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**The Archaeology of the Delaware Chalcedony Complex:  
A Preliminary Report**

by

Jay F. Custer, H. Henry Ward, and Scott C. Watson



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**THE ARCHAEOLOGY OF THE DELAWARE CHALCEDONY COMPLEX:  
A PRELIMINARY REPORT**

Jay F. Custer, H. Henry Ward, and Scott C. Watson

**ABSTRACT**

The Delaware Chalcedony Complex consists of a series of outcrops of chalcedony, jasper, and chert in northeastern Maryland, northwestern Delaware, and southeastern Pennsylvania. Prehistoric peoples utilized these materials to manufacture tools from Paleo-Indian through Woodland II times. Five major quarry sites and more than ten associated reduction sites and camps have been identified to date.

**INTRODUCTION**

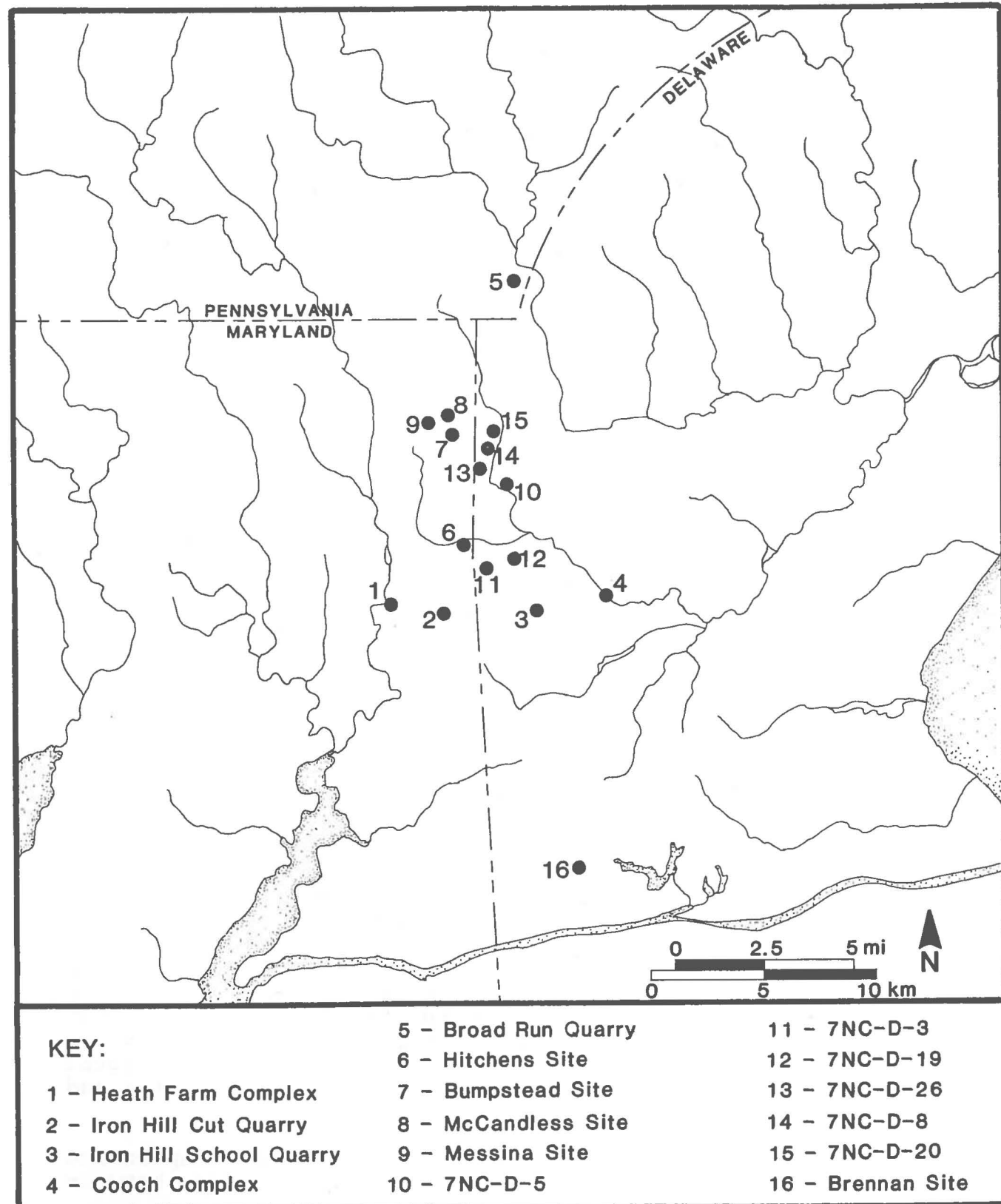
The purpose of this paper is to describe the prehistoric utilization of a series of primary cryptocrystalline outcrops in northeastern Maryland, northwestern Delaware, and southeastern Pennsylvania (Figure 1). These outcrops have been named the Delaware Chalcedony Complex by Wilkins (1976) and a description of the lithic materials has also been published (Custer and Galasso 1980:2-3). However, there has been no comprehensive description of the archaeological sites associated with the outcrops. This paper will describe the associated sites and artifacts from the sites. In most cases, new fieldwork has been undertaken to investigate the context of the sites associated with the outcrops. A description of the sites follows a brief discussion of the geologic context of the outcrops.

