1. NAME OF PROPERTY

Historic Name: Meadowcroft Rockshelter

Other Name/Site Number: 36WH297

2. LOCATION

Street & Number: North Branch of Cross Creek, 4.02 km from Avella Not for publication: N/A

City/Town: Avella, Independence Township Vicinity:

State: Pennsylvania County: Washington Code: 125 Zip Code: 15312

3. CLASSIFICATION

Ownership of Property		Category of Property	
Private:	X	Building(s):	___
Public-Local:	___	District:	___
Public-State:	___	Site:	X
Public-Federal:	___	Structure:	___
		Object:	___

Number of Resources within Property

Contributing	Noncontributing
1	___ buildings
___	___ sites
___	___ structures
___	___ objects
1	___ Total

Number of Contributing Resources Previously Listed in the National Register: 1

Name of Related Multiple Property Listing: N/A

4. STATE/FEDERAL AGENCY CERTIFICATION

As the designated authority under the National Historic Preservation Act of 1966, as amended, I hereby certify that this ____ nomination ____ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ____ meets ____ does not meet the National Register Criteria.

Signature of Certifying Official Date

State or Federal Agency and Bureau

In my opinion, the property ____ meets ____ does not meet the National Register criteria.

Signature of Commenting or Other Official Date

State or Federal Agency and Bureau

5. NATIONAL PARK SERVICE CERTIFICATION

I hereby certify that this property is:

___ Entered in the National Register
___ Determined eligible for the National Register
___ Determined not eligible for the National Register
___ Removed from the National Register
___ Other (explain):

Signature of Keeper Date of Action

6. FUNCTION OR USE

Historic: Domestic Sub: Single dwelling, multiple dwelling

Current: Recreation and Culture Sub: Museum

7. DESCRIPTION

Architectural Classification: N/A

MATERIALS: N/A
Foundation: N/A
Walls: N/A
Roof: N/A
Other: N/A

Describe Present and Historic Physical Appearance.

GENERAL SITE SETTING (Adovasio, et. al. 1975; Carlisle and Adovasio 1982; Adovasio et al. 1984; Tuttle 1977)

Location and General Geology
Meadowcroft Rockshelter (36WH297) is a stratified, multi-component site located 48.27 air kilometers (78.84 km via road) southwest of Pittsburgh and 4.02 surface kilometers northwest of Avella in Washington County, Pennsylvania (Photos 1-4). The site is situated on the north bank of Cross Creek, a small tributary of the Ohio River, which lies some 12.16 km to the west. The site is located in the Pittsburgh Plateaus Section of the Appalachian Plateaus Physiographic Province.

Meadowcroft Rockshelter has produced the longest continuous (although not continually occupied) stratified sequence of cultural remains in Pennsylvania and the northeastern United States (Photos 5-7). The site was used and reused as a short-term hunting and/or gathering campsite during the Paleo-Indian, Archaic, Woodland and Historic periods. Cultural materials recovered from its lower levels have been radiocarbon dated to 16,000 B.P. and pre-Clovis times (Photos 8-18). It is the pre-Clovis remains and well-stratified cultural sequence above them that makes this shelter an exceptional place to study the initial occupations of the region and subsequent adaptations by various groups present in western Pennsylvania and the eastern United States.

Meadowcroft Rock Shelter is oriented roughly east-west with a southern exposure, and stands some 15.06 m above Cross Creek and 244.92 above sea level (Photo 2). The area protected by the extant overhang is ca. 65 square meters while the overhang itself is some 13 m above the modern surface of the site (Photos 1-4). In addition to the potential availability of water from Cross Creek, springs are abundant in the immediate vicinity of the shelter. The prevailing wind is west to east across the mouth of the shelter providing almost continuous ventilation and ready egress for smoke and insects. The Cross Creek floodplain below, and bluff face and bluff top immediately around Meadowcroft Rockshelter, are currently covered with a mixed deciduous forest.

On the bluff top behind Meadowcroft Rockshelter, a reconstructed nineteenth century rural village was erected. Meadowcroft Village is managed as a private park and provides visitors a taste of rural life during the nineteenth century. It is owned and run by the Historical Society of Western Pennsylvania. An exhibit about Meadowcroft Rockshelter is on display in their museum building.

Geologically, Meadowcroft is located in the unglaciated portion of the Appalachian or Allegheny Plateau, west of the valley and ridge province of the Appalachian Mountains, and northwest of the Appalachian Basin. The surface rocks of this region are layered sedimentary rocks of Middle to Upper Pennsylvania Age (Casselman Formation). The predominant lithologies are shale, quartz, sandstone, limestone, and coal in decreasing order of abundance. Deformation is very mild with a regional dip of three to five degrees to the southeast.

Physiography
Topographically, the region within which Meadowcroft is located is maturely dissected. More than 50 percent of the area is in valley slopes with upland and valley bottom areas in the minority. The stream pattern is dendritic with drainage running northwestward to westward toward the West Virginia-Ohio border and the Ohio River. Present topography was probably generated during the Pleistocene when increased precipitation and runoff caused extensive down cutting. Since the Wisconsin Glacial boundary only extends southward to northern Beaver County (some 40 km north), the Cross Creek Valley and Meadowcroft Rockshelter probably existed in nearly their present configuration well before the close of the Wisconsin, ca. 11,000 B.P.

Geology of the Site
Meadowcroft Rockshelter is formed beneath a cliff of Morgantown-Connellsville sandstone, a thick fluvial or channel sandstone within the Casselman Formation (Upper Conemaugh) of the Pennsylvania Period. This sandstone varies from a sub-greywacke to protoquartzite in composition. It is an immature sandstone composed predominantly of quartz grains with minor amounts of mica, feldspar, and rock fragments.

The rock unit immediately underlying the Morgantown-Connellsville sandstone was not observed in the field but is undoubtedly a less resistant lithology, most probably shale. Thus, a re-entrant is formed beneath the sandstone cliff. The ceiling of this re-entrant or rockshelter is gradually migrating upward and cliff-ward as erosion occurs both on the rockshelter ceiling and the cliff face. Within the face of the shelter excavation, the recession of the drip line representing the cliff edge position can be plainly seen. Most typically, erosion results in the dislodgment of individual sand grains. More rarely, rock fragments up to the size of a small house have fallen.

ARCHEOLOGICAL WORK CONDUCTED AT MEADOWCROFT ROCKSHELTER 1973-1979, 1990-1999

Methodology (Carlisle et. al., 1982)
Archeological excavations were conducted each spring and summer at Meadowcroft Rockshelter under the direction of James M. Adovasio of the Department of Anthropology, University of Pittsburgh from 1973 to 1979 (six field seasons, 417 excavation days of 12 to 14 hours) (Photos 5-7). Additional work was conducted under the direction of James M. Adovasio of the Mercyhurst Archaeological Institute, Mercyhurst College during the 1990s primarily as site maintenance activities to clean up slumps in the shelter. A wooden shelter was built over excavation units to protect them when actual excavation work was not being conducted in 1973 (Photos 2-3). Various modifications were made to the covering shelter over the years as the excavations expanded into its current configuration. The wooden shelter protects the excavation units from the weather and additional roof falls from the rockshelter. The excavated section of Meadowcroft Rockshelter remains braced, but unfilled under the current shelter. There are plans to build a more substantial structure over the excavation units with walkways so the general public will be able to actually visit and view the site.

Prior to excavation, a complete floral inventory was taken of the extant vegetation within and around the rockshelter, the talus slope and contiguous upland slope. All vegetation within 20 m (5.6 ft) east and west of the mid-point of the modern rockshelter overhang was then systematically stripped to the level of minute roots and twigs. The topography of Meadowcroft Rockshelter was then mapped with an alidade and plane table. A grid system originally consisting of 2 m (6.6 ft) square units was established. All horizontal coordinates were reckoned relative to this grid. A permanent elevation datum and subsidiary data were affixed to the north wall of the Rockshelter from which all vertical measurements were taken. The grid system was subsequently modified into 1 m (3.3 ft) square units which became the primary excavation unit during the 1974 and later field seasons. In addition, 0.5 m and 0.25 m (1.6 and 0.8 ft) square units were employed when required as more precise recording devices.

Excavations began in 1973 by opening a south to north trench that started outside the dripline and worked into the dry portion of the shelter. This permitted delineation of the various strata and provided a baseline site profile spanning both 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 (Fig. 1).

Each excavation square was excavated using trowels, dental picks or other small utensils as needed, while following the natural stratigraphy and when possible, microstratigraphy of the shelter (Fig. 2). When a natural

stratum was sufficiently thick, it was subdivided into arbitrary 5 or 10 cm excavation levels. Strata and microstrata 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 analyses.

Standardized field forms were used to map and make notes about each excavated level within each square at the site. The data were codified and computerized either on site (1974 and later) or in the archeological laboratory at the University of Pittsburgh. At the beginning of the 1974 season, phone lines were strung into the shelter and a TTY (teletype; it was a desk-sized keyboard with computer paper feed that printed out all commands and responses, it had no visual monitor display) computer terminal 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.

All fill from all strata except the deepest occupational unit, Stratum IIa, was dry-processed through ¼ in (0.6 cm) mesh hardware cloth. Fill from Stratum IIa was wet-processed with water through ⅛ in (0.3 cm) mesh hardware cloth. In order to recover materials smaller than ⅛ or ¼ in (0.3 – 0.6 cm), a constant volume sample (CVS) of fill (2900 cc, 177 in^3) was taken from each natural stratum, microstratum or arbitrary 5 or 10 cm level within each major stratum from every excavated square on the site. If the CVS sample was derived 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, the smallest of which was 200 µ. If the sample was derived from a fire feature, it was also processed through the graded sieves using hydrogen peroxide (H_2O_2) flotation. The combination of dry/wet screening and flotation procedures resulted in the recovery of over two million separate items from Meadowcroft Rockshelter.

Cultural features were quartered or cross-sectioned and mapped in three dimensions. 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 approximately 4 cm^2 (1.6 in^2). 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 microstrata of the shelter.

Specific geological sampling procedures employed at Meadowcroft Rockshelter included the extraction of 12 continuous sediment columns from selected localities across the site. These columns were cut from the surface of the site to sterile Stratum I. In two cases, the columns were extended into sterile Stratum I. Bulk samples of ca. 1000 g (2.2 lb) were extracted at 5 or 10 cm (ca. 2 – 4 in) sampling intervals in each column. Where sediment changed composition, that is, at stratum interfaces, samples were taken on both sides of the change. The sample columns were placed to insure complete coverage of all major strata and the site from east to west. Samples were also taken both inside (north) and outside (south) of the dripline. The bulk samples were augmented from 1976 onward by splits derived from all the CVAs derived from every excavated stratum and microstratum unit. Each bulk sample was divided into fractions; a portion of which was set aside for grain size analysis, analysis of silt/clay fraction, carbonate analysis, palynological assay, geochemical composition, trace element analysis, microfaunal study and at the most minute level, electron microscope analysis of the diagenesis of individual sand grains.

Another geological sampling series was started in 1974 and continued year-round through 1978. An aluminum sampling tray was placed on the sloping wooden roof that protected the excavation. An area of 25 m^2 (268.8 ft^2) was swept daily to collect sand and rock fragments falling from the modern rockshelter ceiling and wall; the

area of collection was divided into 5 m (16.5 ft) strips extending from the tray up to the cliff face. The purpose of this study was to establish the kind, character and volume of modern sedimentation at the site by comparing the samples with weather variables such as temperature, humidity, precipitation, and other parameters that affect modern sedimentation. This provided a useful index or gauge by which the composition of the colluvial pile at the site was judged, both in terms of sedimentation mechanisms and rate of accumulation.

To gauge the effects of sheetwash from upland sources at the site, a large holding tank (400 l; 105.7 gal) and drainage system were emplaced above the eastern margin of the rockshelter in 1976. The holding tank effectively trapped all sediment and water moving at that locus during rainstorms. The drainage area at the sampling location encompassed some 25 m^2 (268.8 ft^2). The upland area above the tank was about 0.9 km^2 (0.35 mi^2). This sampling procedure facilitated the establishment of an index of the kind and volume of upland materials transported during rainstorms and offered another method of studying the accumulation of the Meadowcroft colluvial pile.

A final geological sampling series was undertaken at the Rockshelter involved the extraction of a column of rock samples from the base to the top of the Morgantown-Connellsville cliff at 20-50 cm (ca. 8 – 20 in) intervals. Thin sections were prepared from these samples and compared on the basis of grain size and composition to samples taken from roof spalls in the colluvial pile. The comparisons permitted study of the patterns of erosion of the rockshelter face.

At the end of each field season at Meadowcroft Rockshelter, a wooden shelter was constructed over the excavation to protect it from weather and vandalism over the winter. All excavated materials, including artifacts, floral, faunal, CVS, 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.

Data derived from the various analyses were used in a series of interim reports of the Meadowcroft Project (Adovasio et al. 1975; 1979-1980a; 1979-1980b; Carlisle and Adovasio 1982; and see Appendix 1 for a complete list of Meadowcroft publications). The materials in these interim reports are more comprehensive than most final reports and provide the data provided in the discussion that follows. However, a final report of work at Meadowcroft Rockshelter is planned for publication in the future.

SUMMARY OF STRATA AND ASSOCIATED CULTURAL REMAINS FROM MEADOWCROFT ROCKSHELTER

Meadowcroft Rockshelter is a deeply stratified, multi-component site in Washington County, Pennsylvania. Eleven well-defined stratigraphic units were isolated at the site and meticulously excavated using the best stratigraphic methodology available at the time. In fact, the excavations are still widely considered to be state-of-the-art (Custer 1996; Fagan 1990, 1991, 1995). The Strata were numbered from Stratum I, the oldest and deepest unit, to Stratum XI, the uppermost and youngest. The 52 radiocarbon assays make Meadowcroft one of the most extensively dated sites in eastern North America.

Stratum I

Stratum I was the basal stratum at the shelter and was found at the base of a limited number of units that were excavated to that depth. It is presumed that Stratum I is continuous across the site based on the limited excavations. It is composed of a weathered blue-gray shale. No cultural materials were recovered from Stratum I.

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 on organic materials recovered in interface deposits were 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) and 21,380 B.P. ± 800 years (19,430 B.C., uncorrected; SI-2121).

Stratum II
Stratum II was composed of sand and silt derived largely from the rock shelter walls and also contained some larger roof spalls. I 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 38 cultural features were identified in Stratum IIa. They were classified as 26 firepits/hearths, 5 refuse/storage pits, 1 roasting pit, 1 fire floor, 1 ash/charcoal lens and 4 specialized activity areas (Stuckenrath et al. 1982:79).

The earliest cultural remains were recovered from lower Stratum IIa. Lower Stratum IIa contains all the Pre-Clovis Paleo-Indian materials. 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. ± 975 years (14,225 B.C., uncorrected; SI-2354) to 13,240 B.P. ± 1010 (11,290 B.C., uncorrected; SI-2065). In addition, there are three radiocarbon dates of 21,070 B.P. ± 475 years (19,120 B.C., uncorrected; DIC-2187), 19,600 B.P. ± 2400 years (17,650 B.C., uncorrected; SI-2060) and 19,100 B.P. ± 810 years (17,150 B.C., uncorrected; SI-2062) that were derived from materials of uncertain, but possible cultural origins, from the lowest portion of this stratum. The 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.

Middle Stratum IIa is separated from lower Stratum IIa by a roof spalling episode. A radiocarbon date derived from a sample just above this roof spalling episode dated to 12,800 B.P. ± 870 years (10,850 B.C., uncorrected; SI-2489). Another roof spalling episode separates middle Stratum IIa from upper Stratum IIa. A radiocarbon sample recovered just below this roof spalling episode dated to 11,300 B.P. ± 700 years (9350 B.C., uncorrected; SI-2491). Middle Stratum IIa represents additional Paleo-Indian (i.e., Clovis and later) levels at the rockshelter.

There were 123 chipped stone artifacts recovered from lower and middle Stratum IIa including one unfluted lanceolate point named the Miller Lanceolate (Photos 8-9), several unhafted bifaces (Photo 17), unifaces (including two "Mungai Knives", Photo 12 rightmost artifact and Photo 13), prismatic blades (Photos 15-16) and fragments of prismatic blade cores (Photo 14), utilized flakes and debitage flakes (Photo 18) (Fitzgibbons 1982). The Miller Lanceolate point, one Mungai Knife and most of the other chipped stone specimens were recovered from lower Stratum IIa. A second Mungai Knife and two gravers were recovered from middle Stratum IIb. Microscopic analysis of lithic raw materials employed in these early artifacts indicated 31 specimens (31.6% of the assemblage that could be identified) were made from Brush Creek Chert, a locally available chert (Vento and Donahue 1982:124). However, significant portions of the assemblage were made from exotic lithic materials including 17 specimens (17.3%) made from Flint Ridge Chalcedony/Vanport Chert

and 16 specimens (16.3%) made from Kanawha Chert (Vento and Donahue 1982:124). The nearest sources of Flint Ridge Chalcedony/Vanport Chert is located 112.6 km (70 mi) northwest of Meadowcroft Rockshelter, while Kanawha Chert is found 183.4 km (114 km) southwest of the site (Vento and Donahue 1982:116). The lithic raw material data indicate the early inhabitants of Meadowcroft Rockshelter had been in the region long enough to discover local chert sources, but also utilized or exploited materials from a much larger territory than just the local region. Alternatively, the exotic lithic materials may indicate trade with neighboring groups, if they were present at that time.

The earliest human remains recovered from Meadowcroft also came from lower Stratum IIa. A fragment of a middle hand phalanx from an immature individual was recovered from Feature 99 in association with a radiocarbon date of 13,270 B. P. ± 340 years (11,320 B.C., uncorrected; SI-2488, Sciulli 1982:176). A second human bone, a weathered fragment, probably a section of occipital bone, was recovered from Feature 133 in association with a radiocarbon date of 13,240 B.P. ± 1010 years (11,290 B.C., uncorrected; SI-2065).

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 (see enclosed photograph, Stile 1982:137). It was recovered in a firepit/hearth that also provided a radiocarbon sample dated to 16,175 B.P. ± 975 years (14,225 B.C., uncorrected; SI-2354).

Faunal remains were not well represented from lower Stratum IIa. Only 11 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.

A bipointed wooden tool was recovered from lower Stratum IIa (Stiles 1982:35). It resembles a foreshaft for a compound dart or spear shaft.

Floral remains from the earliest levels are also 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).

Upper Stratum IIa is separated from middle Stratum IIa by a roof spalling episode. Radiocarbon dates from Stratum IIb were 9075 B.P. ± 115 years (7125 B.C., uncorrected; SI-2061) and 8010 B.P. ± 110 years (6060 B.C., uncorrected; SI-2064). The latter date was from a feature found immediately below the roof fall episode that separates upper Stratum IIa from Stratum IIb.

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 is found above upper Stratum IIa across the entire site. There are 12 radiocarbon dates from Stratum IIb ranging from 6670 B.P. ± 140 years (4720 B.C., uncorrected; SI-2055) near its base to 3210 B.P. ± 95 years (1260 B.C., uncorrected; SI-1681) at the top of the stratum.

The remains from Stratum IIb are assigned to the Middle and Late Archaic. Six firepits/hearths, three refuse/storage pits, six fire floors, eight ash/charcoal lenses and two specialized activity areas were found in

Stratum IIb (Stuckenrath et al. 1982:79). Diagnostic point types recovered from Stratum IIb included 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 and 1 Merom-like points (Fitzgibbons 1982:102). Perishable artifacts recovered included 3 pieces of simple plaited basketry, 1 pointed wooden twig, 1 complete and 1 tip of bone awls and 1 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 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 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). Cultural features found in the stratum included 26 firepits/hearths, 2 refuse/storage pits, 8 fire floors, 17 ash/charcoal lenses and 1 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. The following identified projectile points types were recovered from the stratum; two Big Sandy-like, two Brewerton Side-Notched, three Brewerton Corner-Notched, three Buffalo Stemmed, one Lehigh Broad-like, three Merom-like, three Trimble-like, one Adena Ovate Base, one Levanna Triangular and one Koster Corner-Notched-like forms (Fitzgibbons 1982:102). Five Half-Moon ware and one Watson Cord-Marked sherds were also recovered in this stratum (Johnson 1982:146). 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 first domesticated plant remains came from Stratum III. Specimens of *Cucurbita* sp. were recovered from the top of the stratum in association with a radiocarbon date of 3065 B.P. $\pm$ 80 years (1115 B.C., uncorrected; SI-1664; Cushman 1982:216). However, the actual ages of the cultigens identified has not been confirmed by AMS dating, making the inferred ages a bit questionable. The quantity of wild nuts, seeds and fruit pits also increased in Stratum III (Cushman 1982:215-217).

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. Eight radiocarbon dates ranged in age from 3050 B.P. $\pm$ 85 years (1100 B.C., uncorrected; SI-2049) to 2290 B.P. $\pm$ 90 years (340 B.C., uncorrected; SI-SI-2051). There were 35 fire pits/hearths, 9 refuse/storage pits, 3 roasting pits, 13 fire floors, 15 ash/charcoal lenses and 3 specialized activity areas found in Stratum IV (Stuckenrath et. al. 1982:79).

Most of the cultural remains from Stratum IV were assigned to the Early Woodland Period. Diagnostic point styles recovered included two Steubenville Stemmed-like, one Burnsville Notched, one Adena Ovate Base and one Jack's Reef Corner-Notched points (Fitzgibbons 1982:102). In addition, there were 44 Half Moon ware, 2 Watson ware and 1 Monongahela ware sherds (Johnson 1982:146). Perishable artifacts recovered included six fragments of simple plaited basketry, one wooden snare trigger, two cut twigs, one wooden ring, one beveled wooded 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 *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 16 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). The actual ages of the various cultigens identified has not been confirmed by AMS dating, making the inferred ages somewhat questionable.

