** remains to be completed. All **species** identified from the post-Paleo-Indian levels were from **species** found in or recently extirpated from the area (Guilday and Parmalee 1982).

Stratum I-II interface

Stratum I is separated from Stratum II by a veneer of fine blue silty clay sediments derived from the bedrock **shale** combined with roof spall fragments. Interface deposits were found in units inside and outside of the **dripline** and are assumed to be continuous across the site. No cultural remains have been found in interface deposits.

Radiocarbon Dates for Stratum I-II Interface (F85)
31,400 B.P. ± 1200 years (29,450 B.C., uncorrected; OxA-363)
30,900 B.P. ± 1100 years (28,950 B.C., uncorrected; OxA-364)
30,710 B.P. ± 1140 years (28,760 B.C., uncorrected; SI-1687)
21,380 B.P. ± 800 years (19,430 B.C., uncorrected; SI-2121)

Stratum I (F99)

Stratum I is the lowest **stratum** at the shelter and was found at the base of a limited number of units that were excavated to that depth (roughly 16 feet below the 1973 surface). **Archaeologists** presumed that Stratum I is continuous across the site based on the limited **excavations** to that depth. It is composed of a weathered blue-gray **shale**. No cultural materials were recovered from Stratum I.

Conclusion

Excavations at Meadowcroft Rockshelter ended after 1979. Approximately three-quarters of the area under the **dripline** and one-third of the area immediately outside the **dripline** (Fig. 19) were excavated over that period of time (however, not every interior unit was excavated to the base of the shelter). It was decided in 1979 that the remaining deposits should be preserved for future work when newer **methodologies** and technologies might yield significant new data. Since 1979, only maintenance work cleaning up a few slumps and areas where water leakage occurred under the wooden shelter has been conducted at Meadowcroft Rockshelter. There remain significant deposits of all eleven defined **strata** at Meadowcroft Rockshelter that could be excavated using newer **methodologies** and techniques to address new research questions and extract information and data not recovered by **excavations** conducted during the 1970s.

Stratigraphy is one of the most important tools **archaeologists** have for understanding site use and change over time for any **excavation**. At Meadowcroft Rockshelter, the great depth and intact nature of the site provided crucial **evidence** about change over time. Each **stratum** represents a time when that layer was the surface under the Rockshelter. When people would visit the site, they would create activity areas (**features**) and leave objects behind. **Stratigraphy** helps **archaeologists** make sense of how the site's use changed over time, including the reasons for why people visited, what they ate there, the size of groups visiting, and even the time of year they visited.

All the information gathered during the **excavations** each year were packed up and returned to the lab after the field season. **Archaeologists** spent the next several months (and in some cases years) analyzing the information and verifying their initial hypotheses before determining the cultural significance, and subsequently the interpretation, of the site.

Tables

Stratigraphic Profile of Meadowcroft Rockshelter					
Strata	Tag	Varying Thickness	Deposition Mode	Deposition Forces	Deposition Rate
XI	f3, f8	12-15 cm		Sheetwash	925 years
X	f25	1-5 cm	Silty clay	Sheetwash	
IX	f9	5-15 cm	Silty clay	Sheetwash	
VIII	f12	.5-5 cm	Large particles, sand	Sheetwash	
VII	f13	20-40 cm	Sandy loam	Sheetwash, Spalling	365 years
VI	f63, f129	60-140 cm	Silty clay	Spalling, Sheetwash	375 years
V	f14	20-40 cm	Sandy loam	Sheetwash, Attrition	625 years
IV	f16	30-70 cm	Sandy loam	Sheetwash, Attrition	760 years
III	f18	30-110 cm	Silty clay	Attrition, Sheetwash, Spalls	200 years
IIb	f46	40-130 cm	Sand and Silt	Attrition and High Spall	4,700 years
IIa upper	F46		Sand and silt	Attrition and High Spall	13,000 years
IIa middle	f46		Sand and silt	Attrition and High Spall	
II a lower	f46		Sand and silt	Attrition and High Spall	
I/ II	f85		Fine blue silt	Quiet water	*
1	F99	bedrock	Birmingham shale (300 Million Years Old)	swamp	*

Reporting Time at Meadowcroft Rockshelter

Stratum	tag	Carbon 14	Uncorrected calendar Dates	Cultural Period
XI	F3, f8	175 YBP	AD 1775±50	Contact (1550-1750 AD)
X	F25			Late Prehistoric
IX	F9	685 YBP	AD 1265±80	Late Prehistoric
VIII	F12	630 YBP	AD 1320±100	Late Prehistoric
VII	F13	1290 YBP	AD 1025±65 – AD 660±60	Late Woodland
VI	F63, f129			Late/ Middle Woodland
V	F14	2155 YBP	AD 285±65 – 205±65 BC	Early/ Middle Woodland
IV	F16	3050 YBP	340±90 BC - 1100±85 BC	Early Woodland
III	F18	3255 YBP	980±75 BC - 1305±115 BC	Terminal/ Early Woodland
IIb	F46 (0 cm – 46/50 cm depth)	6670 YBP	1260±95 BC – 4720±140 BC	Middle Archaic
IIa upper	F46	8011-10950 YBP	6060±110 BC - 9350±700 BC	Early Archaic
IIa middle	F46	10950- 12951 YBP	9350±700 BC - 10850±870 BC	Paleo
IIa lower	F46	13240-19601 YBP	11290±1010 BC - 17650±2400 BC	Paleo
I/II	F85	21380-30711 YBP	19430±800 BC - 28760±1140 BC	Middle Wisconsinan
1		31401	29450	Middle Wisconsinan

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