

Article

Ancient Ponds, Marl Deposits, and Native American Archaeology in the Ridge and Valley Province of Maryland and Pennsylvania

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Abstract

Ponds of early to middle Holocene age are identified in the Ridge and Valley Province of Maryland and Pennsylvania through the occurrence of marl deposits associated with the floodplains of low order streams. A 2-sigma calibrated radiocarbon date indicates that marl formation began no later than 7812–7326 BC. The ponds and associated wetlands are one focus of native settlement movements in the region. Excavations and borings into marl, marl-related sediments and adjacent deposits reveal sequences of marl, produced during periods of ponded and still water, alternating with strata of organic, alluvial silts. These profiles represent the shrinking, swelling, and periodic disappearance of ponds. Changes in stream dynamics and climate are explored as explanations for these physical changes. Archaeological data is useful for understanding the timing of these paleo environmental changes. In turn, an understanding of the nature of the pond environments enhances reconstructions of Indian settlement and subsistence strategies.

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Introduction

Ponds or extensive backwater areas, and associated marshes of early through middle Holocene age, are identified through the occurrence of marl deposits associated with the floodplains of first through third order streams. Excavations into marl and adjacent deposits reveal sequences of marl, produced during periods of ponded and still water, alternating with strata of organic, alluvial silts representing former, more well-drained surfaces. These stratigraphic sequences are interpreted as representative of the shrinking, swelling, and periodic disappearance of ponds and associated habitats.

In what follows I review the formation, age and distribution of marl deposits linked with a number of soil series in the Great Valley of Maryland and nearby areas of Pennsylvania. Implications for local and regional interpretations of how Native American peoples used related landscapes, and what might be inferred about ancient climate and stream dynamics on the basis of the pedological data are addressed. This updates, supplements, and complements the previous efforts of Curry and Custer (1983), Curry and Stewart (1986), Gardner (1990), Shaw (1993), Shaw and Rabenhorst 1997), and Stewart (1981:238–257, n.d.). Data are primarily derived from pedological, geomorphic, and archeological studies focused on the Marsh Run and St James Run drainages in south-central Washington County, Maryland (Figure 1).

Nature of the deposits

Marl is defined as a soft, loose, earthy material with varying amounts of CaCO₃, clay, and silt, and is formed primarily in freshwater conditions (Hubbard and Herman, 1990; Singewald, 1951:171). In the study area marl deposits range from .5 meter to over 8 meters in thickness, with a 2 meter thickness being most typical (Shaw, 1993; Shaw and Rabenhorst, 1997). In the Maryland Great Valley marl is stratified with marl-related and non-calcareous alluvial silts. Buried A horizons occur, as well as organic rich alluvium (Shaw, 1993:34). The black, heavily organic A horizons at the current surface, and those that are buried, likely owe some of their character to the luxuriant vegetation that both fringed the ponds and occupied the marshy ground following their disappearance. In the study area marl deposits are most frequently mapped as the Warners soil series. The Fairplay (marl) silt loam was formerly included in the Warners series. Marl also is associated with the Massenetta series (Shaw and Rabenhorst, 1997:41; United States Department of Agriculture 2005, 2011, 2018).

Swamp Pond Snail (*Lymnaea palustris*, a freshwater gastropod is well represented in the marl and marl-related sediments as is the Ram's Horn Snail (*Gyraulus sp.*) according to Shaw and Rabenhorst (1997:54). Shells of freshwater fingernail clam (*Sphaerium cf. simile Lamarck*), and an air-breathing, marsh-adapted snail (*Physa sp.* and *Planorbis sp.*) also occur in the marl deposits (Fuller, 1978:127–128; Singewald, 1951:172). These species of snails, particularly *Gyraulus sp.*, inhabit low energy depositional environments, shallow or stagnant water settings Shaw (1993:14–15). Hollow, tube-like concretions are found in the marl and are probably