Stratum V

Stratum V was encountered in all excavated units and is presumed to be continuous across the site. Stratum V overlay Stratum IV and was 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). Five radiocarbon dates were obtained from features in this stratum and ranged from 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. Cultural features encountered in Stratum V included 20 firepits/hearths, 1 refuse/storage pit, 1 roasting pit, 2 fire floors, 6 ash/charcoal lenses and 4 specialized activity areas (Stuckenrath et al. 1982:79).

Cultural remains were assigned primarily to the Early Woodland or Middle Woodland occupation of the site. Diagnostic projectile points recovered included one Adena Ovate Base, one Bennington Corner-Notched and one Chesser Notched types (Fitzgibbons 1982:102). Five Watson ware sherds and one Monongahela ware sherd were also recovered from the stratum (Johnson 1982:146). 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. followed by *Amaranthus* sp. and Chenopodiaceae (Cushman 1982:215-217).

Stratum VI

Stratum VI was encountered only in units located within the dripline of the shelter. It overlaid Stratum V and was under Stratum VII. The massive "New Roof Fall" (Fig. 1) 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 most of the rest of the matrix. The thickness of 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 firepits/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. The only identified diagnostic point recovered from Stratum VI was one Levanna Triangular point (Fitzgibbons 1982:102). No ceramics were found in this unit. 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 VII

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. Two radiocarbon dates were obtained from the unit and were 1290 B.P. ± 60 years (A.D. 660, uncorrected; SI-3026) and 925 B.P. ± 65 years (A.D. 1024, uncorrected; SI-2047). Cultural features from this stratum included nine firepits/hearths, one fire floor, two ash/charcoal lenses, one specialized activity area and one fragmentary human burial (Stuckenrath et al. 1982:79).

Cultural materials from Stratum VII were assigned to the Late Woodland occupation of Meadowcroft. Three untyped projectile points were found in Stratum VII (Fitzgibbons 1982:102). A total of 23 Watson ware sherds were also recovered (Johnson 1982:146). 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 VIII

Stratum VIII was encountered only in about three-fourths 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 was 630 B.P. ± 100 years (A.D. 1320, uncorrected; SI-3023). One firepits/hearth was recorded in Stratum VIII.

Cultural remains from this stratum were sparse and were assigned to the Late Woodland Period. Only one untyped projectile point was recovered (Fitzgibbon 1982:102). No ceramics were recovered from unequivocal Stratum VIII contexts. One piece of unidentifiable cordage and 1 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. and *Crataegus* sp. (Cushman 1982: 215-317).

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 of 685 B.P. ± 80 years (A.D. 1265, uncorrected; SI-2363) 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 firepits/hearths were recorded in this unit.

Cultural materials from Stratum IX were assigned to the Late Woodland period. Diagnostic points recovered included one Steubenville Stemmed-like, one Bennington Corner-Notched, three Jacks Reef Corner-Notched, four Levanna Triangular and one Madison Triangular forms (Fitzgibbon 1982:102). Ceramics recovered from a slump outside of the dripline that included materials from Strata VIII to XI included Watson Ware and Monongahela ware sherds (Johnson 1982:146). No perishable artifacts and no identified floral remains have been identified from this unit.

Stratum X

Stratum X is only found in the western three-quarters 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).

Chipped and ground stone artifacts from Stratum X were assigned to the Late Woodland Period and some historic Euro-American artifacts were also found (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 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 single radiocarbon date of 175 B.P. $\pm$ 50 years (A.D. 1775, uncorrected; SI 3013) was obtained on charcoal from a feature in this level. Four firepits/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 Euro-American Period. However, a few prehistoric artifacts were also recovered (Stuckenrath et al. 1982:78) including two Chesser Notched points (Fitzgibbons 1982:102). Watson ware and Monongahela ware sherds were recovered from slumped matrix from levels VIII-XI. 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. and *Arctium* sp.

Excavations at Meadowcroft Rockshelter ended after 1979. Approximately three-quarters of the area under the dripline (however, not every interior unit was excavated to the base of the shelter) and one-third of the area immediately outside the dripline (Fig. 1) were excavated over that period of time. 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 still remains 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.

The unexcavated areas of Meadowcroft Rockshelter, along with the existing excavated materials, have the continuing potential to answer these questions:

1. When did people initially occupy North American and, more specifically, move into the Eastern United States?
2. How large a territory was utilized by the earliest inhabitants of the Eastern United States and North America?
3. What were the subsistence practices of the Earliest Americans?
4. How have prehistoric Native American peoples of the Eastern United States adapted to changing climates during the transition from Pleistocene to Holocene climates?

5. How have the economic systems of prehistoric Native Americans in the Eastern United States changed through time?

How Meadowcroft has and may continue to provide answers to these questions is discussed in Section 8, below.

8. STATEMENT OF SIGNIFICANCE

Certifying official has considered the significance of this property in relation to other properties:
Nationally: X Statewide: _ Locally:

Applicable National Register Criteria:	A_ B_ C_ D X
Criteria Considerations (Exceptions):	A_ B_ C_ D_ E_ F_ G
NHL Criteria:	6
NHL Theme(s):	I. Peopling Places V. Developing the American Economy VI. Expanding Science and Technology VII. Transforming the Environment VIII. Changing Role of the United States in the World Economy
Areas of Significance:	Archeology – Prehistoric; Exploration/Settlement
Period(s) of Significance:	16,000 B.P. to 175 B.P.
Significant Dates:	N/A
Significant Person(s):	N/A
Cultural Affiliation:	Paleoindian, Archaic, Woodland, Late Prehistoric, Historic
Architect/Builder:	N/A
Historic Contexts:	The Earliest Americans (Paleoindian) Theme Study for the Eastern United States

State Significance of Property, and Justify Criteria, Criteria Considerations, and Areas and Periods of Significance Noted Above.

NARRATIVE STATEMENT OF SIGNIFICANCE

Summary
Meadowcroft Rockshelter was listed in the National Register in 1977. It was accepted under Criterion D because the site provides information important to our understanding of regional and national prehistory. The site was periodically utilized and reoccupied from the earliest Paleo-Indian times through the Archaic and Woodland Periods by Native American peoples, and during the Historic Period by Euro-Americans. It has provided one of the longest, if not the actual longest, stratified sequence of cultures in the United States. It has provided information about the earliest migrants into the eastern United States and evidence for some of the earliest domesticated crops in the northeastern United States.

Meadowcroft Rockshelter demonstrates that humans have been in the Americas since at least 16,000 B.P., increasing the known period of human occupation of the New World by approximately 25 percent. This brings the archeological data more in line with estimates needed for the development of language and Native American biology in the New World. It also provides a greater time depth for various cultural adaptations, such as 11,000 B.P. maritime adaptations along the Peruvian coast, to develop in the New World. Further, it enables archeologists to examine a Pleistocene adaptation in an environment with a very low population density. It also allows us to examine the technology fresh out of Siberia and what is potentially the predecessor to Clovis: a question which has always been an enigma. Australia is the only other continent where we can examine rates of migration and the specifics of how people migrate into totally new environments. Using the Clovis First model it appeared that new land was occupied very quickly and it was characterized by the development of a distinctive style of artifacts (i.e. fluted points). Based on Meadowcroft, and now Cactus Hill and Monte Verde, it appears that this process may be slow as it was in Australia.

Meadowcroft Rockshelter qualifies for National Historic Landmark designation under Criterion 6 and addresses the NHL Thematic Framework through the themes: Peopling Places, Developing the American Economy, Expanding Science and Technology, Transforming the Environment and the Changing Role of the United States in the World Community. The site is also being nominated under the Earliest Americans of the eastern United States Theme Study.

Meadowcroft Rockshelter meets Criterion 6 by addressing the NHL thematic framework in the following ways. The site addresses the theme "Peopling Places" because it provides and has the potential to yield additional information about the earliest human migrations into the eastern United States and how communities changed through time in northeastern North America. It also addresses the theme, "Developing the American Economy," because information from Meadowcroft Rockshelter can be used to address factors related to the economic pursuits of the various prehistoric Native American groups that occupied the site and region. The multidisciplinary approach to the excavation and analysis of remains from Meadowcroft Rockshelter, along with its potential to yield additional important scientific information about prehistoric lifestyles, addresses the NHL theme, "Expanding Science and Technology." The applicability of the NHL theme, "Transforming the Environment," is based on how data from Meadowcroft Rockshelter can be used to study how prehistoric peoples manipulated, used, and adapted to their environment(s) and how this changed through time. The site also addresses the theme the "Changing Role of the United States in the World Community," because the

earliest occupations of Meadowcroft Rockshelter have the potential to define early international relationships, and because research conducted here has played a key role in discussions world wide within the scientific community about when people arrived in the New World. Finally, Meadowcroft Rockshelter qualifies for inclusion with the Earliest American Theme Study because it provides evidence for the first documented Pre-Clovis occupation in the United States as well as important evidence for later Paleoindians.

CULTURAL CONTEXT

Prehistoric occupations of Meadowcroft Rockshelter can be assigned to the Paleo-Indian (pre-10,000 B.P.), Archaic (10,000 to 3000 B.P.), Woodland (3000 to 450 B.P.) and Historic Periods (450 B.P. to Present). The record of prehistoric and historic cultures in the region is summarized below.

Paleoindian (pre-10,000 B.P.)

The Paleo-Indian inhabitants of Pennsylvania lived in a late glacial environment. Laurentian ice sheets were retreating through the northwestern portion of the state and had formed Lake Erie by the end of the period. Paleo-Indians adapted to a mosaic of macro- and micro-environmental zones that were available for exploitation during the Late Glacial Period. However, most Late Pleistocene climate reconstructions were made or based on data recovered prior to the Meadowcroft excavations, were overly generalized (i.e., looked only at macroenvironmental reconstruction), were based on data from widely separated points, and did not take into account differences in sample elevations, topography, etc. Nevertheless, they indicated a generalized succession of spruce and pine forests during the Late Pleistocene (Flint 1971; Andrews 1973). Megafauna, including mastodon, mammoth, caribou and *Symbos* sp., were present along with most of the modern fauna of the region. In general, Late Pleistocene environments were unlike anything present in modern times.

The earliest occupations of the region are assigned to the Paleo-Indian period. These peoples are represented by scattered surface finds of fluted Clovis-like points (e.g., McConaughy et al. 1977; Herbstritt 1980) that were either lost or discarded presumably at short-term hunting camps. A much larger Clovis base camp has been identified in eastern Pennsylvania at the Shoop Site (Witthoft 1971). However, Shoop is also largely a surface manifestation. A survey of the Cross Creek Drainage found seven sites, besides Meadowcroft Rockshelter, with surface evidence of Paleo-Indian occupations (Fryman 1982:62-63). These components were classified as one base camp, which produced multiple Paleo-Indian points and other related Paleo-Indian tools, and six bivouacs/short term campsites. Based on this data, it appears that the Paleo-Indian inhabitants of Pennsylvania consisted of small groups or bands of people that may have roamed over a wide territory and exploited whatever foods and natural resources they could find. Occasionally these bands may have coalesced into larger macrobands at sites like Shoop.

Archaic Period (10,000 B.P. to 3000 B.P.)

The Archaic Period coincides, for the most part, with the transition from the Pleistocene environments to the establishment of the modern floral and faunal regimes in the region (Guilday 1967, 1982). Pleistocene megafauna were either extinct or had moved to regions much further to the north. Archaic inhabitants of Pennsylvania hunted and gathered wild forest animals (e.g., white-tailed deer, elk, black bear, etc.) and plants (e.g., walnuts, hickory nuts, berries, etc.) and learned to exploit riverine resources (i.e., fish, shellfish, etc.) that continue to be found in the area today or which were recently extirpated. Throughout the period, Archaic peoples were living in bands, and the bands probably controlled well-established territories within the region.

The Archaic Period has been subdivided into Early, Middle and Late Archaic based largely on temporal differences and changes in lithic technologies through the period. The Early Archaic dates between 10,000 B.P. and 8000 B.P. Diagnostic lithics include corner-notched (e.g., Kirk Corner-notched, Palmer, etc.) or stemmed

projectile points (e.g. Kirk Stemmed) with long, serrated blades or bifurcated-based points (e.g., McCorkle, St. Albans, LeCroy, etc.) with serrated blades. The regional Early Archaic point sequence was largely defined by well-dated specimens recovered from the stratified St. Albans site, located in Kanawha County, West Virginia (Broyles 1971). Points similar to those recovered at St. Albans have been found in surface contexts during regional surveys of southwestern Pennsylvania (Herbstritt 1980:46). A total of 10 additional sites besides Meadowcroft Rockshelter were found to have Early Archaic components within the Cross Creek Drainage (Fryman 1982:63). One of these sites was characterized as a base camp, while the other nine were classified as bivouacs/short-term campsites. Local lithic resources appear to be better represented at Early Archaic than on Paleo-Indian sites from the Cross Creek Drainage.

The Middle Archaic dates between 8000 and 6000 B.P. There is a change in projectile point styles from ones with serrated blades and basal notching to stemmed and side notched styles (e.g., Otter Creek, Halifax, Morrow Mountain I points) which rarely had serrated blades. In addition, there is greater use of ground stone tools (i.e., axes, manos, metates, pestles, etc.) than is noted during the Early Archaic. Middle Archaic remains are found stratified above the Early Archaic materials at St. Albans (Broyles 1971). Middle Archaic points are usually found in lesser quantities than Early Archaic forms in the region (Herbstritt 1980). This observation also holds in the Cross Creek Drainage where only two other Middle Archaic components were identified besides Meadowcroft Rockshelter (Fryman 1982:63). The two components were identified as one base camp and one bivouac/short-term campsite. Thus, although the number of components decreases in the Cross Creek Drainage, the number of identified base camps remains relatively stable from the Paleo-Indian through Middle Archaic periods, suggesting there was not a decrease in local populations. The lack of identified Middle Archaic short-term campsites may be due more to a lack of ability to accurately identify them than to an actual decrease in Middle Archaic populations.

The Late Archaic dates between 6000 and 3000 B.P. It is characterized by a number of different notched and stemmed point styles (e.g., Brewerton Corner-notched, Brewerton Side-notched, Normanskill, Lamoka, Steubenville Lanceolate, Steubenville Stemmed, Snook Kill, etc.). The end of the Late Archaic is sometimes called the Transitional or Terminal Archaic Period (3800-2800 B.P.) and is characterized by the use of broad-bladed spears (e.g., Koens-Crispin, Astabula, etc.), expanded stemmed points (e.g., "fishtail" points) and the use of stone bowls for cooking. Regional survey evidence suggests the Late Archaic sites are numerous and the peoples were placing an even greater emphasis on the use of local lithic raw materials than those preceding them (Herbstritt 1980). This also holds in the Cross Creek Drainage where 20 components besides Meadowcroft Rockshelter were assigned to the Late Archaic/Terminal Archaic period. These components were identified as 3 base camps and 17 bivouacs/short-term campsites. One of the base camps, Cross Creek Village (36WH293), was excavated and produced at least four roughly oval wood post structures associated with Late/Terminal Archaic remains (Applegarth and Cowin 1982). The campsite was not occupied on a year-round basis, but rather the remains suggest a summer through fall utilization of the site. The increase in the number of base camps in the Cross Creek Drainage and in regional surveys suggests there was an expansion of the population during the Late Archaic.

Materials from Late Archaic site excavations demonstrate a continued hunting and gathering existence during the Late Archaic (Dragoo 1959). However, investigations also indicate an increase or intensification in wild plants and riverine resource exploitation. The earliest shell middens identified in the area, the Globe Hill and Steubenville sites (Mayer-Oakes 1955), are from this period. The earliest domesticated plant remains have been recovered from Late Archaic Period sites located in west and southwest Pennsylvania (Smith 1989). To date no unequivocal domesticated plant remains have been recovered from Late Archaic sites in the region around Meadowcroft Rockshelter.

Woodland Period (3000 to 450 B.P.)

The Woodland Period is subdivided into the Early (3000 to 2000 B.P.), Middle (2000 to 1000 B.P.) and Late Woodland (1000 to 450 B.P.) Periods. The early portion of the Woodland Period is characterized by a more sedentary lifestyle focused on extensive exploitation of wild plant, animal, and riverine resources that are supplemented by domesticated plant foods. By the end of the Woodland Period, people are living in permanent year-round villages. Domesticated plants provide most of the food and are supplemented by wild resources.

The Early Woodland Period (3000 to 2000 B.P.) is characterized by many technological and ritual innovations (McConaughy n.d.). The earliest ceramics, Half-Moon Ware, found in the region are from this period and the characteristic point styles are stemmed forms (e.g., Adena, Cresap, Robbins). The later half of the period is noted for the rise of the Adena Culture and use of burial mounds with central log or bark tombs for the burial of important members of the society (Dragoo 1963). The latter suggests the development of complex society and institutions during the Early Woodland (McConaughy 1990). The placement of characteristic Adena blocked-end smoking pipes with some mound burials also indicates tobacco was probably being grown in the region. Unfortunately, relatively few habitation sites from the Early Woodland Period have been extensively investigated or excavated. Grantz (1986) tested an Early Woodland hamlet in Fayette County, Pennsylvania, and found several post mold arcs suggestive of oval or circular structures. Grantz was unable to excavate a complete post mold pattern to confirm that they were wood pole houses, but they probably do represent portions of domestic structures (particularly the post mold pattern in the west end of trench 4). The construction of mounds and probably the construction of wood post domestic houses indicate Early Woodland peoples lived a more settled or sedentary existence. The time needed to build the mounds and the energy expended in construction of wood pole houses is not characteristic of a wide-ranging nomadic lifestyle.

Regional surveys indicate Early Woodland peoples established sites on floodplains, terraces, saddles, benches and hilltops (Herbstritt 1980). Work in the Cross Creek Drainage found 11 Early Woodland components besides those at Meadowcroft Rockshelter (Fryman 1982:65). These components were classified as at least two, and possibly three base camps, and eight or nine bivouacs/short-term campsites. No Early Woodland burial mounds or village sites were identified in the Cross Creek Drainage.

The Middle Woodland Period (2000 to 1100 B.P.) is characterized by the development of settled village life in the area (McConaughy n.d.). Burial ceremonialism and mound construction continues, but they are gradually deemphasized in importance until they are phased out by the end of the period. It should also be noted that the Middle Woodland Period, as it is used herein, follows the pattern used in the Mid-Atlantic region and includes cultures that would be assigned to the Middle and Late Woodland Periods in the Midwestern system.

The early portion of the Middle Woodland (2000 to 1600 B.P.) coincides with the Hopewellian efflorescence and demise in Ohio and the Midwest. The earliest identified and at least partially excavated Middle Woodland mound and village complex in the region is Fairchance Mound and Village (Hemmings 1984), located near Moundsville in the southern portion of the panhandle of West Virginia. Radiocarbon dates from the mound and village indicate they were occupied or built roughly between 1800 and 1700 B.P. The most elaborate tomb in the mound was a stone-lined crypt. A single oval post structure was uncovered by limited work at the village site. Diagnostic artifacts recovered included limestone tempered Watson Ware pottery and Fairchance-notched and Snyders projectile points. Only wild plant and animal food remains were recovered, but all the remains were recovered from the excavation or screening. No flotation was conducted.

The middle portion of the Middle Woodland (1600 to 1400 B.P.) is defined by the remains found at Watson Farm village and mound in the northern panhandle of West Virginia (McConaughy 2000; Dragoo 1956). The mound is rather small, under one meter in height, and had stone crypts in it. Ceramics from the mound and

village consisted largely of limestone tempered Watson Ware, but grit-tempered Mahoning Ware also occurred in some quantity at the sites. The principal diagnostic point type was Chesser Notched. A single oval post domestic structure was uncovered during limited testing in the village. Flotation samples were taken during the village site excavations, but the samples have not been analyzed by botanical specialists. An initial examination of the flotation samples, macrofloral and faunal remains, by the excavators, failed to locate any quantity of easily identified domesticated species (note: *Chenopodium* sp., was present and might be wild or domesticated), and indicates the Watson Farm people were still subsisting primarily on wild plants, animals, fish and shellfish.

The late Middle Woodland (1400 to 1000 B.P.) is not as well documented as the preceding two sections in terms of excavated sites. However, it is during this period that maize horticulture develops into an important part of the local economy. Mounds continue to be built, but they are all very small and most burials lack substantive grave goods. The Avella Mound (36Wh415), located in the town of Avella about three km (1.9 mi) east of Meadowcroft Rockshelter, represents a typical late Middle Woodland Mound (Applegarth and Cowin 1982). Avella Mound is a low, one-meter high mound that included stone crypts. No single "typical" burial type was identified. The mound contained extended, flexed and cremation burials, most lacking any associated grave goods. Avella Mound was located on a knoll at the end of a bench overlooking the modern town of Avella. Unfortunately, coal mining conducted adjacent to Avella Mound prior to its excavation has eliminated any evidence of nearby associated habitations or features. It is during the late Middle Woodland that grit tempered Mahoning Ware pottery becomes the primary ceramic form. A series of diagnostic points, Jack's Reef Corner Notched, Jack's Reef Pentagonal, Kiski Notched and Levanna, indicate that the spear thrower was gradually replaced by the bow-and-arrow during the late Middle Woodland.

A surface survey of the Cross Creek Drainage recorded sites with 15 Middle Woodland Period components excluding Meadowcroft Rockshelter (Fryman 1982:65). No village sites were identified, but one base camp, four mounds and ten bivouacs/short-term campsites were recorded. One of the mounds was the previously mentioned Avella Mound.

The Late Woodland Period (1100 to 450 B.P.) is the best documented period in the region with excavations conducted at many Late Woodland sites (Adovasio et al. 1990; Buker 1968, 1970; George 1974, 1978a, 1978b, 1983; Johnson 1981; Johnson et al., 1998; Michael 1983; Michael and Grantz 1981). The Late Woodland, also referred to as the Late Prehistoric Period, is characterized by the development of the Monongahela culture. Monongahela peoples lived in hamlets (early) and oval villages with central plazas. Larger Monongahela sites were usually located on saddles or benches along major stream drainage divides. Many villages were surrounded by an exterior palisade. The houses were circular and often had an attached storage appendage. Monongahela ceramics may be limestone tempered (usually early forms) or shell tempered. The diagnostic projectile point form was the small triangular Madison Point and it was an arrow point. Maize agriculture was the predominant economic activity. The maize diet was supplemented by wild plant, animal, fish and shellfish. Domesticated beans appear in the region toward the middle of the period and are another dietary supplement.