**GEOLOGIC CONTEXT**

The Delaware Chalcedony Complex includes a wide variety of cryptocrystalline rocks; however, the most common materials are brown jaspers and black cherts. The major recognized varieties of materials within the complex are Cecil Black Flint, Newark Jasper, and Broad Run Chalcedony (Wilkins 1976). Sampling of a number of outcrops (Figure 1) has shown that the black chert and jasper co-occur at a number of locations. However, the Broad Run Chalcedony is relatively distinctive in appearance, with its orange-brown mottling through a translucent matrix, and is found at only one location in Chester County, Pennsylvania (Custer and Galasso 1980:3).

All of the materials of the Delaware Chalcedony Complex are quite variable in quality. Their texture varies between

FIGURE 1  
Site Locations



microcrystalline and cryptocrystalline. Some are highly fractured and interlaced with quartz crystalline inclusions and vesicular voids. Although much of the material in the outcrops is of an unsuitable quality for stone tool manufacture, workable blocks and large fragments can be found without too much effort. It should be noted that textural variability within and between outcrops is mirrored by chemical variability (Wilkins 1976:28-29; Blackman 1974:46-47). Nonetheless, it is possible to discriminate the Delaware Chalcedony cryptocrystalline materials from those of other outcrops in the Middle Atlantic region, such as the Pennsylvania jasper quarries (Blackman 1974; Hatch and Miller 1985).

The geologic origin of the Delaware Chalcedony Complex materials is not clear and has not been extensively studied. Nonetheless, some observations can be made. Based on analysis of hand specimens, Dr. Antonio Segovia of the University of Maryland suggested that the cryptocrystalline materials were secondary replacement jasperoids (Custer and Galasso 1980:2) similar to those described by Lovering (1972). On the other hand, Dr. Thomas Stafford of the Carnegie Institute has described the materials as lateritic jaspers based on field examinations of the outcrops. Blackman (1974:39) concurs with Stafford and descriptions of the processes of lateritic jasper formation (Pearre and Heyl 1960; Thayer 1967) seem to match the geologic setting of the Iron Hill area (Thompson 1979). Furthermore, Phase I/II survey of the outcrops at site 7NC-D-108 on the western slope of Iron Hill revealed the large blocks and nodules of jasper could be found within weathered igneous regolith, thus supporting the hypothesis of a lateritic origin (Lothrop and Custer 1986). The origin of the Broad Run chalcedonies is somewhat different and may be related to metamorphic processes associated with Cockeysville marbles (Thompson 1979). Regardless of their origin, the lithic materials of the Delaware Chalcedony Complex provide a major source of cryptocrystalline raw material for the manufacture of stone tools.

#### OUTCROPS AND ARCHAEOLOGICAL SITES

The following description of archaeological sites associated with the Delaware Chalcedony Complex is not an exhaustive inventory of all archaeological sites showing prehistoric use of the outcrops. Rather, it is intended as a preliminary listing of sites and collections on file with the Maryland Geological Survey and the Delaware Bureau of Archaeology and Historic Preservation. Quarry sites are described first and then secondary reduction sites are noted. Figure 1 shows the site locations.