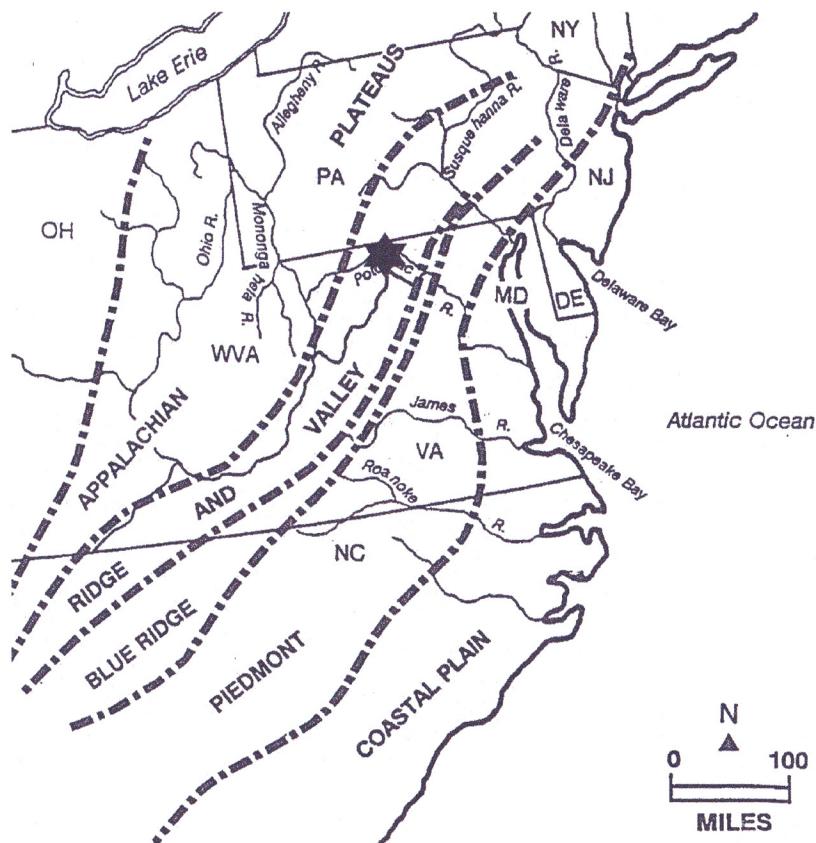


Figure 1. Regional setting of the primary study area (Indicated star) in the Ridge and Valley province, or Great Valley of Washington County, Maryland.

the result of encrustations around plants stems, blades of grass, and the roots of aquatic plants (Singewald, 1951:172; Stewart, n.d.). These observations support the conclusion that the marl is deposited in pond-like settings. The distribution of archaeological sites around the margins of the marl deposits is also suggestive of ponded surface water.

Shaw (1993) and Shaw and Rabenhorst (1997) evaluate models dealing with the formation of marl, and I will not review them here. In brief, surface or ground water in areas of limestone bedrock dissolve the limestone and carry calcium carbonate (lime) in solution. It combines with carbon dioxide in the water to form calcium bicarbonate. When this solution is exposed to conditions that causes it to lose carbon dioxide (e.g., turbulence and the outgassing of CO₂, biological processes of plants, evaporation and the warming of the temperature of the solution in ponded or backwater

settings), calcium carbonate is precipitated (Shaw, 1993:8–14; Singewald, 1951:171). Although inorganic and biogenic processes can lead to marl formation, Shaw's analysis indicates that biogenic processes are primarily responsible for the Maryland deposits; i.e., the effects of algae and aquatic plants in reducing the CO₂ in the aqueous environment, triggering the precipitation of calcite (Shaw, 1993:10). He rejects models of marl developing from calcareous travertines at spring heads and being deposited downstream as alluvium (Shaw, 1993:49). The location of marl deposits viz. the location of springs, and the presence of mollusks indicative of ponded habitats, supports his conclusion. How sections of streams get dammed to the point of being capable of supporting ponded areas within the floodplain is a matter of ongoing study, with the formation of travertine dams considered to be an important component (cf. Hubbard and Herman, 1990; Julia, 1983; Mathews et al., 1965; Shaw, 1993:83). Following Shaw and Rabenhorst (1997:58) ponding could result from beaver dams. Beavers (*Castor sp.*) have played a significant role in altering stream hydrology during the Holocene. Beaver ponds can persist for decades and perhaps longer (Naiman et al., 1988) which would allow for the creation of marl deposits of different magnitudes. The size and distribution of such ponds is a decent match for the spatial extent and distribution of marl deposits in the study area (see below; compare with Butler, 1995:148–183; Coles, 2001; Naiman et al., 1988).