Late Woodland sites are not particularly numerous in the Cross Creek Drainage. Excluding Meadowcroft Rockshelter, only three other sites had Late Woodland components (Fryman 1982:65). All three sites were classified as bivouacs/short-term campsites. The lack of Late Woodland sites in the drainage is probably related to Monongahela preferences for situating villages in upland settings on ridge saddles and benches along stream divides.

Historic Period (450 B.P. to Present)

The early portion of the Historic Period sees the demise of the Monongahela Culture and the movement through the area of various historic Native American tribes (e.g., Delaware, Shawnee, etc.) who were being pushed west

by the expanding European populations. The Monongahela were able to obtain European trade goods (e.g., glass beads, brass kettles, brass ornaments, etc.) at the Foley Farm (36GR52 , Herbstritt, personal communication) and Throckmorton (Michael 1983) sites. However, the Monongahela apparently acquired European trade materials through Native American intermediaries since there are no definitive records of direct European contact with them. The Monongahela left southwestern Pennsylvania during the early seventeenth century. Richardson et al. (2002) have proposed that a series of severe droughts and attacks from the Iroquois forced the Monongahela to abandoned southwestern Pennsylvania circa A.D. 1635. Some Monongahela refugees apparently resettled in Halifax County, in south-central Virginia (Wells 2002). After A.D. 1730, the Delaware, Shawnee and other Native American tribes were pushed through western Pennsylvania because of expanding European settlements along the eastern seaboard (Kent et al. 1981). Currently, there is no direct evidence of historic Native American use of the Cross Creek drainage.

European settlers started to move into southwestern Pennsylvania in the middle of the eighteenth century A.D. and all Native American peoples had been pushed out of southwestern Pennsylvania by the later portion of the eighteenth century. The nineteenth century A.D. was a period of expanding European populations in the region. Early European migrants into the area were primarily farmers. By the middle of the nineteenth century, the iron industry started to develop. By the end of the nineteenth century the area was noted for its coal mines, coke furnaces and steel mills. Small towns and villages, like Avella in the Cross Creek Drainage, developed in response to these industries. These continued to be the main industries in the region through the middle of the twentieth century A.D. when the steel industry went into decline. Today, southwestern Pennsylvania remains a largely rural area. The small towns and villages associated with the coal and steel industries are also in decline. Coal mining, particularly longwall deep mining, remains the primary industry in the region, and cattle and sheep farms are still fairly common businesses in the rural areas.

A NATIONAL TREASURE

Meadowcroft Rockshelter contains remains from a Pre-Clovis occupation at the base of a deeply stratified sequence of younger prehistoric cultures. The presence of Early Archaic remains stratified above the pre-Clovis levels demonstrates those lower levels, even if the actual age is disputed, are from the Paleo-Indian Period. The fact that there remains a substantial unexcavated portion of early and later levels means the site has the potential for others to test the existing interpretations of the site and to yield even more data on the early inhabitants of the United States.

The Pre-Clovis levels at Meadowcroft Rockshelter initially attracted considerable amounts of attention and criticism (see below for more detailed discussions of these). Although it is still not unanimous, many archeologists now accept the remains from the early levels at Meadowcroft as genuine Pre-Clovis materials that represent an ancestral complex for Clovis. The importance of Meadowcroft for interpreting the peopling of the New World has been established in the scholarly literature as the following quotes exemplify (See also Gamble 1993:209; Goodyear 2001:2; Kraft 2001:54):

> Although I have in the past expressed some reservations regarding the early occupation of the Meadowcroft Rockshelter, based on the criticisms of other researchers (Custer 1984a, 1989a), I think that most archaeologists would now agree that critics have run out of objections and we must regard the Meadowcroft Rockshelter as a bona fide site predating 12,000 years (Custer 1996:92).
>
> Along the Nottoway River in Virginia a site known as Cactus Hill has recently produced a classic sequence of Mid-Atlantic archaeology, including Clovis and occupations below Clovis (McAvoy &

McAvoy 1997). The artifacts from the lower levels, thin bifacial points, large blades, bladelets, cores, and other tools, are technologically similar to those from Meadowcroft and could be considered a related complex. The radio-carbon dates from a hearth feature and other samples suggest that the site was occupied between 15,000 and 17,000 14 C yr B.P. Although the combined artifact samples from both sites are small, we suggest that these two assemblages should be considered part of the same technological complex. Further, their chronological placement suggests to us that they are prime candidates for developmental Clovis (Stanford and Bradley 2002:259-260).

Meadowcroft has cheated archaeology's actuarial tables (Meltzer 1993), and remains a viable pre-Clovis candidate long after its initial appearance on the scene. Lately, one of the key objections to the site's antiquity – that the radiocarbon ages were contaminated by groundwater seeping through the lower deposits on site – was effectively rebutted by micro-morphological analyses of the sediments (Goldberg & Arpin 1999) (Meltzer 2002:52).

Meadowcroft Rockshelter remains the best example of a pre-11,000 yr B.P. occupation yet discovered in eastern North America (Bonnichsen and Turnmire 1999:16).

One archaeological site which continues to withstand critical evaluation is Meadowcroft Rockshelter (Adovasio et al. 1978; Adovasio & Carlisle 1988) in Pennsylvania (Fig. 17.1) (Frison and Walker 1990:315).

Given the presence of bifacial projectiles at Meadowcroft and Cactus Hill and perhaps at Saltville (SV-2) based on debitage, it is not difficult to see Clovis emerging from these technologies (Goodyear 2001:6).

A fourth flaw [in the Clovis-first argument] is the existence of sites in North and South America that indicate a human presence prior to Clovis. These include Monte Verde in southern Chile with a radiocarbon age of ca. 12,500 years ago, Meadowcroft in Pennsylvania with stone artifacts dating at least as old as 14,000 RCYA, Cactus Hill in Virginia with ca. 15,000 year old non-Clovis artifacts underlying a Clovis component, . . . (Collins 2002).

Meadowcroft Rockshelter is also cited in all recent North American archeology textbooks, and its importance in interpreting the peopling of the New World is generally recognized. Textbooks from outside the United States also recognize the significance of the rockshelter in interpreting the prehistory of the New World. For example, Gowlett (1993:142) states, "the early date for Meadowcroft seems established beyond most reasonable doubt. Arguments that the radiocarbon dates were contaminated by 'old' carbon from coal are not supported by the evidence." Gowlett (1993:142) also indicates "the early dates for the South American sites and for Meadowcroft provide a sound basis for assessing the spread of human occupation through the Americas."

Meadowcroft Rockshelter has also resulted in the general public becoming interested in archeology and the peopling of the New World. It acts as a link between the professional practice of archeology and the public. Examples from the popular press that show this link include:

At Meadowcroft Rockshelter in Avella, PA, for instance, where for 26 years Adovasio has been excavating under an overhang that juts out from a rock face 43 feet above the ground, scientists are now reconsidering his claim that the charcoal, stone tools and woven material buried there are at least 14,000 and possibly 17,000 years old (Begley and Murr 1999:26).

> Critics told him the charcoal that he presumed came from wood may actually have been contaminated by ancient coal or carbon in the local sediments, which would carbon-date much earlier. Adovasio retorts that what he calls the 'Clovis Mafia' particularly rejects only dates at his site that are older than Clovis but not younger material. Contamination would skew ages for everything, he points out, not just for the finds that run counter to standard theory (Petit 1998:59).
>
> …en el yacimiento paleolítico de Meadowcroft. Con ellas, este investigador (i.e. Adovasio), echó por tierra las teorías Clovis, que databan la presencia de los primeros pobladores americanos hace no más de 11.500 años. Adovasio encontró vestifios de culturas pre-Clovis que alcanzaron el continente hace 18.000 años (Fernández 2000:31).
> *[…at the Paleolithic site of Meadowcroft. This investigator {Adovasio} threw out forever the Clovis theory that dated the first American populations to no more than 11,500 years. Adovasio encountered remnants of pre-Clovis culture which colonized the continent before 18,000 years ago.]*

In addition to textbook and popular references (See also Lozano Ruiz 2000:11; Wright 1999:58), Meadowcroft has also been featured in numerous films about the initial colonization of the New World, including productions by BBC, Nova and the History Channel. In the fall of 2000, German, British and French teams also filmed documentaries at the site. All of these have now aired as of this writing.

National Register Criterion D and NHL Criterion 6
Meadowcroft Rockshelter was accepted to the NRHP under Criterion D and is nominated under NHL Criterion 6 because it yielded and has the potential to yield information about a number of nationally and regionally important archeological research questions that address the NHL themes noted above. The most important of these questions are:

1. When did people initially occupy North America and, more specifically, move into the eastern United States?

2. How large a territory was utilized by the earliest inhabitants of the eastern United States and North America?
3. What were the subsistence practices of the Earliest Americans?
4. How have prehistoric Native American peoples of the eastern United States adapted to changing climates during the transition from Pleistocene to Holocene climates?
5. How have the economic systems of prehistoric Native Americans in the eastern United States changed through time?

When did people initially occupy North America and, more specifically, move into the eastern United States?
Well-dated cultural materials from the lower levels of Meadowcroft Rockshelter provided the first serious challenge to the Clovis-first view of the peopling of the New World. Clovis points were first recorded at Blackwater Draw in association with extinct animals in 1933 (Boldurian and Cotter 1999). With the advent of radiocarbon dating, the Clovis Culture, as it has now come to be known, was dated to between 11,500 to 10,500 B.P. Characteristic materials of the Clovis Culture included fluted Clovis Points, well-made bifaces, prismatic blades, spurred end scrapers and other less diagnostic lithic materials often found in association with extinct animals. By the 1960s, Clovis Culture was the earliest well-dated culture in the New World. However, the dating of the Clovis Culture also became a barrier for investigations into the peopling of the New World. Over the years many more Clovis or Clovis-like (in terms of the fluted point styles) sites have been found in North America. The wide-spread nature of these sites has resulted in Clovis becoming a horizon marker in North

America, and supposedly demonstrates the spread of the culture across the continent. Clovis allegedly was the "first" culture complex of the peoples who migrated from Siberia into Alaska and then south through an ice-free corridor into the continental United States. This view has become known as the Clovis-first hypothesis (Meltzer 1991).

Nevertheless, some archeologists examining the data for the Clovis-first hypothesis were bothered by claims that it represented the earliest migrants into the New World (Bonnichsen and Turnmire 1999:2; Collins 2000). The characteristic Clovis fluted point style is only found in the New World. It does not occur in any known complexes in the Old World. However, there is a single specimen of a biface with a long channel flake removed on one face from the Uptar site in Siberia (King and Slobodin 1996). This specimen does not really resemble a Clovis point and is a unique item from the Uptar site. It may well represent only an accidental channel flake removed from a biface. Comparisons of Clovis and other early point styles with Solutrean points (Stanford and Bradley 2000, 2002) indicated there were roughly similarly shaped points at European Solutrean sites, but no fluted ones. In any case, there is no culture in the Old World that habitually fluted bifaces to make projectile points as did the members of the Clovis Culture. Straus (2000:224), an Old World European specialist, states: "credit should be given where credit is due: Native Americans, descended from diverse Asian populations, were the makers of Clovis and 'pre-Clovis' lithics." Thus, the Clovis Culture did not develop in the Old World, since its development and spread cannot be traced directly from the Old to the New World. Clovis is an *indigenous* New World development. As such, at least one other culture must have come from the Old World to the New and have been present prior to Clovis so Clovis could develop out of that culture. Clovis definitely was not first. This fact has resulted in the development of various Pre-Clovis hypotheses concerning the peopling of the New World. It also has resulted in archeologists looking for demonstrable Pre-Clovis sites. Meadowcroft Rockshelter was not originally excavated with the intention of finding a Pre-Clovis site, but it ended up being the first real claimant for that title. As such, it also became a lightning rod for criticism because it challenged the Clovis-first hypothesis. Most of these challenges revolve around the radiocarbon dating of the early levels from Meadowcroft which will be discussed below.

The Pre-Clovis hypotheses suggest that the progenitor of the Clovis culture would have to have certain technological features that could evolve into Clovis (Stanford and Bradley 2002:257-260). For example, the hypotheses suggest that Pre-Clovis peoples made lanceolate points since it is unlikely that the lanceolate Clovis fluted point style developed out of leaf-shaped, tanged, notched or shouldered types. The development of fluting technology would change the lanceolate point of Pre-Clovis into a Clovis point. Use of a blade technology in the Pre-Clovis group would also be likely since Clovis made and used prismatic blades for a variety of tools, including end scrapers made on blades.

Unfluted lanceolate points and prismatic blades are also characteristics of later Plano cultural complexes. The Clovis-first hypothesis suggests that there was a progression from the basally-fluted Clovis to fully-fluted Folsom into unfluted Plano points. Presumably, it makes no sense for there to be an unfluted lanceolate point Pre-Clovis culture that became fluted Clovis and Folsom point cultures only to change back to unfluted lanceolate point Plano cultures. That argument might be persuasive if the temporal gap between production of unfluted lanceolate pre-Clovis and Plano types actually existed. However, it is now becoming increasingly apparent that things were not so simple during the Paleo-Indian period.

The increasing number and complexity of Paleo-Indian cultures has been summarized by Frison (1993). At the Hell Gap, Carter/Kerr-McGee and Jim Pitts sites, unfluted Goshen points were recovered in stratified contexts *below* Folsom levels (Frison 1993:7-10; Frison, et al. 1996:205-206; Stanford 1999:308). A series of nine radiocarbon dates indicate that the Goshen materials from the Mill Iron site are more or less of equivalent age to Clovis and early Folsom (Frison 1993:8-9; Frison 1996:8). Haynes (1992:364) has questioned the earliest five

of these dates as being possibly contaminated by lignite because one other date of greater than 20,000 B.P. was obtained that was clearly out of line with other dates from the site. However, an anomalous date does not prove any other date was contaminated (and the anomalous date shows that if such contamination occurred, it should really throw off the date). Lignite, vitrinized wood and coal contamination have become the standard claim made against radiocarbon dates that do not support a Clovis-first hypothesis. Regardless of any questions concerning the Mill Iron radiocarbon dates, the stratigraphic placement of Goshen points below Folsom styles demonstrate they are of equivalent age to Clovis. There are also data for the overlap of other Plano point styles with Folsom (Frison 1993).

Holliday and others (1999:449-451) were disturbed when AMS radiocarbon dates they ran on samples from the Plainview site yielded "a surprisingly wide range of ages (Holliday et al., 1999:449)." The early dates were dismissed as somehow contaminated from an "unknown" source (Holliday et al., 1999:449). They state this because "the fluted Clovis and Folsom styles appear to have essentially the same age range in both the northern and southern Great Plains and occupy relatively discrete time intervals (Holliday et al., 1999:451)." They presume Plano forms must also fall into discrete time intervals and, therefore, concluded that the radiocarbon dates must be contaminated. However, the dates could be interpreted in a different manner. Instead of presuming any early dates for unfluted lanceolate points are contaminated because of a Clovis/Folsom-first bias, the dates may in fact show that the points were used over a long period of time.

It should be pointed out that the previously mentioned Goshen points, which have been found in levels below Folsom materials, greatly resemble Plainview points (Frison 1993:8; Frison et al. 1996:205-206). Frison et al. (1996:206) indicate "one of us (Haynes 1991) has raised the possibility that the Plainview type site is as early as Clovis, but if Plainview in the south is younger than Goshen to the north, it would require the Goshen-Plainview continuum to have had a long life and Folsom to have come and gone within the Goshen-Plainview time frame." Thus, there indeed seems to be a long period of use for unfluted lanceolate projectile points in the Great Plains which would explain the range of radiocarbon dates for unfluted lanceolate Goshen-Plainview points.

Very early unfluted lanceolate points have also been found in South America. Lanceolate El Jobo-like points have been recovered at the Monte Verde site, Chile (Collins 1997). The Pre-Clovis occupation at Monte Verde has been dated to at least 12,500 B.P. (Dillehay 1997). There now is a consensus that Monte Verde is a Pre-Clovis site (Meltzer et al. 1997). El Jobo lanceolate points were also recovered from Taima-Taima, Venezuela, in early contexts. However, Lynch (1990:18) questioned the dates for these remains because of possible mixing of older and younger remains. Gruhn and Bryan (1991:343) disagree with Lynch's assessment of the Taima-Taima stratigraphy and relationships. They indicate a series of 14 radiocarbon dates ranging from 13,390 to 12,580 B.P. that firmly date the Unit I stratum and association of extinct animals, with human artifacts. Six dates from the Unit III stratum that caps Unit I range from 10,290 to 9650 B.P. and confirm the early dates for materials from Unit I. They indicate Unit I was not disturbed or mixed with younger materials. Lynch's (1991:349) reply did not really refute Gruhn and Bryan's assertions. Lynch simply indicated he was not certain what the stratigraphy was like at Taima-Taima. Ardila and Politis' (1989) new radiocarbon assays and data from Taima-Taima and Lavallee's (2000:46-47) review of the stratigraphy and dates, confirms the early claims for the El Jobo remains from Taima-Taima. Dillehay (2000:128-132) also considers the early remains from Taima-Taima as valid Pre-Clovis materials. Thus, the El Jobo point is another example of an unfluted lanceolate Pre-Clovis style in the Americas.

The question really should be whether or not there ever was a time when unfluted lanceolate point complexes did not exist during the Paleo-Indian Period. There appears to be a continuum in use of unfluted lanceolate points in the Americas dating prior to Clovis and lasting until after the end of Folsom. Clovis, Folsom and

other fluted point complexes would be better viewed as popular branches off of groups who produced unfluted lanceolate points. Therefore, it should no longer be unexpected that a Pre-Clovis cultural complex would utilize unfluted lanceolate points, etc. There simply was no break in the production of unfluted lanceolate points during the Paleo-Indian Period. New work can only extend the use and production of unfluted lanceolate points further into the past.

Data from Meadowcroft Rockshelter provided the proof needed for a paradigm shift away from the Clovis-first hypothesis where the New World was occupied by people moving out of Beringia and Alaska into the continental United States via an ice-free corridor after 12,500 years ago. The new paradigm has the arrival of the First Americans dating sometime prior to 12,500 years ago. Currently, there is no single accepted hypothesis concerning how people first arrived in the New World. Some hypotheses suggest that Pre-Clovis peoples may have skirted the Wisconsinan ice sheets in boats along the unglaciated coastlines of North America during glacial maximum or perhaps even migrated by foot into the New World prior to the Wisconsinan glacial maximum (Erlandson 2002; Stanford and Bradley 2002). Nevertheless, discussions surrounding the data from Meadowcroft Rockshelter have established the criteria for the identification and study of Pre-Clovis sites, and forced anthropologists to think about alternate methods for peopling the New World. Furthermore, Meadowcroft Rockshelter was not excavated in its entirety, and thus has the potential for providing additional information about Pre-Clovis cultures.

One criticism of the Meadowcroft Pre-Clovis materials was that there were no other similar sites in the United States. There now is at least one other site that is comparable to Meadowcroft in terms of age and materials, Cactus Hill in Virginia (McAvoy and McAvoy 1997, McAvoy 2000). Two unfluted lanceolate points, blades, blade cores and utilized flakes were recovered in stratified contexts below Clovis materials and dated to 15,070 B.P. $\pm$ 70 years (13,120 B.C., uncorrected), 16,670 BP $\pm$ 730 years (14,720 B.C. uncorrected, from a hearth) and 16,940 B.P. $\pm$ 50 years (14,990 B.C., uncorrected, from a hearth) (McAvoy and McAvoy 1997:111, 167; McAvoy 2000; Anderson n.d.b:224). A date of 19,700 B.P. $\pm$ 130 years (17,750 B.C. uncorrected) dated the base of the Cactus Hill dune and is below the cultural bearing levels (Anderson n.d.b:224). It should also be noted that two younger dates were obtained from the Pre-Clovis levels; 10,160 B.P. $\pm$ 60 years (8210 B.C., uncorrected) and 9250 B.P. $\pm$ 60 years (7300 B.C., uncorrected) (Anderson n.d.b:224). These later dates are clearly anomalous since they were recovered below the Clovis level. The artifacts from Cactus Hill match the remains found at Meadowcroft Rockshelter (Photos 9, 15-16, Figs. 3-4) with the exception that they are made from different raw materials (primarily quartzite and chert) (McAvoy and McAvoy 1997:179; Standford and Bradley 2002:260). The radiocarbon date for the Cactus Hill materials also matches those from Meadowcroft.

The Topper site in South Carolina is another site in the eastern United States that has produced blades and flakes in levels stratified below Clovis remains (Goodyear et al., 1999). No projectile points were recovered with the blades or flakes. However, the presence of blades in Pre-Clovis levels matches those found at Meadowcroft and Cactus Hill. Unfortunately, there is no charcoal to provide radiocarbon dates for these remains. Optically stimulated luminescence (OSL) dates on the surrounding matrix suggest the Topper site remains date between 16,000 and 13,000 B.P. (Goodyear 2001:6; Anderson n.d.b:226).

Saltville, Virginia, is another dated Pre-Clovis site. A worked tibia, probably from a musk-ox, was directly AMS dated to 14,510 B.P. $\pm$ 80 years (12,560 B.C., uncorrected) at Saltville (McDonald and Kay 1999:196). There also is a midden-like scatter of 200 clam shells, 500 pieces of small vertebrate remains, charcoal and 125 pieces of lithic debitage from the early stratum that is estimated to date between 13,500 and 13,000 B.P. (Goodyear 2001:3).

Materials from Meadowcroft Rockshelter, Cactus Hill, Topper and Saltville demonstrate that there are Pre-Clovis inhabitants in the Eastern United States prior to 11,500 B.P. Goodyear (2001:6) states: "given the presence of bifacial projectiles at Meadowcroft and Cactus Hill and perhaps at Saltville (SV-2) based on debitage, it is not difficult to see Clovis emerging from these technologies." Claims that Meadowcroft Rockshelter represents a unique site are also no longer valid. However, the number of identified Pre-Clovis sites, including Meadowcroft Rockshelter, and quantity of materials recovered from them remains rather small.

Cultural remains from the lowest strata at Meadowcroft Rockshelter have been radiocarbon dated to between 16,000 and 13,000 B.P. in stratified contexts below radiocarbon dated Early Archaic hearths and associated lithic remains (Table 1). The latter supports the radiocarbon age ascription of the remains to the Paleo-Indian Period. As such, they are currently the earliest well-dated Paleo-Indian remains in the northeastern United States. Lepper (1999:366) states:

> The cultural assemblage documented from lower Stratum IIa has been plausibly argued to represent a Pre-Clovis Upper Paleolithic technology (Adovasio et al. 1988). The several radiocarbon dates for this stratum are entirely consistent with this interpretation. There are no 'anomalous' later Paleoindian or Archaic artifacts associated with these dated early levels that might suggest substantial mixing or contamination.

Nevertheless, there have been persistent claims that early radiocarbon dates from Meadowcroft are contaminated by ancient carbon (Haynes 1980, 1991; Tankersley et al. 1987; Tankersley and Munson 1992). These claims hypothesize that ancient particulate or soluble ionized carbon derived from nearby coal, lignite and/or vitrinized wood deposits were carried in local ground water to the site where the ancient carbon was deposited in early charcoal samples from Meadowcroft. Such contamination hypotheses have not been proven.

Haynes (1980:584-584; 1991) and Tankersley et al. (1987) claimed that the Meadowcroft dates were contaminated with soluble ancient carbon from more deeply buried soils, coal, etc. In order to address Haynes (1980, 1991) and Tankersley et al. (1987) questions concerning soluble carbon contamination of the samples, Adovasio et al. (1990:352) ran AMS dates on the last remaining non-cultural sample from Stratum I (no samples from cultural bearing Stratum IIa remained to be processed) at Meadowcroft. The Stratum I sample was also the preferred one to use to test a hypothesis that there was some type of soluble coal contamination of Meadowcroft radiocarbon samples. It should have produced more widely divergent dates between the soluble and solid split sample because of longer exposure to soluble coal contamination, than would be expected from any younger Stratum II dates, if such contamination existed. The increased exposure to the contaminant would make any divergence in the dates wider and less likely to be due to statistical counting errors. Thus, it would be even more likely to show that contamination occurred, than those from any cultural sample. The sample was examined for evidence of particulate coal, etc., and for *Densosporites* spores that would have been present in local coal samples by both the Smithsonian and Oxford radiocarbon labs. No evidence for coal, etc., was found in the sample. Then the soluble portion was extracted from the solid portion and both portions of the split sample were independently AMS dated at Oxford. Adovasio et al. (1990:352) indicated:

> The result for the solid fraction was 31,400 $\pm$ 1,200 years, 29,450 B.C. (OaX-363). The soluble fraction was dated at 30,900 $\pm$ 1,100 years, 28,950 B.C. (OaX-364). These dates conform very closely to a previously calculated Smithsonian lab date of 30,710 + 1,140 years, 28,760 B.C. for this level. . .

If the hypothesis was correct concerning ground water soluble coal contamination, the split solid and soluble samples should have varied widely and been different from the Smithsonian sample run from that same level. The Smithsonian date should also have produced an older date than the pretreated solid charcoal sample if the hypothesis was correct. However, the three dates from Stratum I are statistically identical. This should not have happened if they really were contaminated with either particulate or soluble older contaminates.

Tankersley et al. (1987) discussed how to recognize coal contamination of dates at archeological sites and provided examples of sites they believed had dates contaminated by coal. Unfortunately, in the examples of proposed contamination they provided, the only proposed evidence was that coal was found at or near the sites. They did not demonstrate the dated samples actually contained or were contaminated with coal. This was an assumption on their part and one that may not be correct. Samples from 11Mx66 and 12Po10 did not deviate by much from the expected dates (Tankersley et al. 1987:320). These could have been simple statistical inaccuracies of the counting process (e.g. Shott 1992). Using two sigma standard deviations would place most of these dates either in the expected counting range or just outside it. This is not proof of sample contamination. Other samples from 46Wd35 and 33Ha17 were widely divergent (16,000 to 37,000 years) from the expected dates (Tankersley et al. 1987:320). These were unlikely dates based on stratigraphic context of the samples in association with Late Woodland and Fort Ancient remains at these sites. Thus, they probably were contaminated by coal or some other substance. However, contamination (whether by coal or some other material) was actually demonstrated by the context of the samples which indicated the dates were incorrect. Conversely, early dated samples from Meadowcroft Rockshelter were recovered in good stratigraphic location (Table 1). Early dated samples were not found in association with much later levels, materials and dates as were the examples used by Tankersley et al. (1987). Nearly identical radiocarbon dates from Cactus Hill (see above) on similar artifacts also suggest that Meadowcroft samples were correctly dated and were not the result of older contamination (Custer 1996:92; Meltzer 2002:52).

Nevertheless, Tankersley and Munson (1992) continued to press the claim that vitrinized wood, coal, etc., somehow contaminated the Meadowcroft radiocarbon date samples. They also extended the claim of contamination to the later dates at the shelter. This was largely based on recovery of a carbonized cob of primitive 16 row popcorn from Stratum IV in association with charcoal dates from hearths of 2325 B.P. $\pm$ 75 years (375 B.C., uncorrected) and 2290 $\pm$ 90 years (340 B.C., uncorrected) (Adovasio et al. 1997:9). These dates would make the cob the earliest dated maize from the eastern United States (Tankersley and Munson 1992:324). However, the presence of seemingly early maize is not proof that the post-Paleo-Indian Meadowcroft charcoal samples were somehow contaminated with older materials. First, the charcoal samples associated with the maize were recovered in the dry portion of the shelter where ground water percolation did not occur. Simply put, the proposed mechanism for contaminating radiocarbon samples is not present in the dry portion of the shelter. Second, the contamination claims ignore the Early Woodland artifacts that were associated with the cited dated samples, and for that matter, appropriate artifacts recovered in association with the other later dated samples from Meadowcroft. If the dates are too old for the maize, they are correct for the associated artifacts. If the dates actually should be younger, then they would not accurately date associated artifacts. However, there is another possible explanation for the seemingly anomalous dating of the maize. It might be that the maize actually is not from the Early Woodland period and was introduced to the level by unidentified bioturbation. This would not be the first case of maize being recovered from seemingly good early contexts in the eastern United States but was subsequently found to date to later times (e.g., Conard et al. 1984).

Additionally there is a chance that the cob is accurately dated by the associated radiocarbon dates at Meadowcroft. The specimen of maize from Stratum IV is of a primitive 16 row popcorn (Cushman 1982:216). Maize from post-Stratum IV levels was all of a "high yield" form of maize (Cushman 1982:218), most likely 8

row Northern Flint. Most maize recovered from eastern North America from post-A.D. 800 contexts is also 8 row Northern Flint (Kraft 2001:280-281). Thus, the type of maize recovered from Stratum IV suggests, but does not prove, it is an early variety. Although no earlier radiocarbon dated macrobotanical evidence for maize has been found in Eastern North America, there are microbotanical data that suggest maize was present in the region at a much earlier date. Maize pollen was found in a core taken in Lake Shelby, Alabama, between organic samples dated to 3580 B.P. ± 100 years (1630 B.C., uncorrected) and 3240 B.P. ± 80 years (1290 B.C., uncorrected)(Fearn and Liu 1995:111). Fearn and Liu (1995:110-111) also note that maize pollen has been recovered from dated contexts at Fort Center, Florida (2500 B.P., 550 B.C. uncorrected), B. L. Bigbee Lake in Mississippi (2400 B.P., 450 B.C., uncorrected) and Dismal Swamp, Virginia (2200 B.P., 250 B.C. uncorrected). Based on these data, Fearn and Liu (1995:115), "speculate that corn was present in eastern North America much earlier than the macrobotanical record indicates but that it was cultivated as a minor crop and left only a sketchy microfossil record similar to the situation reported for the tropics." The dated maize pollen samples indicate it is possible for maize to have been present at Meadowcroft Rockshelter during the Early Woodland Period. However, to definitively settle the age of the Meadowcroft cob, it needs to be directly AMS dated. In any case, Tankersley and Munson's hypothesis that dates associated with the early maize from Meadowcroft demonstrate radiocarbon sample contamination at Meadowcroft Rockshelter is unsupported by both associated artifact remains and lack of a contamination mechanism.

Tankersley and Munson (1992:323-324) also claimed to have examples of two additional sites that display coal contaminated radiocarbon dates; Enoch Fork Rockshelter (15Pe50) and Swan's Landing (12Hr304). Adovasio et al. (1992:329) indicated Tankersley and Munson's claim that a 13,480 B.P. date associated with an Early Archaic Kirk level at Enoch Fork Rockshelter was incorrect. The sample was actually derived from several levels below the Early Archaic Kirk level at Enoch Fork and was not associated with it. Stratigraphically, it was not out of line and not necessarily anomalous. It is unclear whether or not coal may have contaminated the one sample cited from the Early Archaic Kirk levels at Swan's Landing or whether it was simply a statistical anomaly from the counting process. However, even if the Swan's Landing sample was contaminated with a coal derived substance, it does not prove that Meadowcroft materials were so contaminated. At Swan's Landing, it would be the associated materials that showed it was an anomalous date. The early dated samples from Meadowcroft were not recovered in association with younger remains.

Adovasio et al. (1980, 1990, 1992, 1998b, 1999) have addressed additional claims concerning contamination of the early radiocarbon samples by Haynes (1980, 1991), Tankersley et al. (1987) and Tankersley and Munson (1992). An actual coal seam is not located in the immediate vicinity of Meadowcroft Rockshelter, but "small, isolated and discontinuous fragments of vitrinized Pennsylvania-age wood" do occur west of the north (back) wall of the shelter (Adovasio et al., 1990:349).

Adovasio et al. (1980:590) indicate:

> Haynes and Stuckenrath collected samples of the upper vitrinite exposure in 1976. Haynes (personal communication) kept his sample in a beaker of water on his Tucson windowsill for several months; nothing happened. Stuckenrath boiled his sample in sodium hydroxide to discover that the pretreatment removed only a trace of soil adhering to the sample; eventually he boiled it in every reagent and hydrocarbon in his laboratory, but nothing happened.

In other words, the vitrinize wood from Meadowcroft Rockshelter is not soluble in anything that would be found in local ground water and in almost any other type of chemical agent. Therefore, it cannot be a source of contamination at the shelter.

Concerning actual coal contamination Adovasio et al. (1990:351) state:

> Even before the publication or pre-publication circulation of the manuscript by Tankersley et al. (1987) every radiometric sample from all Pleistocene-age levels was examined for coal particles using both optical and scanning-electron microscopy. No coal particles were ever identified by the four radiocarbon laboratories or by the independent researchers despite the fact that in order to contaminate a sample on the magnitude that has been suggested, nearly 35 percent of the sample would have to be coal.

Thus, it is unlikely that the early radiocarbon samples from Meadowcroft were contaminated with ancient coal.

Goldberg and Arpin (1999) also examined Meadowcroft Rockshelter deposits using a micromorphological analysis of the sediments to determine the depositional and post-depositional history of the shelter. They state, "the results largely confirm the original work of the excavators, pointing to deposition by attrition, roof fall, and sheet wash, and reveal no evidence of groundwater contamination of the early levels" (Goldberg and Arpin 1999:325). Also, microscopic examination of the Strata I/II through V sediments under fluorescent light, a coal petrology technique to determine if non-particulate organic materials are present, resulted in them stating, "observation of the thin sections in ultraviolet light revealed no extraordinary fluorescence that could be interpreted as humate or coal particulate contamination (Goldberg and Arpin 1999:340)." Goldberg and Arpin (1999:340) conclude that "we see no evidence of groundwater saturation of any strata nor do we see evidence of any other mechanisms by which particulate or non-particulate contamination could have been introduced into the sediments in general and into the charcoal samples in particular." In other words, the contamination mechanisms proposed by Haynes (1980, 1991), Tankersley et al. (1987) and Tankersley and Munson (1992) simply are not present at Meadowcroft Rockshelter. Meltzer (2002:52) states "that the radiocarbon ages were contaminated by groundwater seeping through the lower deposits on site – was effectively rebutted by micromophological analyses of the sediments." Anderson (n.d.a.:73) indicates Adovasio et al. "appear to have effectively refuted arguments against the [radiocarbon] dating" at Meadowcroft. Collins (2002), Custer (1996:92), Goodyear (2001:2) and Kraft (2001:54) also now accept the early radiocarbon dates from Meadowcroft.

Several other points should be made concerning contamination by particulate or ionized carbon from coal, lignite and/or vitrinized wood carried in ground water. First, if the mere presence of nearby coal is reason to demonstrate contamination of radiocarbon date samples, then it should be noted that most of Western Pennsylvania, Ohio, West Virginia, Kentucky, Indiana and Illinois are underlain by coal deposits. Also, if ground water really could easily pick up ancient contaminants from coal, etc., and then the contaminants become inserted into relatively recent charcoal, nearly all dated samples from these states should be so affected. Needless to say, no one has made such claims for the archeological record from the region, and it is unlikely that most samples and dates were contaminated by coal, etc. Second, any contamination mechanism must explain how particulate coal fragments could drop out only into charcoal samples while not being found scattered throughout site sediments from this region in general, and Meadowcroft strata in particular. Ancient particulate coal would have to have some type of special affection for or attraction to younger charcoal, but not to sand, silt and other materials. Similarly, why should ionized ancient carbon be attracted only to younger charcoal? Thus, it remains for those continuing to claim that the Meadowcroft dates were somehow contaminated by coal, lignite and vitrinized wood to actually prove that they were. No actual data supporting claims of such contamination exists.

Kelly (1987) suggested contamination of the early radiocarbon dates might have occurred through bioturbation and/or human activities. There is little evidence in support of this hypothesis. Animals, insects, etc., would

have to carry the contaminants as solid particles and not as soluble ones to the locus of the dates. These particulates would have been easily recognized by the labs examining the samples. The animals, etc., would also have to move the contaminants a relatively long way for those species. The closest vitrinized wood is over 7 m away and coal, etc., would have to travel at least 0.8 km to arrive at the site (Adovasio et al. 1990:349-351). Animals would also have to go through several large rock falls at the site to bring any vitrinized wood particles to the early sample locations. These animals, etc., would then have to dig around and contaminate every hearth in Stratum II with sufficient coal, etc., to have the dates run in appropriate stratigraphic order. This scenario is highly unlikely, and it is also unlikely that such extensive burrows would have gone totally unnoticed by the crew who excavated the microstratigraphy of the shelter.

The early radiocarbon dates have also been questioned because of a lack of associated extinct fauna and ancient flora remains from Meadowcroft Rockshelter (Dincauze 1981, 1984; Mead 1980). One problem is that most bone remains from Stratum IIa were fragmentary, calcined and relatively small. Only 11 bone fragments were recovered and species identified: included white-tailed deer, eastern chipmunk, southern flying squirrel, deer mouse, passenger pigeon, toad and colubrid snake (Guilday and Parmalee 1982:171). Guilday and Parmalee (1982:171) believed the chipmunk and possibly the deer mouse may have burrowed down into these levels. All the early faunal remains can be held in one hand and are hardly a representative sample of what was in the region during the Late Pleistocene. Nevertheless, it should be stressed that Late Pleistocene biological communities were unlike any modern ones. FaunMap data for the 15,500 to 9500 B.P. Late Glacial period (Illinois State Museum web site: http://museum.state.il.us/research/faunmap/query/) indicated white-tailed deer (Fig. 5), southern flying squirrel (Fig. 6), deer mouse (Fig. 7, in this case, assuming that it did not burrow into this level) and eastern chipmunk (Fig. 8, also assuming in this case it did not burrow into this level) may have been found in the area around Meadowcroft Rockshelter during the Late Pleistocene. FaunMap does not provide data on bird species, but passenger pigeons nested as far north as James Bay, Ontario, during the Historic Period (Todd 1963:430), and this suggests it could have been present at Meadowcroft during the Late Glacial period. The toad specimen could not be identified to species, but the American toad, *Bufo americanus*, is one of the more common species and has a modern northern range boundary from southeastern Manitoba across to James Bay and into Labrador (Sutton and Sutton 1985:576). The modern distributions for all of the mammal species except southern flying squirrel also extend north to at least James Bay (Figs. 5, 6, 7, 8) indicating they are all fairly hardy species. In other words, although the remains from the Stratum IIa are generally characterized as "temperate" Holocene species, they also are a part of the cooler modern Canadian biotic regime. Thus, it is not surprising to find them included with Late Pleistocene assemblages from cooler climates as demonstrated in the Late Glacial FaunMap data. The lack of extinct species may only be due to the selective nature of the animals hunted by early Meadowcroft inhabitants and the luck of preservation for resident species.

Similarly, the quantity of floral remains from Stratum IIa is minimal, but are usually assigned to "temperate" Holocene species (Adovasio et al., 1980:593-594). Pollen remains were not well-preserved in Stratum IIa and only 26 individual pollen grains were identified. Of these, only 9 were pollen from trees; 6 from *Tsuga* sp., 2 from *Quercus* sp. and 1 from *Betula* sp. (Adovasio et al. 1998a:16, Table 8). The rest of the pollen was from grasses and other small plants. The sample is insufficient to actually characterize the local environment during the Paleo-Indian Period. The early macrofloral remains indicate deciduous forest elements were located near Meadowcroft during the Late Pleistocene. These data are not inconsistent with pollen and climatic data found in Ohio during the Late Pleistocene. Shane (1994) indicates there were at least some minor deciduous forest elements present throughout the Late Pleistocene. However, deciduous forest elements increased while coniferous species declined to "low frequencies" during the 13,000 to 11,000 B.P. period (Shane 1994:12). Thus, it is likely that the sheltered Cross Creek Drainage functioned as a refugium for temperate species during the Late Pleistocene as proposed by Braun (1950). Finally, the presence of deciduous forest macrobotanical

elements at Meadowcroft is likely due to selective collecting by the early inhabitants who would have favored those materials for food, etc., over those from coniferous species. As such, they do not accurately reflect the percentages of species that were present at that time, only that they were favored by the people living at Meadowcroft.

It should be noted that temperate forest remains were also found in association with a Clovis-like point at the Shawnee-Minisink site, located in the Delaware River Valley of Eastern Pennsylvania, and AMS dated to 10,940 B.P. $\pm$ 90 years ago (8990 B.C., uncorrected) (Dent 2002:55-57; Dent and Kaufmann 1985; Kauffman and Dent 1978:4-5). This date was run on a hawthorn seed (Dent 2002:55). The presence of deciduous elements at Shawnee-Minisink (Dent 2002:55-57; Dent and Kaufmann 1985; Kauffman and Dent 1978:4-5; Kraft 2001:69) by the end of the Pleistocene, when pollen samples from the area characterize it as having a spruce-fir and pine forest (Dent 2002:69), is not inconsistent with knowledge about biotic zones. Dent (2000:70) indicates:

> Boreal ecosystems feign monotony over time and space (Winterhalder 1983:9). In reality, boreal ecologies are actually complex and relatively dynamic mosaics, consisting of many small habitats or 'patches.' These patches are created by local edaphic conditions, as well as by an internal rhythm of disturbance and succession endemic to the ecosystem . . .

The belief that there were successional bands of dense spruce and pine forests moving across the northeastern United States during the Late Pleistocene and early Holocene must be rethought. As Dincauze (n.d.:177) states concerning our view of Late Pleistocene plant communities: "the generalizations we have lived with clearly mislead." Plant communities probably were much more mosaic in nature during those periods and affected by edaphic and orographic conditions as much as climatic ones. The presence of deciduous elements at Meadowcroft should not be considered unusual or as proof that it must date to a later period.

Finally, all of the data for Meadowcroft Rockshelter have been published in a variety of publications (see list of references in Appendix A). In particular, the early materials from the shelter have been published in many places, discussed, critiqued and examined by more archaeologists and scientists than any other site in the eastern United States. A final publication remains to be produced, but it will not provide any new information or data that has not already been presented. In summary, there is absolutely no proof of radiocarbon date contamination, the Pre-Clovis materials are in the appropriate stratigraphic relationships with later materials (which critics always seem to ignore) and the recent discoveries at Cactus Hill and other sites demonstrate it can no longer be considered unique. In support of this Custer (1996:93) states: "I think most archaeologists would now agree that critics have run out of objections and we must regard the Meadowcroft Rockshelter as a bona fide site predating 12,000 years ago."

Future excavations in the remaining intact lower strata have the potential to answer any new questions raised concerning the actual age of the Paleo-Indian remains at Meadowcroft Rockshelter. There are potentially unexcavated early remains under later rock falls in the northern excavated part (i.e., the site was only excavated down to those large rocks; the rocks people are working on top of in the foreground of Photos 6-7) of the shelter and sections along the unexcavated eastern side that might provide additional information concerning the early occupations of the site.

How large a territory was utilized by the earliest inhabitants of eastern United States and North America?

The cultural remains from the earliest levels of Meadowcroft Rockshelter are definitely from the Paleo-Indian period, whether or not they are accepted as evidence for a Pre-Clovis occupation of the United States. They are stratified below dated Early Archaic hearths with associated lithics and as such, represent some of the earliest inhabitants of the region.