Nearly three dozen localities are associated with the Warner soil series, and presumably marl deposits in the Maryland section of the Great Valley (Mathews, 1962). Together, this accounts for at least 1646 acres (Mathews, 1962; Shaw, 1993: Table 1–1). This is neatly paralleled by the 1140 acres noted for adjacent areas of southcentral (Franklin County) Pennsylvania (Long, 1975; Shaw, 1993: Table 1–1). The extent of marl deposits likely is greater than this because of their periodic occurrence with other soil series, and the failure to map marl deposits within the boundaries of developing urban areas (Shaw, 1993:32).

Analysis of mapped data indicates that the size of individual marl localities ranges from about one acre to over 340 acres. The greatest number is associated with first and second order streams. However, the largest individual marl localities (one extending for over 8 kilometers), are associated with third order streams. Deposits occur in a range of settings including stream junctions, stream and spring heads, along the mid-range of streams. Marl deposits are associated with both pronounced stream meanders and extensive stretches of straight stream channels. The vast majority of marl deposits are associated with stream sections where the gradient is 1% or less. However, deposits can be noted for stream areas where the grade ranges between 6% and 10%.

There is considerable variation in the soil profiles in which marl is found. The most complex sequences are seen closer to the channel of active streams. A typical "central pond" profile can possess multiple, non-calcareous alluvial horizons, one to three buried A horizons, and 6 or more strata of marl. Profiles at the edge of the former ponds reveal much less variation: single buried A horizons if such are present at all, and one or possibly two strata of marl. Examples of excavation profiles containing marl and marl-related sediments are shown in Figures 2–5.



Figure 2. Excavation profile approximately 4.5 feet in length. A plowzone caps an equally organic stratum with marl-related sediments (lighter colors) stratified below with other alluvium. An organic soil is at the base of the profile.



Figure 3. Excavation profile approximately 2.6 feet in length. Black Lines indicate the base of the plowzone and the top of buried organic soil.

Age of deposits

The marl generally is considered to be post-Pleistocene in age, given that deposits are located in areas formed during the present physiographic stage of associated streams



Figure 4. Excavation profile approximately 1.6 feet in length. A plowzone consisting of marl and related sediments overlays a marl stratum. The base of the profile is a red brown, well-developed clay loam B2t horizon, not a buried surface.

(Singewald, 1951:172; Vokes and Edwards, 1974:130). There is a small unusual occurrence on a terrace of an existing stream (Singewald, 1951:175). Initially archaeologists speculated that some form of ponded environments were in existence by at least 6500 BC, and possibly as early as 7500/7000 BC. The clustering of Native American bifaces diagnostic of the Early and Middle Archaic periods of regional pre-history around the edge of marl deposits were the basis for this thinking (e.g., Curry and Stewart, 1986; Stewart, 1981:238–257). Gardner (1990) made similar observations in relation to marl deposits in the Shenandoah Valley of Virginia.

During his pedological fieldwork Shaw recovered a portion of a log from a marl deposit at a depth of 140 cm. This context was 20 cm above the contact between the marl and the underlying sediment. It produced a radiocarbon date of 8520 ± 100 BP or 6570 BC ± 100 years (Shaw, 1993:82; Shaw and Rabenhorst, 1997:57). No lab or identification number is reported for the assay. Using the radiocarbon calibration program CALIB REV8.2 yields a 2 sigma date of 7812–7326 BC with a median of 7557 BC (Reimer et al., 2020; Stuiver and Reimer, 2020). The initiation of marl formation would presumably pre-date this time frame. Updated calibrations of radiocarbon dates for diagnostic bifaces of the Early and Middle Archaic periods would overlap Shaw's calibrated date and even predate it (e.g., Stewart, 2018:Table 2).

Some version of the ponds may exist as late as AD 900 or even later. At site 18WA126, Late Woodland (circa AD900–1600) artifacts are found directly on top



Figure 5. Excavation profile approximately 4.3 feet in length. A plowzone caps a series of marl and marl-related alluvial strata. At the base of the excavation a black organic soil caps marl.

of marl-like alluvium in a pond-edge setting. Middle Woodland, Jacks Reef projectiles (AD 300–900) are the first diagnostic artifacts to appear consistently on surfaces/fast ground above what were once ponded areas. The latest diagnostic artifacts that consistently cluster around the margins of active ponds can be attributed to the Late Archaic and Early Woodland periods (circa 3000–700BC). Most of the ponds have probably disappeared for good sometime between 700 BC and AD 300/900, judging from the context and juxtaposition of chronologically diagnostic artifacts. Late Woodland artifacts (AD 900 and later) are consistently found on surfaces and in plowed sediments above the final incarnations of the ponds.