Analyses of the lithic raw material used in the production of their stone tools provides information on the movements of the Paleo-Indian peoples that occupied Meadowcroft Rockshelter. Many lithic raw materials utilized by the early Meadowcroft inhabitants are of non-local origin. There are two possible explanations for the presence of exotic raw materials at Meadowcroft during the Paleo-Indian Period. It is possible that the inhabitants traveled relatively long distances to obtain chert from the Kanawha Valley to the southwest and from the Flint Ridge (Vanport) Chalcedony quarries in central Ohio. However, it is also possible that the exotic raw materials were obtained through trade with other peoples inhabiting the quarry areas. Until early inhabitants of equivalent ages to those from Meadowcroft are found in the quarry areas that could act as trading partners, it must be assumed that the former hypothesis is the most likely one. The Meadowcroft data suggest early inhabitants of the area exploited a relatively large territory in the northeastern and midwestern United States. Comparisons of remains from Cactus Hill and Saltville, Virginia, Topper, South Carolina, and Meadowcroft, Pennsylvania, may provide additional data on the territorial range of the earliest inhabitants of the eastern United States since raw materials used at the southern sites differs from those used at Meadowcroft.

Gardner (1974) proposed that Paleo-Indian settlement patterns revolved around procurement of raw materials for their stone tools. Custer (1984:54-55) modified and divided Gardner's model into one of a cyclical pattern of movements focused on a single large quarry and a serial pattern based on exploitation of a series of small quarries. Base camps were located near the large quarry in the cyclical pattern whereas base camps were located away from the quarries in the serial pattern. Sites that are part of the serial pattern would produce a wider variety of lithic raw material types. Gardner's (1974) Flint Run Complex represented an example of the cyclical pattern which relied primarily on a single lithic source.

The variety of raw materials used by the early inhabitants of Meadowcroft Rockshelter suggests it is part of Custer's serial pattern. They did not rely on any one raw material source for production of their stone tools. Meadowcroft would also likely represent a short-term campsite within this settlement pattern. Blades and flakes made from Flint Ridge Chalcedony suggest they traveled 112.6 km from the rockshelter into central Ohio to procure this material (Vento and Donahue 1982:117). Similarly, Kanawha Black Chert was used to manufacture some tools at Meadowcroft, and it outcrops 183.4 km to the southwest of the site (Vento and Donahue 1982:116). Thus, the Meadowcroft Paleo-Indian inhabitants apparently traveled over significant distances to obtain raw material to make their stone tools and exploited a relatively large territory.

The early lithic assemblage from Meadowcroft has the potential to provide even more information about population movements and territories exploited by the earliest inhabitants of the region. Thin sectioning, various trace element analyses, and scanning electron microscopic examination of tools and debitage flakes from the early levels could provide more definitive raw material identification for those remains. The data could be used to more precisely identify the territorial range of the early Meadowcroft inhabitants. Information concerning territorial ranges and/or trade in raw materials could also be obtained for the Archaic and Woodland occupants of Meadowcroft, based on lithic studies. These data could be compared to those from the Paleo-Indian Period to see if there are any similarities or changes in territorial exploitation through time in the region.

What were the subsistence practices of the Earliest Americans?

Floral and faunal remains from the lower levels of Meadowcroft Rockshelter are rather sparse, but those that do exist suggest the earliest inhabitants were more than just big game hunters. White-tailed deer and smaller game

were taken, and wild nuts may have been exploited. There is no direct evidence that the Paleo-Indians at Meadowcroft hunted now-extinct forms of elephants or other Pleistocene species.

Only a few Paleo-Indian sites in the northeastern United States have produced any subsistence remains, and no site has produced an abundance of floral and faunal remains (Dincauze n.d.:178). Therefore, any subsistence sample from undisturbed contexts at a Paleo-Indian site is significant. The potential for obtaining additional floral and faunal specimens at Meadowcroft exists under the later rock falls (presuming a method of removal for the large rocks could be developed that would not damage strata under them) in the northern and dry portion of the shelter and along the eastern side of the site.

How have prehistoric Native American peoples of the Eastern United States adapted to changing climates during the transition from Pleistocene to Holocene climates?
The Paleo-Indian and Archaic remains from Meadowcroft Rockshelter span the period from the end of the Pleistocene through the establishment of the modern Holocene environment. Subsistence remains and non-cultural deposits (i.e., the soil matrix composition, animal predator-prey deposits, accumulation of pollen and other natural floral deposits) from the shelter provide information on local climate and environmental changes during this transition. Having a relatively continuous sequence of human occupations throughout this climatic sequence provides information on how people adapted to the changes.

Materials from Meadowcroft and sites located during the Cross Creek survey indicate there was an ephemeral use of the drainage by mobile hunters and foragers during Paleo-Indian times (Adovasio et al. 1998a:18). Meadowcroft Rockshelter is characterized as a short-term bivouac or transitory campsite occupied by people with a sophisticated lithic technology during the Paleo-Indian period. There was an increase in use of the Cross Creek Valley during the Early Archaic based on an increase in identified components (8 Paleo-Indian vs. 11 Early Archaic) and diagnostic artifacts recovered (28 Paleo-Indian vs. 105 Early Archaic points) (Adovasio et al. 1998a:5-18). Most of the sites, including the Early Archaic occupations at Meadowcroft Rockshelter, continue to represent short-term bivouac sites. However, one Early Archaic base camp was also identified indicating a more intensive utilization of Cross Creek Valley resources. Blades that were present in the Paleo-Indian lithic assemblages abruptly drop out and are not found in Early Archaic assemblages from the Cross Creek Valley. Also, point types characteristic of Early Archaic populations are a variety of notched and stemmed styles instead of various lanceolate forms used during the Paleo-Indian period. The changes in lithic technology between Paleo-Indian and Early Archaic times are probably related to changes in hunting strategies. There is a decrease in use of the Cross Creek Valley during the Middle Archaic since only three components were identified (Adovasio et al. 1998a:19). Meadowcroft continued to be used as a short-term hunting and foraging bivouac during the Middle Archaic. The other Middle Archaic sites were identified as a base camp and one other bivouac site. Diagnostic projectile points recovered from the Early and Middle Archaic components in the Cross Creek Valley are stylistically related to those from the southeastern United States (Adovasio et al. 1998a:22). They suggest that either local inhabitants were influenced by or actually represented migrant groups from the South. There was a dramatic increase in the use of Meadowcroft Rockshelter and the Cross Creek drainage during the Late Archaic/Transitional Period (Adovasio et al., 1998a:19-20). The number of identified components from the valley increased to 316. Meadowcroft Rockshelter is characterized as a base camp for hunting and foraging groups, one of four in the valley, during the Late Archaic/Transitional Period. Stylistically, the diagnostic Late Archaic/Transitional points from Meadowcroft and Cross Creek sites are related to regional types from the area immediately south of Pennsylvania, the midwestern and northeastern United States (Adovasio et al., 1998a:23). They suggest local people changed their interaction with groups to the south during the Early and Middle Archaic, to those further north or west.

There is an increased reliance on riverine resources noted through the Paleo-Indian and Archaic sequence at Meadowcroft Rockshelter (Guilday et al. 1980). Fritz (1999) has hypothesized that the early cultivation of cucurbits in the eastern United States might be related to use of the gourds as fish net floats more so than as food. The presence of cucurbit remains by the end of the Late Archaic Period and beginning of the Early Woodland (Cushman 1982:216), along with an increasing reliance on riverine resources during the Archaic at Meadowcroft, lends support to her hypothesis.

The Woodland Period is represented by a decrease in the number of sites used in the Cross Creek drainage. A total of 12 Early Woodland, 17 Middle Woodland and 4 Late Woodland components were identified (Adovasio et al. 1997; Adovasio et al. 1998a:5-21). Meadowcroft continued to act as a base camp during the Early Woodland Period, but was only a short-term bivouac site during the Middle and Late Woodland. The appearance of cultigens and ceramics in the Early Woodland components of Meadowcroft demonstrates there was a shift in regional adaptations to the environment after 1000 B.C.

The floral and faunal remains from Meadowcroft Rockshelter's Archaic (Cowin, personal communication), Early and Middle Woodland levels, represent the only significant identified samples for those periods from western Pennsylvania archeological contexts (Tables 2, 3, 4, 5; McConaughy n.d.). Any comparisons between adaptations made by peoples in western Pennsylvania and other areas of the eastern United States will utilize these data. Meadowcroft Rockshelter has the potential to yield additional floral and faunal samples from the remaining unexcavated eastern section of the shelter, and from unsorted flotation samples that remain with the Meadowcroft collections. Similarly, questions concerning the spread or movements of various Archaic and Woodland groups in the eastern United States can be addressed by comparisons with Meadowcroft artifacts.

The unexcavated sections along the eastern side of the site have the potential to provide additional information about these periods and adaptations made by local peoples.

How have the economic systems of prehistoric Native Americans in the Eastern United States changed through time?

Examination of the entire cultural sequence from Meadowcroft Rockshelter provides information on long-term changes in the economic systems of the peoples living in the region. Analysis of the lithic remains shows changes in raw material exploitation through time. Floral and faunal remains from Meadowcroft Rockshelter show an increasing utilization of fresh water mussels during the Late Archaic (Lord 1982:203-204) and the slow adaptation of horticultural practices during the Woodland Periods (Cushman 1982:216-219). Meadowcroft Rockshelter has produced evidence for some of the earliest dated cultigens in Pennsylvania and the northeastern United States (Cushman 1982:216), but the dates for the maize remains are still in dispute (Tankersley and Munson 1992:324, see above).

The *Cucurbita* sp. remains recovered in association with radiocarbon dates of 3065 B.P. $\pm$ 80 years (1115 B.C., uncorrected), 2820 B.P. $\pm$ 75 years (870 B.C., uncorrected) and 2815 B.P. $\pm$ 80 years (865 B.C., uncorrected) from Meadowcroft (Cushman 1982:216) can no longer be viewed as anomalously early specimens. Recent discoveries of much older *Cucurbita* sp. remains at Memorial Park in northeastern Pennsylvania (Hart and Asch Sidell 1997) and Sharrow, Maine, (Peterson and Asch Sidell 1996) demonstrate cucurbits were cultivated at a relatively early date in the northeastern United States. One rind sample from Memorial Park was directly AMS dated to 5404 B.P. $\pm$ 552 years (3454 B.C., uncalibrated, Hart and Sidell 1997:527) and the Sharrow sample was directly AMS dated to 5695 B.P. $\pm$ 100 years (3745 B.C., uncorrected, Peterson and Asch Sidell 1996:689). Even older *Cucurbita* sp. specimens have been recovered from midwestern (Asch and Asch 1985; Conard et al., 1984:443-446; King 1985; Fritz 1999:423) and mid-South (Kay et al., 1980) Archaic Period sites. Cucurbit remains are also relatively abundant in later Middle Woodland sites from neighboring Ohio (Wymer 1996:39-

43) demonstrating its popularity in the region. Pepo squash was clearly an early cultigen and remains from Meadowcroft can help trace its development and use in the eastern United States.

Fritz (1999) has hypothesized that cucurbits were grown for use as fish net floats and not simply for food. The increase in reliance on riverine resources at Meadowcroft during the Late Archaic and Early Woodland periods may document this function for early cucurbits.

Additional studies of the floral and faunal remains from Meadowcroft may yield information concerning changes in the economic systems in the eastern United States. AMS radiocarbon dates run directly on samples from Meadowcroft Rockshelter may help determine just when the first maize appeared in the northeastern United States. Meadowcroft Rockshelter also has the potential to yield additional floral and faunal samples from the unexcavated eastern section of the shelter.

THE NHL THEMATIC FRAMEWORK

Meadowcroft Rockshelter is nationally significant under National Historic Landmark themes: Peopling Places, Developing the American Economy, Expanding Science and Technology, Transforming the Environment and the Changing Role of the United States in the World Community. Additionally, Meadowcroft Rockshelter is one of the most important early sites in the eastern United States, which qualifies it for inclusion under the *Earliest Americans of the Eastern United States Theme Study*.

Peopling Places:
The oldest incontrovertible cultural remains were recovered from Stratum IIa at Meadowcroft Rockshelter and have been radiocarbon dated between 16,175 and 11,300 years ago (Adovasio et al. 1990). These materials provided the first well-dated Pre-Clovis component in good stratified contexts in the United States. The Pre-Clovis component and the relative ease of access to Meadowcroft Rockshelter resulted in the site being scrutinized by more than 700 archeologists from North America and the world at a level to which few archeological sites have ever been subjected. Although there is still some debate about the dating of the early remains (see above discussion, Adovasio et al. 1992, 1999; Haynes 1980, 1991; Tankersley et al. 1987; Tankersley and Munson 1992), many archeologists now accept the site as evidence that humans occupied the New World prior to 12,500 years ago (Anderson n.d.a.:73; Bonnichson and Turnmire 1999:16; Collins 2002; Custer 1996:92; Goodyear 2001:2; Kraft 2001:54; Meltzer 2002:52 and Stanford and Bradley 2002). The Stratum IIa materials are minimally of Paleo-Indian age--no matter what one's view is of the claim that they are Pre-Clovis--because Stratum IIa artifacts are found in good stratified contexts below Early Archaic hearths and associated lithics dated to 8010 B.P. $\pm$ 110 years (6060 B.C., uncorrected) and 9075 B.P $\pm$ 115 years (7125 B.C., uncorrected). The lack of associated diagnostic Early Archaic points does not indicate the shelter was unoccupied during the Early Archaic, only that they did not leave behind diagnostic artifacts. Diagnostic Middle Archaic remains are found in association with dated hearths located in levels above them, thus, demonstrating these features are of Early Archaic origin. In this context, it should again be stressed that recent work has not only confirmed the original stratigraphy, but conclusively demonstrated the complete absence of any particulate or non-particulate contamination or even potential sources for same that might affect radiocarbon samples at Meadowcroft (Goldberg and Arpin 1999).

Data from Meadowcroft Rockshelter necessitated a paradigm shift away from one where the New World was occupied by people moving out of Beringia and Alaska into the continental United States via an ice-free corridor after 12,500 years ago (see more detailed discussion above). Supposedly, the first inhabitants south of the glaciers in the United States were members of the Clovis Culture. The new paradigm necessitated by the Meadowcroft remains indicates that the arrival of the First Americans occurred sometime before 12,500 years

ago, prior to the establishment of the Clovis Culture. And as Feder (1999:94) indicates: "with the radiocarbon dates for Monte Verde and Meadowcroft, it is obvious that the first human occupation of the New World must be pushed back further still." Currently, there is no single accepted hypothesis concerning how people first arrived in the New World. Some hypotheses suggest that Pre-Clovis peoples may have avoided crossing between or over the Wisconsinan ice sheets by taking boats around the unglaciated coastlines of North America during glacial maximum, or perhaps even migrated by foot into the New World prior to the Wisconsinan glacial maximum (Erlandson 2002; Stanford and Bradley 2002). Nevertheless, discussions surrounding the data from Meadowcroft Rockshelter have established the criteria for the identification and study of Pre-Clovis sites and forced anthropologists to think about alternative methods for peopling the New World. Furthermore, Meadowcroft Rockshelter was not excavated in its entirety and it has the potential for providing additional information about Pre-Clovis cultures.

Recent claims of a Pre-Clovis/Solutrean connection between the Old and New World (Stanford and Bradley 2000, 2002) are based in part on the blade technology found at Meadowcroft Rockshelter and Cactus Hill. The acceptability of the case for Solutrean ancestry of New World Pre-Clovis groups rests, to some extent, on archeologists' views of the Meadowcroft assemblage. At the very least, the early materials from Meadowcroft Rockshelter have initiated discussions about the peopling of the New World in times or ways not seriously considered before its excavation. Indeed, recently D. Meltzer (personal communication, 2000) stated that Meadowcroft has been the focal point and lightning rod for all Pre-Clovis discussions for more than 20 years. Additional studies and analyses of the Meadowcroft Pre-Clovis materials may resolve the question of a Solutrean connection with the New World.

The Pre-Clovis cultural remains from Meadowcroft Rockshelter provides researchers with the best evidence for migration of the earliest peoples into the eastern United States. Analyses of these materials have provided insight into when these people arrived, what they did after arrival, and how large a territory they may have exploited. The unexcavated portions of Meadowcroft Rockshelter also ensure that further work and analyses to confirm or refute arguments concerning when the first people migrated into the United States, and from what direction they arrived, can be conducted at the site in the future.

Developing the American Economy:
In addition to the Pre-Clovis occupation, Meadowcroft Rockshelter has provided evidence for Archaic, Woodland, and historic Euro-American use of the rockshelter in good stratified contexts. Meadowcroft has produced floral and faunal remains from all occupational strata and provide a means of studying the economies of the regional cultures and how they changed through time (Adovasio et al. 1997, Adovasio et al. 1998a; Cushman 1982; Guilday et al. 1980, Guilday and Parmalee 1982; Lord 1982; McConaughy n.d.). Remains from Meadowcroft Rockshelter and Shawnee-Minisink (Kauffman and Dent 1978; Klein 1985; McNett et al. 1977:284, McNett 1985:73, 322) demonstrate that the early Paleo-Indians were not merely big game hunters but also hunted smaller game and fished. They also show how Archaic groups adapted to the establishment of the modern environment by increasing their reliance on locally available fauna and floral resources as well as utilizing an increasing amount of riverine resources.

The appearance of cultigens in the eastern United States and the development of horticulture in the Middle Atlantic, are important regional questions that can be addressed by the Meadowcroft samples. Domesticated squash appeared during the Early Woodland period at Meadowcroft Rockshelter and only supplemented wild food resources at that time. Samples of maize have also been recovered from the rockshelter in Early Woodland contexts. However, the maize was dated only by associated charcoal radiocarbon dates. New dating methodologies, particularly AMS radiocarbon dating, could be conducted in the future to conclusively confirm the early nature of the maize remains from Meadowcroft. Even if the maize cob dates later than what is

suggested by its stratigraphic placement and associated charcoal radiocarbon dates, it, along with later dated maize specimens and cucurbit remains from Meadowcroft, would still represent some of the best samples for studying the development and use of cultigens in the region.

Analyses of lithic materials utilized by the various inhabitants of Meadowcroft Rockshelter in the production of their chipped stone tools provides data on where and how lithic raw materials were obtained by the different prehistoric groups, and how this may have changed through time in the region. Flint Ridge (Vanport) Chalcedony was exploited by the Pre-Clovis inhabitants of Meadowcroft to make blades and other tools (i.e., based on debitage flakes recovered – no other formal Flint Ridge Chalcedony tools were recovered at the site). The quarries for this material are in central Ohio 112.6 km from the site (Vento and Donahue 1982:117). Similarly, Kanawha Black Chert was used to make bifaces and the Mungai Knives at Meadowcroft. Kanawha Black Chert outcrops 183.4 km to the southwest of the site (Vento and Donahue 1982:116). Raw material studies may provide a means of determining territories exploited by the later cultural groups from the site if it can be shown that the groups actually moved around to obtain the lithic raw material (i.e., proof would be similar complexes to those from Meadowcroft found in the area where the raw material was obtained). Territories would be smaller if it could be demonstrated that lithic raw material was actually obtained via trade with other groups (based on comparisons between Meadowcroft assemblages and assemblages from potential trading partner groups; the latter would have a few artifacts, but not complete assemblages, similar to those from Meadowcroft). Raw material studies also provide information about how stone tools were manufactured, used or rejuvenated as part of their normal "life" span at campsites.

Meadowcroft also holds the potential for providing additional information about Paleo-Indian economic systems since it was not excavated in its entirety. Areas under the younger northern roof falls and on the eastern side of the site remain to be excavated. They could produce additional samples of flora, fauna and lithic artifacts that are important in understanding early economic systems.

Expanding Science and Technology:
Materials from Meadowcroft Rockshelter have the potential for providing information about the development of Paleo-Indian lithic technology. The Miller Lanceolate point (Photo 9), along with similar "Early Triangular" points from Cactus Hill (Fig. 3), may be the prototypes for later fluted point styles in the eastern United States. The general pentagonal to triangular appearance of these points also suggests they were resharpened, and if so, they were curated tools and rejuvenated as required. These points were also made from higher quality raw material than some of the other pre-Clovis tools. Determining why this was done, when lesser quality raw material apparently would have been just as functional, might provide insights into the technology and actual function of these tools. Meadowcroft and Cactus Hill will play a role in determining how early spears types were developed and the uses for which they were employed (i.e., single or multiple functions, etc.). The production and use of prismatic blades by the Pre-Clovis inhabitants of Meadowcroft (Photos 14-16) and Cactus Hill (Fig. 4) also are likely precursors of formal blades produced by Clovis and later Paleo-Indians in the eastern United States (Goodyear 2001:6; Meltzer 2002:43; Standford and Bradley 2002:259-260). Even Fiedel (1999:109), who accepts the unproven claims for coal contamination of the radiocarbon dates, states that "the small blades found there [Meadowcroft Rockshelter] seem to fit the emerging picture of early Clovis or Proto-Clovis toolkits in the Southeast." This technological trait may also be one that eventually links the earliest inhabitants of the United States to ancestral Old World cultures.

Remains from Stratum IIa at Meadowcroft also provide a means of examining the technology that permitted humans to adapt to Late Glacial environments. Hunting technologies required adaptations to capture a variety of small animals based on the remains from Meadowcroft. There is little evidence that they exploited large game, but the materials from Meadowcroft do not rule out such exploitation at other early sites.

In terms of expanding archeological science and technology, Meadowcroft Rockshelter was one of the first archeological project sites to have an on-site computer link used to track site data as they were being produced. Telephone and electrical lines were strung into the rockshelter. A teletype computer terminal (TTY) was set up in the rockshelter in 1974 and subsequent seasons. The TTY was connected to the University of Pittsburgh mainframe via a 300-baud acoustic modem. Data and information were typed into the TTY during the course of excavation and sent to the University of Pittsburgh mainframe for storage. The computer hook-up allowed for real-time communication with the mainframe and statistical treatment of the data which resulted in daily modifications to the field procedures. The information could also be retrieved from the mainframe when needed to aid in site interpretation. Additionally, a lighting system was installed which employed a complex system of quartz halogen, mercury vapor, and daylight-corrected fluorescent bulbs to facilitate excavation visibility and photography, a first in a rockshelter environment. The lighting system allowed the site to be enclosed and protected in a wooden structure, which is very important, but it did not affect the meticulous field work and the identification of strata.