Archaeology and native prehistory

The former wetland and pond areas represented by the marls and related sediments would have been attractive from the point of view of hunter gatherers seeking edible plants, fish, fowl, and other game. No seeds or plant remains were recovered during excavations into archeological, marl, or associated deposits. No attempt, however, was made to process excavated sediments in a chemical flotation that could remove calcium carbonate that might have encrusted such remains.

Throughout the Middle Atlantic Region and beyond Native American interest in pond and wetland habitats is in full swing by 6500 BC and the time during which bifurcated-base projectiles/bifaces are in use (e.g., Anderson, 1991; Cowin, 1991; Funk, 1991; Leedecker and Holt, 1991; Stewart and Cavallo, 1991; Wall, 1991).

The archaeological sites situated around the margins of ponds are functionally comparable to encampments and activity areas that we might find elsewhere in the Ridge and Valley. There is nothing unusual in the range of artifact classes seen at the pond-related sites, nor in the frequency with which artifact classes or types are represented. The pond environs are simply good places to do a lot of the things that native hunters and gatherers do elsewhere. Put another way, pond environs are definitely a draw for settlement and the locus of human activities, but they are not part of some economic specialization. The superposition that the pond and wetland orientation of sites indirectly reflects an intensive interest in useful plants, especially beginning during the Early/Middle Archaic period, is often repeated. However, neither floral remains nor specialized aspects of artifacts assemblages are infrequently marshalled to underscore this interpretation.

But there is no escaping the fact that the pond environments have a special attraction for the native inhabitants of the Ridge and Valley. The number and density of archaeological sites around former pond areas far exceeds what has been observed along streams of comparable order, but which lack an associated wetland or marsh. Analysis of the settings of known prehistoric sites throughout West Virginia, Maryland, and Pennsylvania sections of the Great Valley indicate that the presence of a stream and floodplain environment alone is not enough to draw prehistoric settlements, or guarantee the human use of a particular landscape (e.g., Stewart, 1981).

Archaeological sites are not always associated with marl deposits, regardless of their areal extent or stream order association. I believe that this relates to the relative size and density of native populations through time, and the nature of group movements across the landscape. Not all attractive environments, no matter how we define them, were exploited by ancient peoples. There is a better chance that such environments were exploited after 3000 BC when regional population levels were higher and well defined senses of territory were developing.

Geomorphology and paleoenvironments

The cycle of pond shrinking and swelling is not as straightforward as Dennis Curry and I originally envisioned (1986), especially as regards their relationship with cycles in regional climate. It seems clear, however, that the genesis of the ponds is fairly synchronous across the broader region. Why? I still feel (cf. Stewart, 1981:252–254) that this episode can be tied with regional climate and its effect on stream dynamics. I base this on several observations:

- the marl/ponds and associated mollusks reflect still water conditions - the deposition of the marl associated with the Warners series is favored by still-water conditions;
- the cooler and wetter climates and steeper stream gradients of pre-7000/6500 BC times (cf. Carbone, 1976; Vento and Rollins, 1989; Vento et al., 1990) would not have favored marl deposition without invoking widespread damming of streams by beaver; and

- circa 7000/6500 BC (cf. Carbone, 1976; Vento and Rollins, 1989; Vento et al., 1990), climate is warmer and drier, decreasing stream flow and likely promoting marl deposition.

A variety of studies (see Stewart 1990 and detailed reviews in Vento et al., 1990) have shown that between 6500 BC and 6000 BC, major streams have stabilized in their general historic channels throughout the Middle Atlantic Region. This coincident initiation of marl formation throughout the broader area also suggests that the formation of travertine, and travertine dams, may be responsible for creating ponds, rather than random processes like the construction of beaver dams (Shaw, 1993:83). The termination of the ponds and marl deposition can probably be related to the effective height that floodplain surfaces achieve after 700 BC, and the inability of natural processes to effectively dam sections of streams.

For the “in-between time”, it is not reasonable with the data we now have to attempt to correlate fluctuations in pond size, disappearance, and reappearance with changes in climate, and resultant effects on surface water and stream regimes. But I can’t help but feel that there is a pattern in the stratigraphic record, especially as regards the occurrence and age of buried A horizons. The consistent appearance of buried A horizons in floodplains dating to terminal Archaic/Early Woodland times (circa 1700 BC - 700 BC), and early segments of the Late Woodland period (circa AD 800/900–1300) throughout the region (e.g., Stewart 1990, Vento et al., 1990) seems to be more than serendipitous. Similar buried surfaces are known for the Potomac drainage in the Maryland Great Valley (Stewart, n.d.), and I would hazard to say that we could pick out comparable paleosols in the marl-related profiles.