Meadowcroft Rockshelter was also one of the first sites in the northeastern United States that truly employed an interdisciplinary approach to its excavations and analyses. At least 32 different technological specialists (Carlisle et al. 1982:17-18) were actively involved in the excavations at Meadowcroft, including people with expertise in palynology, paleontology, sedimentology, geology, paleobotany, malacology, archeomagnitism, radiocarbon dating, computer technology and various archeological specialties. Other specialists have been added to the research team as needed over the years (e.g., Goldberg and Arpin 1999).

Beyond the field work, Meadowcroft Rockshelter and the debate it caused in the archeological community, has resulted in a set of criteria used by the profession to identify Pre-Clovis sites. It has resulted in archeologists realizing they must dig deeper once they have reached Clovis levels or strata that date to the Clovis time period (e.g., Goodyear et al. 1999).

Transforming the Environment:
Meadowcroft Rockshelter has provided evidence for Pre-Clovis, Archaic, Woodland, and historic Euro-American use of the rockshelter in good stratified contexts. Meadowcroft has produced floral and faunal remains from all occupational strata and these provide a means of studying the economies of the regional cultures, and how they changed through time. These remains demonstrate that the early Paleo-Indians were not merely big game hunters, but also hunted smaller game. The stratified sequence of cultural remains at Meadowcroft also provide information about how groups in the eastern United States adapted to changes from glacial to post-glacial environments. Early, Middle and Late Archaic remains document the transition to hunting and gathering in first pine forest, and then into modern mixed deciduous floral regimes found in the eastern United States through the Holocene. An increase in use of riverine resources through the Archaic Period is also documented at Meadowcroft.

The question of when horticulture first appeared in northeastern North America, remains one of the more important questions that can be addressed by the Meadowcroft samples. Domesticated squash appeared during the Early Woodland period at Meadowcroft Rockshelter and only supplemented wild food resources at that time. Samples of maize have also been recovered from the rockshelter in Early Woodland contexts. However, these domesticated plants were dated only by associated charcoal samples making their dates suspect. New dating methodologies, particularly AMS radiocarbon dating, could be utilized in the future to conclusively confirm the early ages of the maize and squash remains from Meadowcroft. Regardless of the radiocarbon dates, the maize from Early Woodland levels at Meadowcroft is from a primitive form of 16 row popcorn (Cushman 1982:216). All maize specimens from post-Stratum IV at Meadowcroft were a more productive

species of maize (Cushman 1982:218), and maize from post-A.D. 800 contexts in northeastern North America usually is from a highly productive 8 row Northern Flint (Kraft 2001:204, 280-281). Wymer (1996:47) has suggested that a few specimens of early AMS dated maize from Ohio and the midwest represent, "ceremonial [items] in this and the succeeding early Late Woodland Period," rather than subsistence items. The later 8 row Northern Flint was clearly a subsistence item where it was found (Kraft 2001:280-281). The remains from Meadowcroft may help explain the changes from ceremonial to subsistence maize use and "the post-Stratum IV corn documents the evolution of good quality and probably high-yield maize varieties" in eastern North America (Cushman 1982:218).

In her study of macrofloral remains from Meadowcroft, Cushman (1982:216) noted an "increase in weedy annuals since ca. 1000 B.C., especially *Amarathus* sp., which suggests some increase in land clearance and disturbance. Pollen data (see Table 1) from the same period corroborate this observation." The implication from land clearance after 1000 B.C. is that there was clearance of fields for horticulture. However, it may also reflect a more sedentary lifestyle requiring building materials and fuels for cooking fires. The pollen and floral remains from Meadowcroft provide important information on how people affected and used eastern North American environments. They also provide data on changes from a seasonally based movement for hunting and gathering, to more sedentary lifeways from the Archaic to Woodland Periods in the East.

The Changing Role of the United States in the World Community:
The Pre-Clovis artifacts from Meadowcroft Rockshelter include a lanceolate point (named the Miller Lanceolate), bifaces, unifaces, prismatic blades, core fragments, and debitage. Remains from other Pre-Clovis sites (e.g., Cactus Hill and Saltville, Virginia, Topper, South Carolina, etc.) are usually compared to the Meadowcroft assemblage (Goodyear 2001; McAvoy and McAvoy 1997; Standford and Bradley 2002:259-260). In addition, claims for Pre-Clovis inhabitants in other sections of the New World also are evaluated with Meadowcroft in mind (Lozano Ruiz 2000).

Meadowcroft is an important site in linking early New World Cultures with those from the Old World. The Meadowcroft remains have been compared to those from Late Pleistocene cultures in Siberia in order to determine where and who were the first people and culture to enter the New World. For example, prismatic blades from Meadowcroft are similar to microblades found in the Dyuktai culture from western Siberia which dates between 35,000 and 10,000 years ago (see papers in West 1996).

Recently, a Pre-Clovis/Solutrean connection between the Old and New World has been hypothesized based on the blade technology found at Meadowcroft Rockshelter and Cactus Hill (Stanford and Bradley 2000; 2002). To date, this hypothesis has not gained wide acceptance and has been highly criticized (Straus 2000). Nevertheless, Stanford and Bradley have made claims concerning early New World and Upper Paleolithic Old World cultures that have necessitated reexamination of the Meadowcroft remains with a world-wide perspective. Meadowcroft has the potential for providing information about just how the early cultures of the New World were related to developments in other areas of the world.

Meadowcroft has the potential to yield additional information about New and Old World connections as it is compared to new discoveries in Siberia, Europe and Pre-Clovis sites in the New World. If the large rock falls in the excavated northern side of the shelter are safely removed, Meadowcroft could produce additional early remains in sealed contexts that may answer questions concerning world-wide relationships. There also are unexcavated sections of the shelter along the eastern side that have the potential to produce additional early remains in good stratigraphic contexts.

Stanford and Bradley (2002:260) also indicate that the Pre-Clovis materials from Meadowcroft, along with those from Cactus Hill, are a likely "precursor of Clovis technology." The presence of the earlier materials from Meadowcroft and Cactus Hill, and a large quantity of Clovis points recovered from the eastern United States – more than found in the western United States – implies to some archeologists that Clovis technology was actually invented in the eastern United States (Meltzer 2002:43), and subsequently spread to the west. Meadowcroft and Cactus Hill have produced unfluted lanceolate points that only need the addition of fluting technology to be transformed into Clovis points (Goodyear 2001:6). They also have a blade technology that carries over into Clovis (Fiedel 1999:109). The materials from Meadowcroft and Cactus Hill play an important role in the interpretation of Clovis origins.

Meadowcroft Rockshelter is one of the most important sites excavated in the eastern United States. The reasons for this are simple. At the present time, no other site in the rest of the United States has provided such a well-dated sequence of cultural occupations at one location. Because of its exposure in the trade and popular presses, Meadowcroft Rockshelter's importance is recognized worldwide by both archeologists (Custer 1996:92; Goodyear 2001:2; Kraft 2001:54; Meltzer 2002; Standford and Bradley 2002) and the general public. Meadowcroft revolutionized how archeologists view the peopling of the New World. It has resulted in archeologists actively looking for stratified Pre-Clovis sites when they previously would have stopped or completed their excavations. Because of this site, there now has been a paradigm shift. Because of the work at Meadowcroft Rockshelter, Clovis is no longer considered by most New World archeologists as the first American culture (Meltzer 1991).

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Previous documentation on file (NPS):

__ Preliminary Determination of Individual Listing (36 CFR 67) has been requested.
_X_ Previously Listed in the National Register.
__ Previously Determined Eligible by the National Register.
__ Designated a National Historic Landmark.
__ Recorded by Historic American Buildings Survey: #
__ Recorded by Historic American Engineering Record: #

Primary Location of Additional Data:

_X_ State Historic Preservation Office
__ Other State Agency
__ Federal Agency
__ Local Government
__ University
__ Other (Specify Repository):

10. GEOGRAPHICAL DATA

Acreage of Property: Less than one acre.

UTM References:	**Zone**	**Easting**	**Northing**
	17	543220	4459460

Verbal Boundary Description: A quadrilateral (see map and satellite photograph with boundaries) formed by lines connecting the following UTM points, all from Zone 17:

Northwest: Easting: 543190 Northing: 4459500
This point is out in woods with no close identifying feature. The western NHL boundary formed by this point and the southwestern point is basically the dividing line between the direction of drainage above the bluff line. Areas to the west drain away from Meadowcroft Rockshelter, to the east of the line, they drain over or around the rockshelter.

Northeast: Easting: 543290 Northing: 4459500
The line from the northwest to northeast point goes through the woods and crosses just north of the existing ponded area north of the site - the erosional features that include this modern pond that contributed sediments that washed over the bluff and became slopewash into Meadowcroft Rockshelter are included by this northern boundary.

Southwest Easting: 543190 Northing: 4459400
This point is basically at the northwest corner of the old metal bridge that crosses Cross Creek to the southwest of the shelter – it is planned for replacement by PennDOT and the new bridge will cross over to a point further

to the west than the current bridge. A line from this southwest point to the southeastern point basically follows the northern bank of Cross Creek.

Southeast: Easting: 543290 Northing: 4459400
The eastern NHL boundary line formed by this point and the Northeastern point is located about 23 m due west of the southwestern corner of the parking lot for the Meadowcroft Village parking lot. It also is the dividing line for bluff drainage where areas to the west drain down and over the bluff toward Meadowcroft Rockshelter and away from it to the east of the line.

Boundary Justification:

The boundaries for the Meadowcroft Rockshelter (Figs. 9-10) were based on GPS readings taken in the deciduous woods around the shelter. They include the immediate uplands that contributed and contribute soil sediments via sheetwash to Meadowcroft Rockshelter, the Meadowcroft Rockshelter cliff face (Fig. 11), the cliff face immediately east and west of the current excavations, and the talus slopes below the shelters down to Cross Creek. All of these features or locations either contributed to or have the potential to contribute additional information about the occupations of and/or geological processes at work at Meadowcroft Rockshelter.

11. FORM PREPARED BY

Name/Title: Dr. Mark McConaughy, Archeologist

Address: Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Bushy Run Battlefield
P.O. Box 468
Harrison City, Pennsylvania 15636-0468

Telephone: (724) 527-5585 x 103

Date: April 15, 2004

Edited by: Erika K. Martin Seibert
National Park Service
National Historic Landmarks Survey
1849 C St., N.W.
Washington, DC 20240

Telephone: (202) 354-2217

DESIGNATED A NATIONAL HISTORIC LANDMARK
April 05, 2005

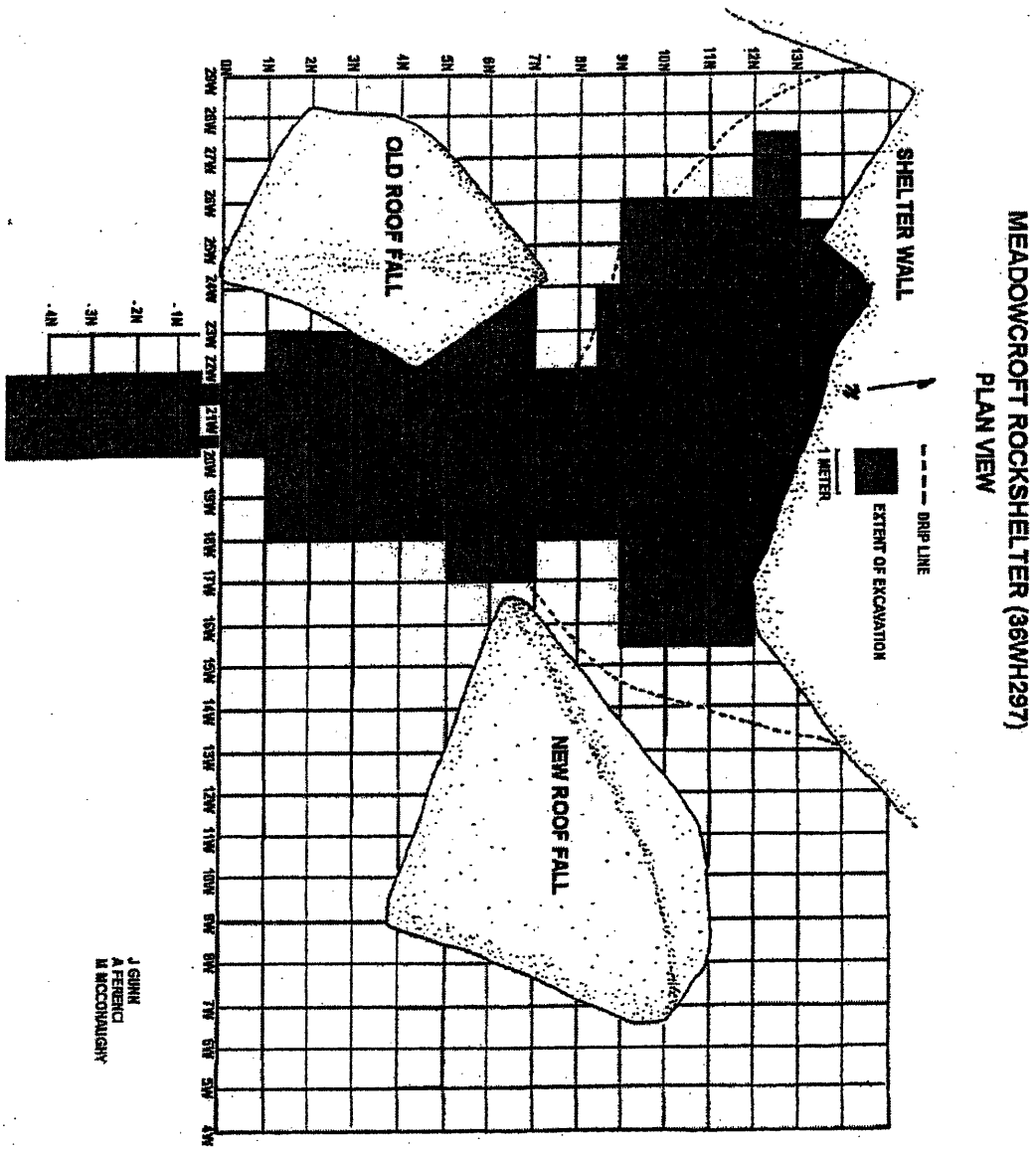

Figure 1: Map of excavated units at Meadowcroft Rockshelter.

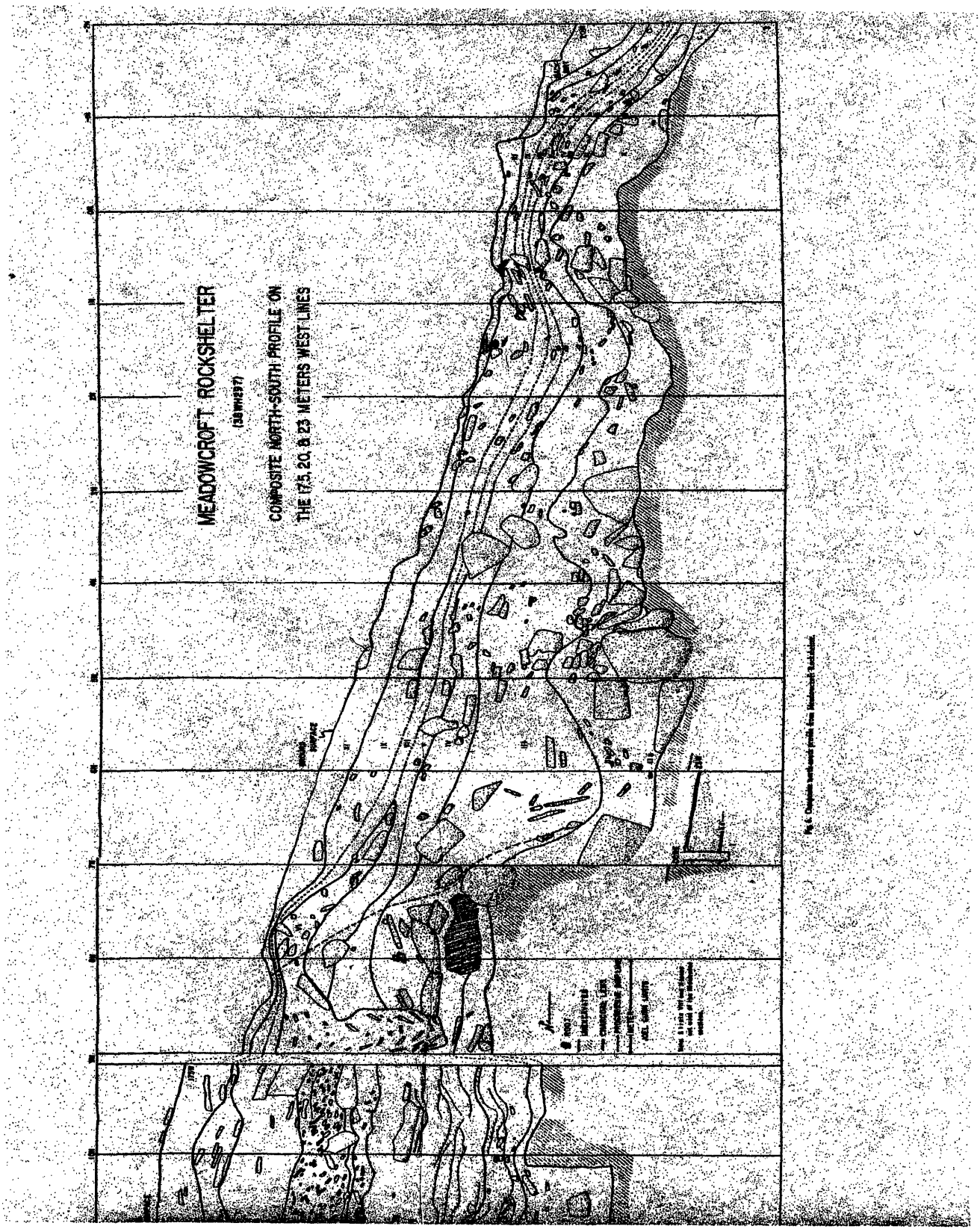

Figure 2: Profile of Meadowcroft Rockshelter.

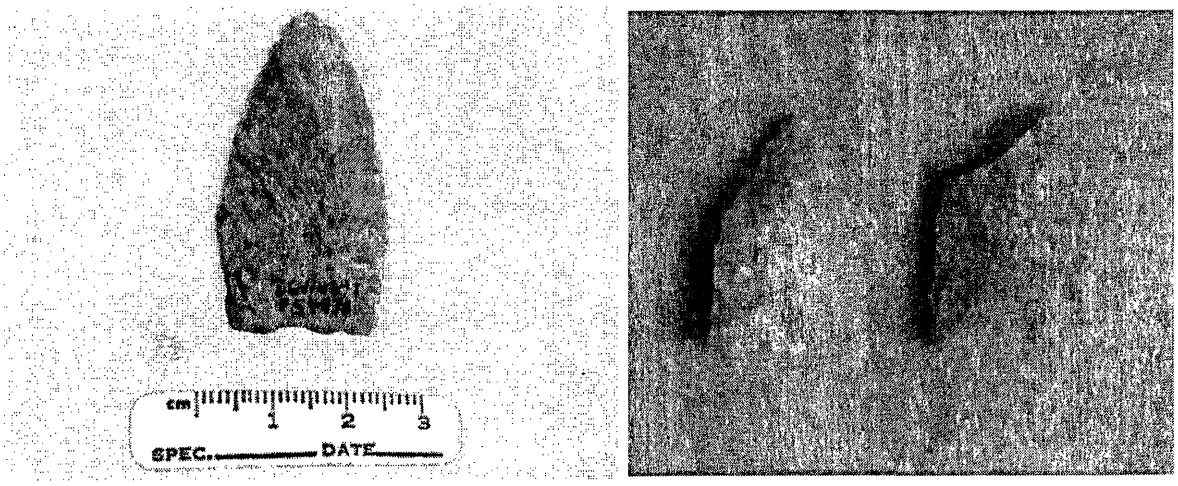

Figure 3: Comparison of Miller Lanceolate point (left, Miller Lanceolate from Photo 9) and two "Early Triangular" points from Cactus Hill (Cactus Hill points from Fig. 5.42 McAvoy and McAvoy 1997:111 - not to scale since no scale was provided with the Cactus Hill points to permit matching of sizes).