The auger transects completed by Shaw (1993) across a number of stream systems with related marl deposits show that the position of ponded areas can shift to one side of the stream or the other. It is clear, however, that the most extensive ponds occur late in the overall sequence, possibly during terminal Archaic and Early Woodland times. This means that somewhere out there, along the edge of an Early Holocene version of these ponds, are Early Archaic and Middle Archaic sites covered by later expansion of the ponds and the deposition of marl and alluvium. Gardner (1990) found evidence of this in the Shenandoah Valley.

Transects used to examine the marl and adjacent sedimentary and archaeological deposits crosscut the stream valleys under study; lateral sampling and testing along the stream course and marl deposits has not been as extensive. It is therefore difficult to say precisely how extensive a pond may be at a given point in time, or whether a number of closely spaced, but distinctive ponds occur within a stretch of floodplain. The latter is certainly a possibility given the profiles that have been examined. Alluvium that caps classic marl deposits can have marl mixed within it. The tops of marl deposits represent fast ground susceptible to erosion at times immediately following the drying up of a pond. Floodwaters are mixing, transporting, and depositing marl with other alluvial sediments during periods when the ponds are not in existence.

The age of the marl deposits and associated ponds raises some interesting questions regarding marl formation, local geomorphology, and regional climate. Marl formation, trends in climate, and Native American settlement choices all seem intertwined across a broad region and will require a substantive effort to tease apart.

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References

- Anderson D (1991) The bifurcate tradition in the south Atlantic region. *Journal of Middle Atlantic Archaeology* 7: 91–106.
- Butler D (1995) The geomorphic influence of beavers. In: *Zoogeomorphology: Animals as Geomorphic Agents*. Cambridge, UK: Cambridge University Press. 148–183.
- Carbone V (1976) *Environment and Prehistory in the Shenandoah Valley*. Ph.D. dissertation, Department of Anthropology, The Catholic University of America, Washington, D.C. University Microfilms, Ann Arbor, Michigan.
- Coles BJ (2001) The impact of Western European beaver on stream channels: Some implications for past stream conditions and human activity. *Journal of Wetland Archaeology* 1: 55–82.
- Cowin V (1991) Middle archaic in the upper Ohio valley. *Journal of Middle Atlantic Archaeology* 7: 43–52.
- Curry D and Custer J (1983) Holocene climatic change in the middle Atlantic area: Preliminary observations from archeological sites. *North American Archaeologist* 3(4): 275–285.

- Curry D and Stewart R (1986) Extinct ponds and prehistoric site distribution: Implications for paleoenvironments in the Ridge and Valley Province. Paper presented at the Annual Meeting of the Middle Atlantic Archaeological Conference, Rehoboth, Delaware.
- Fuller S (1978) The changing molluscan community. In: Flynn K and Mason T (eds) *The Freshwater Potomac: Aquatic Communities and Environmental Stress*. Rockville, Maryland: Interstate Commission on the Potomac River Basin, 124–131.
- Funk R (1991) Middle archaic in New York. *Journal of Middle Atlantic Archaeology* 7: 7–18.
- Gardner W (1990) Travertine-Marl deposits and prehistoric archaeological association. In: Herman JS and Hubbard Jr. DA (eds) *In Travertine-Marl: Stream Deposits in Virginia*. Charlottesville, Virginia: Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources, Publication 101, Charlottesville, Virginia, 43–64.
- Hubbard DA and Herman JS (1990) Overview of travertine-marl volume. In: Herman JS and Hubbard Jr. DA (eds) *Travertine-Marl: Stream Deposits in Virginia*. Charlottesville, Virginia: Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources, Publication 101: 43–64.
- Julia R (1983) Travertines. In: *Carbonate Depositional Environments*. Washington, DC: American Association of Petroleum Geologists Memoir, 33: 64–72.
- Leedecker C and Holt C (1991) Archaic occupations at the Indian Creek V Site (18Pr94), Prince Georges County, Maryland. *Journal of Middle Atlantic Archaeology* 7: 67–90.
- Long RS (1975) Soil Survey of Franklin County, Pennsylvania. USDA, Soil Conservation Service. Government Printing Office, Washington, D.C.
- Mathews HL, Prescott GW and Obenshain SS (1965) The genesis of certain calcareous floodplain soils of Virginia. *Soil Science Society Proceedings*, pp. 729–732.
- Matthews ED (1962) *Soil Survey of Washington County, Maryland*. USDA and the Maryland Agricultural Experiment Station, United States Government Printing Office, Washington, D.C.
- Naiman R, Johnston C and Kelley J (1988) Alteration of North American streams by beaver. *Bio Science* 38(11): 753–762.
- Reimer P, Austin WEN, Bard EE, et al. (2020) The IntCal20 Northern Hemisphere radiocarbon age calibration curve (0–55 cal kBP). *Radiocarbon* 62(4): 725–757.
- Shaw J (1993) *Soils Developed in Freshwater Marl Sediments in the Hagerstown (Great Limestone Valley)*. M.S. thesis, Department of Agronomy, University of Maryland, College Park.
- Shaw J and Rabenhorst MC (1997) The geomorphology, characteristics, and origin of the freshwater marl sediments in the Great Limestone Valley, Maryland, USA. *Catena* 30: 41–59.
- Singewald JT JR (1951) Marl. In: Cloos E (eds) *The Physical Features of Washington County*. Baltimore.: Maryland Geological Survey, 171–174.
- Stewart R (1981) *Prehistoric Settlement and Subsistence Patterns and the Testing of Predictive Site Location Models in the Great Valley of Maryland*. The Catholic University of America, Anthropological Studies, No. 48. Washington, DC.
- Stewart R (1990) Sedimentary sequences, archaeology, and environmental change in the Delaware River Basin. In: Vento F and Rollins H (eds) *Genetic Stratigraphy, Climate Change, and the Burial of Archaeological Sites Within the Susquehanna, Delaware, and Ohio River Drainage Basins*. Harrisburg: Report on file, Bureau for Historic Preservation of the Pennsylvania Historical and Museum Commission, 1–156.
- Stewart R (2018) A radiocarbon foundation for archaeological research in the Upper Delaware Valley: New Jersey, Pennsylvania, and New York. Report prepared for the New Jersey

- Historic Preservation Office, Trenton. Available at: https://www.nj.gov/dep/hpo/1identify/arkeo_upp_del_val.htm.
- Stewart R (n.d) *Archaeological Testing of Select Sites in the Hagerstown Valley, Maryland*. Philadelphia, PA: Manuscript on file, Laboratory of Anthropology, Temple University.
- Stewart R and Cavallo J (1991) Delaware valley middle archaic. *Journal of Middle Atlantic Archaeology* 7: 19–42.
- Stuiver M and Reimer PJ (2020) Radiocarbon Calibration Program CALIB REV8.2.
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATIONAL COOPERATIVE SOIL SURVEY (2005) Fairplay Series. Available at: https://soilseries.sc.egov.usda.gov/OSD_Docs/F/FAIRPLAY.html (accessed 19 February 2023).
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATIONAL COOPERATIVE SOIL SURVEY (2011) Warners Series. Available at: https://soilseries.sc.egov.usda.gov/OSD_Docs/W/WARNERS.html (accessed 19 February 2023).
- UNITED STATES DEPARTMENT OF AGRICULTURE, NATIONAL COOPERATIVE SOIL SURVEY (2018) Massanetta Series. Available at: https://soilseries.sc.egov.usda.gov/OSD_Docs/M/MASSANETTA.html (accessed 19 February 2023).
- Vento F and Rollins H (1989) Development of a late pleistocene-holocene genetic stratigraphic framework as it relates to atmospheric circulation and climate change in the Upper and Central Susquehanna River Drainage Basin. Report on file, Bureau for Historic Preservation of the Pennsylvania Historical and Museum Commission, Harrisburg.
- Vento F, Rollins H, Stewart RM, et al. (1990) Genetic stratigraphy, climate change, and the burial of archaeological sites within the Susquehanna, Delaware, and Ohio River Drainage Basins. Report on file, Bureau for Historic Preservation of the Pennsylvania Historical and Museum Commission, Harrisburg.
- Vokes HE and Edwards J (1974) *Geography and Geology of Maryland*. Baltimore: Maryland Geological Survey.
- Wall R (1991) Early to middle archaic period occupations in Western Maryland: A preliminary model. *Journal of Middle Atlantic Archaeology* 7: 53–65.

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