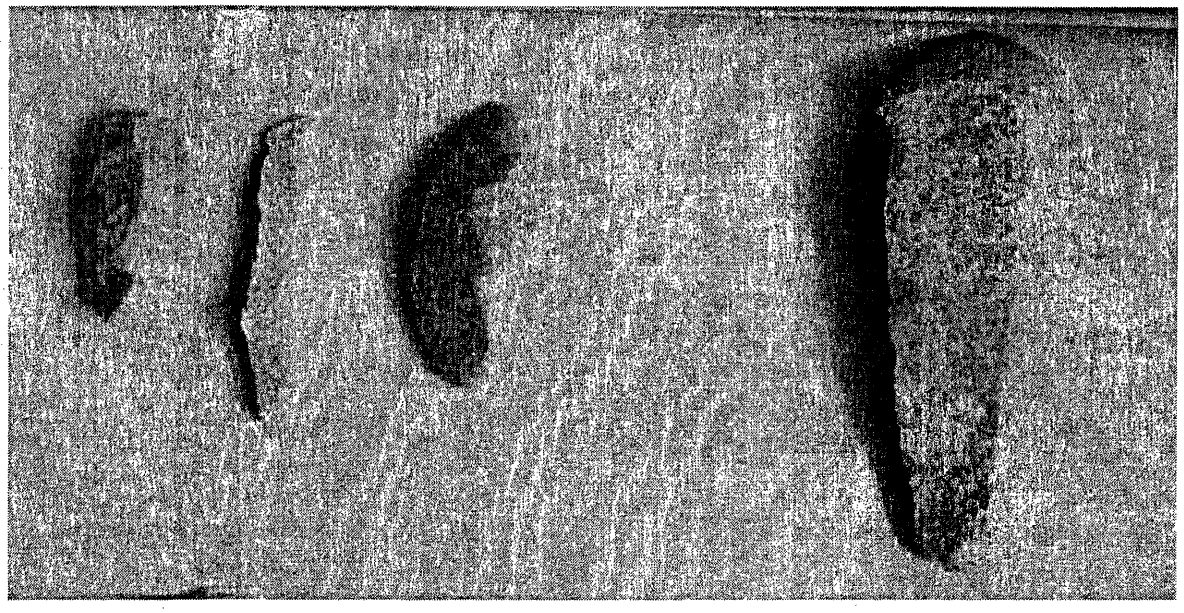

Figure 4: Compare these small and large blades from Cactus Hill (from Fig 5.42, McAvoy and McAvoy 1997:111) to those from Meadowcroft Rockshelter (photos 15 and 16, below)

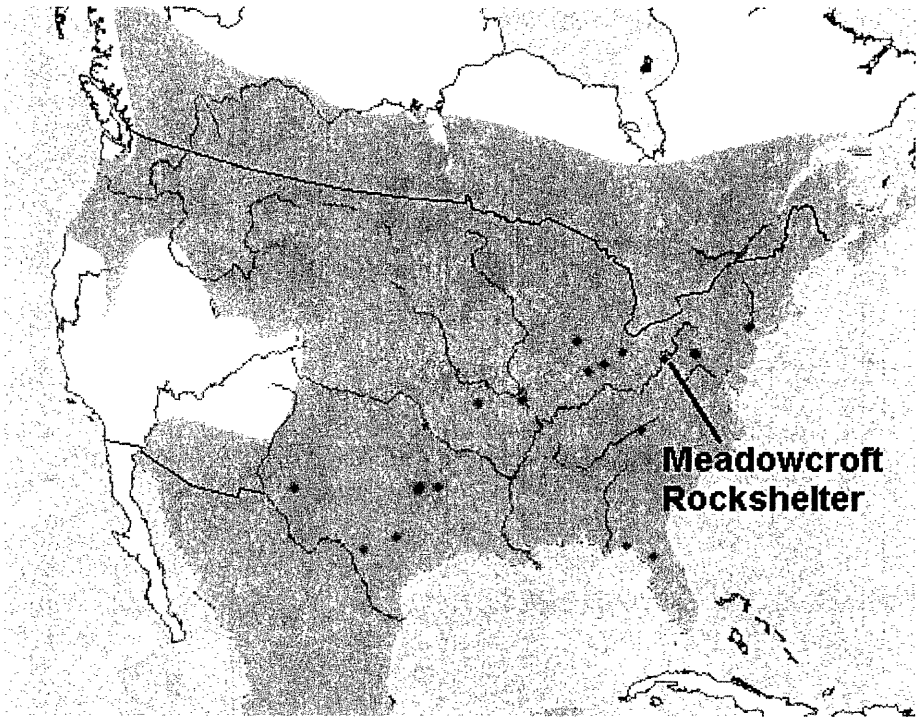

Figure 5: Late Glacial FaunMap distribution of *Odocoileus virginianus*, White-tailed Deer, dots are sites between 15,500 and 9500 years ago. Shaded area shows modern distribution. Map produced by query at http://museum.state.il.us/research/faunmap/query; the Illinois State Museum FaunMap site.

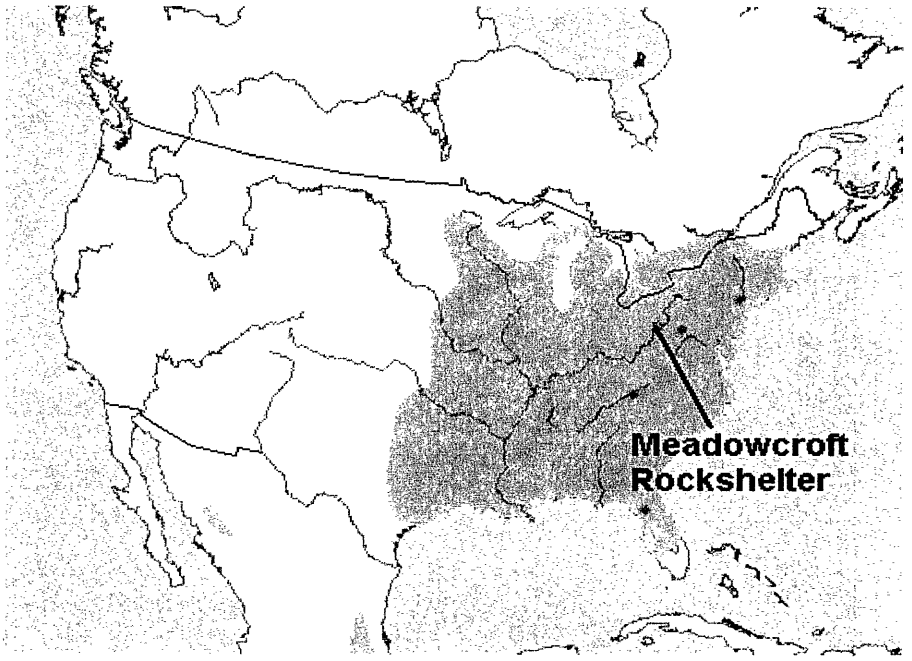

Figure 6: Late Glacial FaunMap distribution of *Glaucomys volans*, Southern Flying Squirrel, dots are sites between 15,500 and 9500 years ago. Shaded area shows modern distribution. Map produced by query at http://museum.state.il.us/research/faunmap/query; the Illinois State Museum FaunMap site.

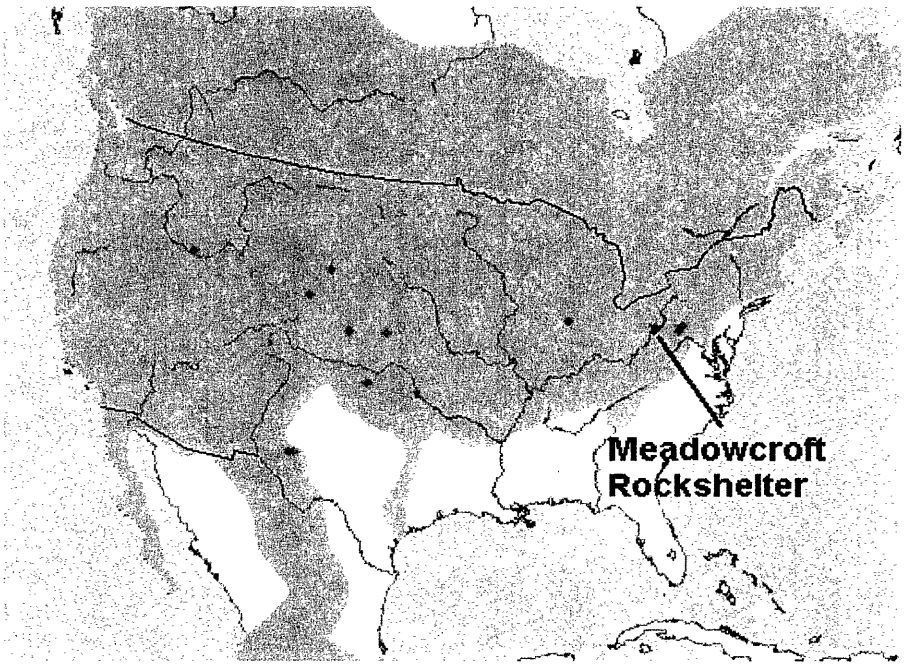

Figure 7: Late Glacial FaunMap distribution of *Peromyscus maniculatus*, Deer Mouse, dots are sites between 15,500 and 9500 years ago. Shaded area shows modern distribution. Map produced by query at http://museum.state.il.us/research/faunmap/query; the Illinois State Museum FaunMap site.

Note: Meadowcroft specimen (shown on map) was not actually listed on this map because it was only identified to the genus level. This map is provided simply to show that even if it was from Stratum IIa, it would not necessarily be out of place.

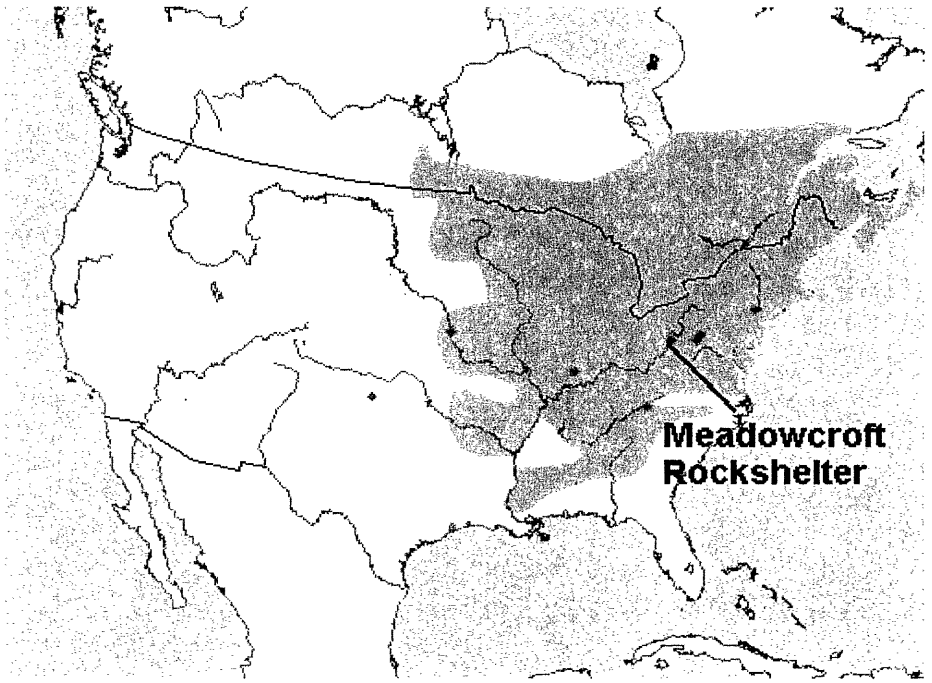

Figure 8: Late Glacial FaunMap distribution of *Tamias striatus,* Eastern Chipmunk, dots are sites between 15,500 and 9500 years ago. Shaded area shows modern distribution. Map produced by query at http://museum.state.il.us/research/faunmap/query; the Illinois State Museum FaunMap site.

Note: This map is provided simply to show that even if it was from Stratum IIa, it would not necessarily be out of place.

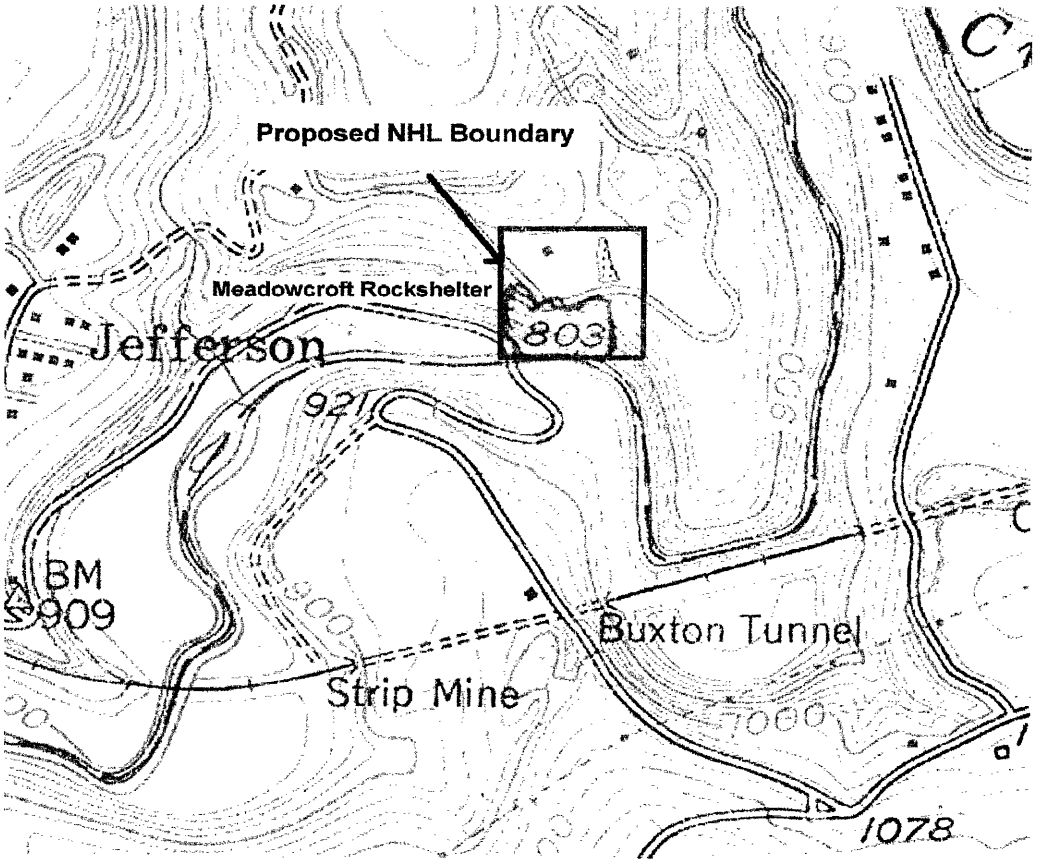

Figure 9: Meadowcroft Rockshelter and proposed NHL Boundary

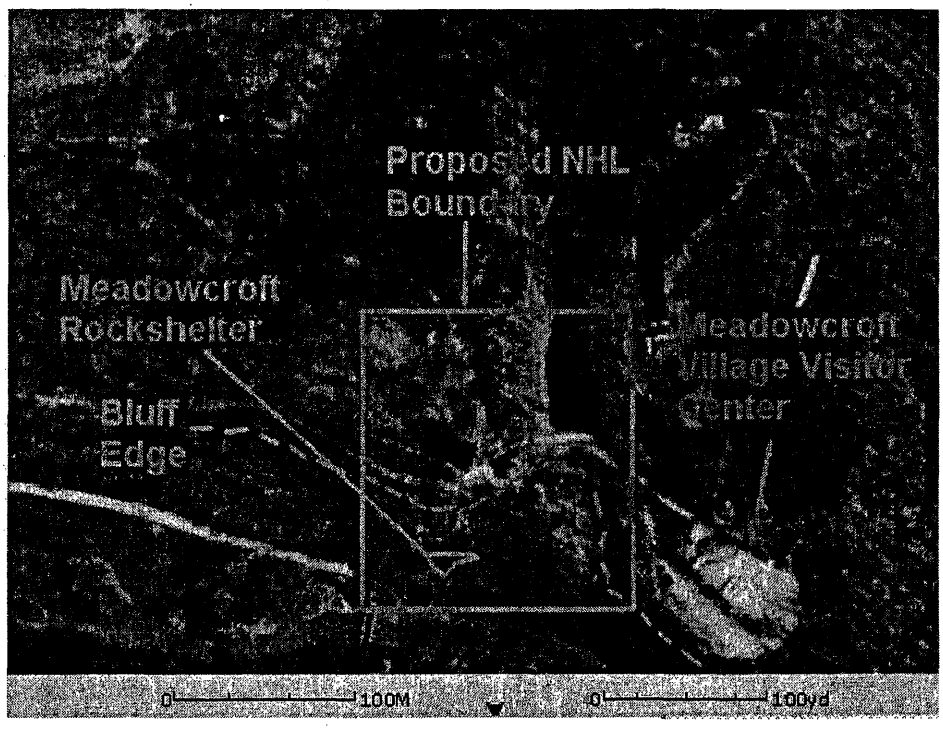

Figure 10: Satellite photograph of Meadowcroft Rockshelter with proposed NHL boundary.

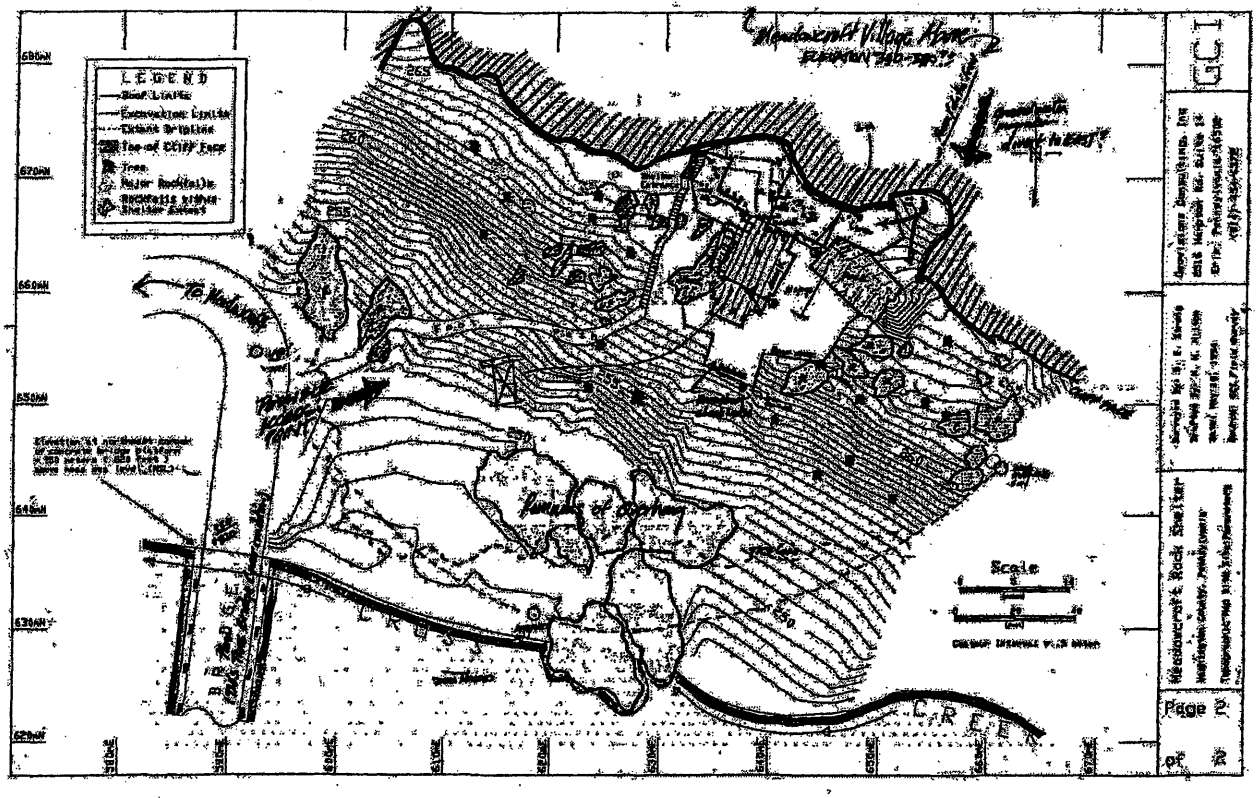

Figure 11: Topographic map of Meadowcroft Rockshelter produced by Geovisions Consulting, Inc. for Meadowcroft Village in 1994 showing the extent of existing wooden structure over excavations.

Table 1: Meadowcroft Radiocarbon Dates in Stratigraphic Order of Occurrence					
Lab No.	Date B.P.	one sigma	Uncorrected BC-AD	Stratum	Associated Cultural Remains
SI-3031	175	50	AD 1775	XI	Historic
SI-2363	685	80	AD 1265	IX	Late Woodland
SI-3023	**630**	**100**	**AD 1320**	**VIII**	**Late Woodland**
SI-2047	925	65	AD 1025	VII	Late Woodland
SI-3026	1290	60	AD 660	VII	Late Woodland
SI-3024	1665	65	AD 285	V	Middle Woodland
SI-3027	1790	60	AD 160	V	Middle Woodland
SI-3022	1880	65	AD 70	V	Middle Woodland
SI-2362	2075	125	125 BC	V	Early Woodland
SI-2487	2155	65	205 BC	V	Early Woodland
SI-2051	2290	90	340 BC	IV	Early Woodland
SI-1674	2325	75	375 BC	IV	Early Woodland
SI-2359	2485	350	535 BC	IV	Early Woodland
SI-3031	2655	120	705 BC	IV	Early Woodland
SI-1665	2815	80	865 BC	IV	Early Woodland
SI-1668	2820	75	870 BC	IV	Early Woodland
SI-1660	2860	80	910 BC	III	Early Woodland
SI-2049	**3050**	**85**	**1100 BC**	**III**	**Early Woodland**
SI-2066	2930	75	980 BC	III	Early Woodland
SI-1644	3065	80	1115 BC	III	Terminal Archaic
SI-2053	3090	115	1140 BC	III	Terminal Archaic
SI-3030	3100	90	1150 BC	III	Terminal Archaic
SI-2046	3115	70	1165 BC	III	Terminal Archaic
SI-1679	**3255**	**115**	**1305 BC**	**III**	**Terminal Archaic**
SI-1681	3210	95	1260 BC	IIb	Terminal Archaic
SI-1680	3770	90	1820 BC	IIb	Terminal Archaic
SI-2063	3950	240	2000 BC	IIb	Late Archaic
SI-2058	3970	85	2020 BC	IIb	Late Archaic
SI-2054	4005	85	2055 BC	IIb	Late Archaic
SI-1685	4820	85	2870 BC	IIb	Late Archaic
SI-2056	**4380**	**500**	**2430 BC**	**IIb**	**Late Archaic**
SI-2358	6290	355	4340 BC	IIb	Middle Archaic
Pitt-122	6315	280	4365 BC	IIb	Middle Archaic
Pitt-292	6630	70	4680 BC	IIb	Middle Archaic
SI-2055	6670	140	4720 BC	IIb	Middle Archaic
SI-2064	8010	110	6060 BC	IIa	Early Archaic
SI-2061	9075	115	7125 BC	IIa	Early Archaic
SI-2491	11,300	700	9350 BC	IIa	Paleo-Indian
SI-2489	12,800	870	10,850 BC	IIa	Paleo-Indian
SI-2065	13,240	1010	11,290 BC	IIa	Paleo-Indian
SI-2488	13,270	340	11,320 BC	IIa	Paleo-Indian

SI-1872	14,925	620	12,975 BC	IIa	Paleo-Indian
SI-1686	15,120	165	13,170 BC	IIa	Paleo-Indian
SI-2354	16,175	975	14,225 BC	IIa	Paleo-Indian
SI-2062	19,100	810	17,150 BC	IIa	Paleo-Indian ?
SI-2060	19,600	2400	17,650 BC	IIa	Paleo-Indian ?
DIC-2187	21,070	475	19,120 BC	IIa	Paleo-Indian ?
SI-2121	21,380	800	19,430 BC	I-II Interface	Pedological
SI-1687	30,710	1140	28,760 BC	I	Pedological
OxA-364	30,900	1100	28,950 BC	I	Pedological
OxA-363	31,400	1200	29,450 BC	I	Pedological
BOLD DATES -= reversals in sequence					
All culturally related dates were run on charcoal from hearths with the exception					
of sample SI-1680 which was run on a bark fragment from a bark basket.					
Sample SI-2060 was run on a bark fragment and SI-2062 and DIC-2187 were run					
on charcoal from small charcoal concentrations not conclusively identified as hearths.					
References for the dates:					
Adovasio et al. 1990					
Herbstritt 1988:20-21					

Table 2: Table 2 from McConaughy n.d. listing floral remains from Early Woodland sites from Western Pennsylvania and vicinity.

Floral Remains from Early Woodland Sites

Common Name	Genus	species		36WH297 Half Moon Phase	36WM601 Half Moon Phase	36WH297 Cresap Phase	36FA262 Cresap Phase	36AL285 ?Cresap Phase?
Maple	Acer			1		1		
Amaranth	Amaranthus	sp.		21				
	Arctium	sp.				1		
Pawpaw	Asimina	sp.				1		
Hickory Nut	Carya	sp.		3.1g		4.2g	4+	0.2g
Hackberry	Celtis	sp.		many		many		
Chenopodiaceae	Chenopodium			8		1		
Goosefoot	Chenopodium	sp.		1		2	45	
Compositae				1				
Squash	Cucurbita	sp.		minimum of 2*				
Gramineae				8				
Juglandaceae				1.2g		1.2g		
Walnut/butternut	Juglans	sp.		16.8g	Minimum of 1*	20.3g		
Tupelo?	Nyssa	sp.		3				
Polygonaceae				1				
Knotweed	Polygonum	sp.		2	Minimum of 1*		3	
Pokeweed	Phytolacca	sp.					1	
Cherry/plum	Prunus	sp.		21				
Acorn	Quercus	sp.		3.3g		6.5g	8+	
Wild berry	Rubus	sp.		26			1	
Wild Blueberry	Vaccinium	sp.		38				
Wild Grape	Vitis	sp.		4				
Maize	Zea	mays				minimum of 1*		

All are individual specimen counts unless other measurements indicated.	
* indicates exact numbers/quantities not provided	
+ indicates mixed individual specimen and weighed or volume measurements provided.	

References	
36FA262	Grantz 1986:17
36WH297	Cushman 1982:215-217; Skirboll and Applegarth 1977:80
36AL285	King 1998
36WM601	Ballweber 1989:89

Table 3: Table 3 from McConaughy n.d. listing faunal remains from Early Woodland sites located in Western Pennsylvania and vicinity.

Faunal Remains from Early Woodland Sites

Common Name	*Genus*	*Species*	*36WH297 **	*36FA262*
Freshwater Mussel	Elliptio	dilatatus	X	
Freshwater Mussel	Lampsilis	ovata	X	
Unidentified shellfish				2+
Gar	Lepisosteus	sp.	1 (1)	
White sucker	Catostomus	commersonnii	4 (2)	
Redhourse	Moxostoma	sp.	9 (1)	
Sucker	Castostomidae		4 (2)	
Creek chub	Semotilus	atromaculatus	3 (2)	
Minnow	Cypinids		2 (2)	
Catfish	Ictaluridae		1 (1)	
Walleyed Pike	Stizostedion	sp.	4 (1)	
Bass	Micropterus	sp.	2 (2)	
Drumfish	Aplodinotus	grunniens	2 (2)	
Unidentified fish			67 ()	6
Salamander	Ambystoma	sp.	2 (1)	
Hellbender	Cryptobranchus	alleganiensis	21 (1)	
American or Fowler's Toad	Bufo	americanius/fowleri	2523 (189)	
Frog	Rana	sp.	7 (2)	
Frog or Toad	Rana or Bufo		67 ()	
Snapping Turtle	Chelydra	insculpta	6 (1)	
Wood Turtle	Clemmys	insculpta	2 (1)	
Eastern Box Turtle	Terrapene	carolina	68 (1)	
Turtle			7 (1)	

Broadhead skink	Eumeces	laticeps	3 (1)	
Plainbelly water snake	Nerodia	erythrogaster	3 (1)	
Northern water snake	Nerodia	sipedon	1 (1)	
Water snake	Nerodia	sp.	7 ()	
Common Garter snake	Thamnophis	sirtalis	2 (1)	
Garter snake	Thamnophis	sp.	1 ()	
Eastern hognose snake	Heterodon	platyrhinos	6 (1)	
Racer	Coluber	constrictor	22 (1)	
Coachwhip snake	Masticophis	flagellum	2 (1)	
Racer or coachwhip snake			3 ()	
Rat snake	Elaphe	obsoleta	9 (1)	
Pine snake	Pituophis	melanoleucus	1 (1)	
Common kingsnake	Lampropeltis	getulus	2 (1)	
Milk snake	Lampropeltis	triangulum	12 (1)	
Kingsnake or Milk snake			3 ()	
Non-poisonous snake	Colubrid		23 ()	
Copperhead	Agkistrodon	contortrix	3 (1)	
Timber rattlesnake	Crotalus	horridus	18 (1)	
Poisonous snake	Viperidae		2 ()	
Snake			13 ()	
Pied-billed Grebe	Podilymbus	podiceps	1 (1)	
Dabbling Duck	Anas	sp.	4 (2)	
Teal	Anas	sp.	1 (1)	
Ring-necked Duck or Lesser Scaup	Aythya	collaris/affinis	3 (2)	
Bufflehead	Bucephala	albeola	2 (1)	
Hooded Merganser	Lophodytes	cucullatus	1 (1)	
Merganser	Mergus	sp.	1 (1)	
Ruddy Duck	Oxyura	jamaicensis	1 (1)	
Duck			10 (2)	
Sharp-shinned Hawk	Accipiter	striatus	3 (1)	
Hawk	Buteo	sp.	2 (1)	

Ruffed Grouse	Bonasa	umbellus	86 (18)	
Wild Turkey	Meleagris	gallopavo	182 (17)	
Bobwhite Quail	Colinus	virginianus	101 (11)	
Common Snipe	Gallinago	gallinago	1 (1)	
American Woodcock	Scolopax	minor	11 (2)	
Passinger Pigeon	Ectopistes	migratorius	1745 (214)	
Eastern Screech Owl	Otus	asio	20 (6)	
Barred Owl	Strix	varia	7 (1)	
Northern Saw-whet Owl	Aegolius	acadicus	4 (2)	
Owl			1 (1)	
Chimney Swift	Chaetura	pelagica	12 (6)	
Belted Kingfisher	Ceryle	alcyon	2 (1)	
Yellow-bellied Sapsucker	Sphyrapicus	varius	5 (1)	
Red-headed Woodpecker	Melanerpes	erythrocephalus	6 (1)	
Red-bellied Woodpecker	Melanerpes	carolinus	16 (3)	
Red-headed or Red-bellied Woodpecker	Melanerpes	erythrocephalus/carolinus	26 (4)	
Downy Woodpecker	Picoides	pubescens	4 (2)	
Hairy Woodpecker	Picoides	villosus	7 (2)	
Northern Flicker	Colaptes	auratus	29 (4)	
Pileated Woodpecker	Dryocopus	pileatus	6 (3)	
Woodpecker			41 (5)	
Eastern Phoebe	Sayornis	phoebe	3 (3)	
Blue Jay	Cyanocitta	cristata	51 (10)	
American Crow	Corvus	brachyrhynchos	1 (1)	
Barn Swallow	Hirundo	rustica	3 (2)	
Tufted Titmouse	Baeolophus	bicolor	1 (1)	
White-breasted Nuthatch	Sitta	carolinensis	3 (1)	
American Robin	Turdus	migratorius	4 (2)	
cf. Veery	Catharus	fuscescens	1 (1)	
Hermit Thrush	Catharus	guttatus	1 (1)	
Yellow-breasted Chat	Icteria	virens	1 (1)	

Sparrow			2 (2)	
Northern Cardinal	Cardinalis	cardinalis	1 (1)	
Common Grackle	Quiscalus	quiscula	2 (2)	
cf. Dark-eyed Junco	Junco	cf. hyemalis	4 (3)	
Unidentified passerine birds			147 ()	
Bird	Aves		754 ()	
Short-tailed Shrew	Blarina	brevicauda	83 (28)	
Hairy-tailed Mole	Parascalops	breweri	81 (12)	
Eastern Mole	Scalopus	aquaicus	94 (10)	
Little Brown Bats	Myotis	sp.	1 (1)	
Eastern Pipistrelle Bat	Pipistrellus	subflavus	1 (1)	
Big Brown Bat	Eptesicus	fuscus	24 (4)	
Unidentified Bat			1 ()	
cf. New England Cottontail Rabbit	Sylvilagus	cf. transitionalis	1 (1)	
Rabbit	Sylvilagus	sp.	222 (3)	
Eastern Chipmunk	Tamias	striatus	160 (20)	
Woodchuck	Marmota	monax	16 (1)	
Gray Squirrel	Sciurus	carolinensis	20 (5)	
Fox Squirrel	Sciurus	niger	3 (3)	
Gray or Fox Squirrel	Sciurus	carolinensis/niger	110 (2)	
Southern Flying Squirrel	Glaucomys	volans	5656 (561)	
Beaver	Castor	canadensis	5 (1)	
Rice rat	Oryzomys	palustris	1 (1)	
White-footed Mouse	Peromyscus	leucopus	8 (4)	
White-footed? Mouse	Peromyscus	sp.	125 (63)	
Eastern Woodrat	Neotoma	floridana	34 (3)	
Meadow Vole	Microtus	pennsylvanicus	21 (10)	
Woodland Vole	Microtus	pinetorum	38 (18)	
Woodland/Meadow Vole	Microtus	sp.	35 (14)	
Southern Bog Lemming	Synaptomys	cooperi	7 (2)	
Muskrat	Ondatra	zibethicus	3 (2)	

Mouse			269 ()	
Dog	Canis	familiarus	2 (1)	
Gray Wolf	Canis	lupus	1 (1)	
Gray Fox	Urocyon	cinereoargenteus	1 (1)	
Black Bear	Ursus	americanus	1 (1)	
Raccon	Procyon	lotor	10 (2)	
Least Weasel	Mustela	nivalis	2 (2)	
Long-tailed Weasel	Mustela	fenata	27 (5)	
Stripped Skunk	Mephitis	mephitis	2 (1)	
River Otter	Lutra	canadensis	1 (1)	
Bobcat	Lynx	cf. rufus	3 (1)	
Elk	Cervus	elaphus	3 (1)	
White-tailed Deer	Odocoileus	virginianus	316 (4)	
Unidentified Mammal			1964 ()	
*No. of specimens (MNI)				
X indicates specimens present but not quantified				
+ indicates some specimens were weighed and not individually counted.				
References				
36FA262	Grantz 1986:16			
36WH297	Guilday et al. 1980..; Faingnaert et al. 1977; Guilday and Parmalee 1982; Adovasio et al. 1998			

Table 4: Table 6 from McConaughy n.d. listing floral remains from Middle Woodland sites from Western Pennsylvania.

Middle Woodland Floral Remains

Common Name	Genus	species	Meadowcroft Rockshleter 36WH297	Fairchance Village 46MR13	Billy #3 36WM717	Backstrum #1 36WM453	Winters Knuckles 36WM432
Hickory Nut	Carya	sp.	6.5 g	151	X	X	3
Shagbark Hickory	Carya	ovata		59			
Bitternut Hickory	Carya	cordiformis		53			
Pignut Hickory	Carya	glabra		10			
Kingnut or shellbark Hickory	Carya	lacinosa		1			
Hackberry	Celtis	sp.	2760				
Juglandaceae			2.5 g				
Walnut/butternut	Juglans	sp.	19.5 g		X		
Black Walnut	Juglans	nigra		232		X	
Acorn	Quercus	sp.	2.5 g	38	X		
Hazel Nut	Corylus	sp.					2
Chenopodiaceae	Chenopodium		6				
Compositae			1	4			
Amaranth	Amaranthus	sp.	14	19			
	Asimina	sp.	1				
	Phytolacca	sp.	2				
Knotweed	Polygonum	sp.				2	
Bedstraw	Galium	sp.				1	
Legume	Lespedesa?	sp.		3			
Tick-trefoil	Desmodium	sp.			X		
Sumac	Rhus	sp.		2			
Honey Locust	Gleditsia	triacanthos		1			

Cherry/plum	Prunus	sp.	1	4			
Wild Plum	Prunus	americana		1			
Ground Cherry	Physalis	sp.		2			
Wild berry	Rubus	sp.	22		X		
Wild Blueberry	Vaccinium	sp.	6				
Wild Grape	Vitis	sp.	2			1	
Squash	Cucurbita	sp.			1		
Maize	Zea	mays				2	1

X indicates present but not quantities not provided

References

36WH297	Cushman 1982:215-217; Skirboll and Applegarth 1977:80
46MR13	Cutler and Blake (1984:65-67)
36WM717	George (1992b:17)
36WM453	Ballweber (1989:68-70), George (1992b:29)
36WM432	George (1996:65)

Table 5: Table 7 from McConaughy n.d. listing faunal remains from Middle Woodland sites from Western Pennsylvania and vicinity.

Middle Woodland Faunal Remains

Common Name	*Genus*	*Species*	46MR13*	46HK34*	36V/H297*
Freshwater Mussel	Elliptio	crassidens	7		
Freshwater Mussel	Elliptio	dilatatus	3		
Freshwater Mussel	Lampsilis	ovata	6		
Freshwater Mussel	Ptychobranchus	fasciolaris	5		
Freshwater Mussel	Lasmigona	costata	3		
Freshwater Mussel	Quadrula	cylindrica	2		
Freshwater Mussel	Pleurobema	coccineaum	2		
Freshwater Mussel	Pleurobema	clara	1		
Freshwater Mussel	Ligumia	recta	1		
Redhorse	Moxostoma	sp.			3 (1)
Sucker	Castostomidae			1 (1)	2 ()
Creek chub	Semotilus	atromaculatus			2 (2)
Catfish	Ictaluridae			2 (2)	1 (1)
Walleyed Pike	Stizostedion	sp.			1 (1)
Bass/Sunfish	Centrarchids				1 (1)
Fish	Pisces			20 (1)	
Hellbender	Crypyobranchus	alleganiensis	1 (1)		5 (1)
American or Fowler's Toad	Bufo	americanius/fowleri			525 (46)
Green Frog	Rana	clamitans			1 (1)
Frog	Rana	sp.			4 (1)
Tree toad?	Hyla?			2 (1)	
Frog or Toad	Rana or Bufo		1 (1)	1 (1)	21 ()
Snapping Turtle	Chelydra	serpentina	1 (1)		
Eastern Box Turtle	Terrapene	carolina	83 (5)	19 (1)	45 (1)

Soft-shelled Turtle	Trionyx	sp.	2 (1)	2 (1)	
Turtle			28 (0)	2 (1)	1 ()
Northern Water snake	Nerodia	sipedon			3 (1)
Water snakes	Nerodia	sp.			2 ()
Racer	Coluber	constrictor			15 (1)
Rat snake	Elaphe	obsoleta			3 (1)
Pine snake	Pituophis	melanoleucus			3 (1)
Kingsnake or Milk snake					1 (1)
Non-poisonous snake	Colubrid			9 (1)	3 ()
Copperhead	Agkistrodon	contortrix			4 (1)
Timber rattlesnake	Crotalus	horridus			7 (1)
Poisonous snake	Viperidae				1 ()
Snake					4 ()
Pied-billed Grebe	Podilymbus	podiceps			1 (1)
Canada Goose	Branta	canadensis	1 (1)		
Dabbling Duck	Anas	sp.			1 (1)
Bufflehead	Bucephala	albeola			2 (1)
Ruddy Duck	Oxyura	jamaicensis			1 (1)
Duck				1 (1)	7 (2)
Cooper's Hawk	Accipiter	cooperii			1 (1)
American Kestrel	Falco	sparverius			2 (1)
Ruffed Grouse	Bonasa	umbellus			47 (8)
Wild Turkey	Meleagris	gallopavo	78 (5)	16 (1)	95 (9)
Bobwhite Quail	Colinus	virginianus			26 (4)
American Woodcock	Scolopax	minor			5 (2)
Gull	Larus	sp.			1 (1)
Passinger Pigeon	Ectopistes	migratorius	1 (1)		837 (82)
Eastern Screech Owl	Otus	asio			7 (2)
Barred Owl	Strix	varia			2 (1)
Northern Saw-whet Owl	Aegolius	acadicus			5 (2)
Chimney Swift	Chaetura	pelagica			4 (2)

Yellow-bellied Sapsucker	Sphyrapicus	varius			2 (1)
Red-headed Woodpecker	Melanerpes	erythrocephalus			2 (1)
Red-bellied Woodpecker	Melanerpes	carolinus			5 (1)
Red-headed or Red-bellied Woodpecker	Melanerpes	erythrocephalus/carolinus			9 (3)
Downy Woodpecker	Picoides	pubescens			3 (2)
Hairy Woodpecker	Picoides	villosus			2 (1)
Northern Flicker	Colaptes	auratus			14 (3)
Woodpecker					24 (5)
Blue Jay	Cyanocitta	cristata			17 (4)
American Crow	Corvus	brachyrhynchos			1 (1)
Barn Swallow	Hirundo	rustica			1 (1)
American Robin	Turdus	migritorius			1 (1)
Gray Catbird	Dumetella	carolinensis			1 (1)
cf. Eastern Towhee	Pipilo	erythrophthalmus			1 (1)
cf. Dark-eyed Junco	Junco	cf. hyemalis			1 (1)
Common Grackle	Quiscalus	quiscula			1 (1)
Unidentified passerine bird					55 ()
Bird	Aves			6 (1)	447 ()
Smoky Shrew	Sorex	fumeus			1 (1)
Short-tailed Shrew	Blarina	brevicauda			16 (5)
Hairy-tailed Mole	Parascalops	breweri			36 (10)
Eastern Mole	Scalopus	aquaticus		3 (1)	28 (4)
Star-nosed Mole	Condylura	cristata			1 (1)
Eastern Pipistrelle Bat	Pipistrellus	subflavus			1 (1)
Big Brown Bat	Eptesicus	fuscus			19 (3)
Hoary Bat	Lasiurus	cinereus			1 (1)
Unidentified bat					3 ()
cf. New England Cottontail Rabbit	Sylvilagus	cf. transitionalis			1 (1)
Eastern Cottontail Rabbit	Sylvilagus	floridanus		13 (1)	
Rabbit	Sylvilagus	sp.	1 (1)		86 (1)
Eastern Chipmunk	Tamias	striatus		1 (1)	72 (12)

Chipmunk	Tamias	sp.	1 (1)		
Woodchuck	Marmota	monax	7 (2)	1 (1)	7 (1)
Gray Squirrel	Sciurus	carolinensis		1 (1)	14 (3)
Fox Squirrel	Sciurus	niger			2 (2)
Gray/Fox Squirrel	Sciurus	carolinensis/niger			67 ()
Squirrel	Sciurus	sp	9 (1)	5 (1)	
Southern Flying Squirrel	Glaucomys	volans			2862 (294)
Beaver	Castor	canadensis	3 (1)		
White-footed Mouse	Peromyscus	leucopus			2 (2)
White-footed? Mouse	Peromyscus	sp.			42 (21)
Eastern Woodrat	Neotoma	floridana			19 (2)
Meadow Vole	Microtus	pennsylvanicus			4 (3)
Woodland Vole	Microtus	pinetorum			8 (4)
Woodland/Meadow Vole	Microtus	sp.			15 (5)
Prairie Mole	Microtus?		1 (1)		
Meadow Mouse	Microtinae			1 (1)	
Muskrat	Ondatra	zibethica	1 (1)		3 (1)
Mouse				2 (1)	96 ()
Porcupine	Erethizon	dorsatum			2 (1)
Dog	Canis	familiarus		3 (1)	2 (1)
Gray Wolf	Canis	lupus	4 (2)		1 (1)
Gray Fox	Urocyon	cinereoargenteus			1 (1)
Black Bear	Ursus	americanus	2 (1)		1 (1)
Racoon	Procyon	lotor	11 (3)	18 (3)	14 (2)
Long-tailed Weasel	Mustela	frenata			6 (2)
Striped Skunk	Mephitis	mephitis		3 (1)	1 (1)
River Otter	Lutra	canadensis	1 (1)		1 (1)
Elk	Cervus	elaphus	21 (2)	1 (1)	4 (1)
White-tailed Deer	Odocoileus	virginianus	1463 (34)	252 (5)	155 (4)
Human	Homo	sapiens		1 (1)	
Unidentified Mammal					1253 ()

*No. of specimens (MNI)					
References					
46MR13	Tanner 1984				
46HK34	McConaughy 2000				
36WH297	Guilday et al. 1980				

APPENDIX I

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