#### Quarry Sites

Quarry sites are defined here as locations which show evidence of the initial procurement and processing of raw materials. For the most part, these sites are characterized by large quantities of waste flakes and amorphous debris. In some

cases, rejected primary bifaces and blocky cores are also present.

**Heath Farm Complex.** The Heath Farm Quarry Site Complex consists of two sites: the Heath Farm Jasper Quarry Site (18CE8) and the Heath Farm Camp Site (18CE66). Both sites were discovered and collected by Elwood Wilkins and John Witthoft.

The quarry site (18CE8) is located on the south side of Route I-95 on the slopes of a small ephemeral stream that flows into Big Elk Creek. At one time, the site extended further up the small drainage channel; however, construction of Route I-95 destroyed the northern section of the site. An outcrop of brown jasper extends from the lane into the Heath Farm to Route I-95 on the southeast slope of a high knoll for a distance of approximately 400 meters. Quarry reduction artifacts are found primarily along the small ephemeral drainage that emerges from the knoll.

The quarry area consists of a series of large boulders of brownish jasper with some darker black colors present. Smaller weathered spalls are also present across the slope. The jasper is of quite variable quality; however, large quantities of material usable for tool manufacture are present. Early observations of the site suggested that there may have been quarry pits in the area; however, they have been destroyed by the I-95 construction. The reduction area consists of a scatter of man-modified blocks of jasper. Artifacts present at the site and in the collections of Elwood Wilkins include many primary bifaces that were discarded due to flaws in the lithic material or manufacturing errors. Much debitage is also present. No diagnostics are present to allow a determination of the cultural/temporal affiliation of the site.

The Heath Farm Camp Site (18CE66) is located in the floodplain of the Big Elk Creek immediately southeast of the Heath Farm jasper quarry (18CE8). The site consists of a scatter of surface artifacts across a small terrace of the Big Elk Creek. A drainage channel of an intermittent tributary of the Elk Creek provides a small poorly drained area adjacent to the main site area. Artifacts from the site include much debitage of jasper that seems to have come from the quarry outcrop location, secondary biface rejects and discards, and numerous finished biface and flake tools. The presence of varied tool types and secondary biface reduction activities suggests that presence of a base camp associated with the quarries. The diagnostic artifacts from the site are few and include Woodland I and Woodland II projectile points. Some preliminary subsurface testing by Wilkins indicates that some materials may be buried intact below the plowzone and may date to earlier time periods. This site contains remains, some of which are intact and preserved in situ, that show the final phases of stone tool production and living area activities for groups visiting and using the 18CE8 quarry. The chance that earlier buried materials exist enhances the site's significance.

**Iron Hill Cut Quarry.** The Iron Hill Cut Quarry (18CE65) is located east of the Penn Central Northeast Corridor railroad tracks, immediately south of the Route I-95 overpass. The outcrop area is located on a ridge and extends 250 meters. An associated lithic reduction area is located on the east bank of a small stream adjacent to the lithic outcrop. This reduction area is 44 meters long and extends 10 meters to the east of the stream. The quarry area consists of a high quality cryptocrystalline jasper outcrop located on a rise created by the Penn Central railway cut on the west and stream downcutting on the east. Some portions of this outcrop may have been destroyed by the construction of the Penn Central tracks and Route I-95. The colors of the jasper range from yellow to red to black, and are found in spalls and boulders.

The Iron Hill Cut Quarry site consists of a prehistoric lithic quarry and a related primary lithic reduction station. Primary reduction flakes were found at both the quarry and reduction area. In addition, jasper cores, a flake tool, a possible hammerstone, and extensive shatter debitage were recovered from the primary reduction area. Due to an absence of diagnostic artifacts, the cultural/temporal affiliation is unknown. The artifacts at the site are undisturbed and from good context.

**Iron Hill School Quarry.** The Iron Hill School Quarry Site (7NC-D-34) is located on the southern slope of Iron Hill along an ephemeral unnamed tributary of Muddy Run. Nodules and blocks of brown jasper, and some black chert, are found eroding from the hillside slopes and are also found within the stream channel. The general area of the quarry has been extensively disturbed by pit mining of iron ore during the 18th and 19th centuries. Test excavations were undertaken at the site in 1974 by the Delaware Bureau of Archaeology and Historic Preservation and these excavations recovered massive amounts of jasper debitage and associated debris. Some blocky cores and primary bifaces were found, but primary stage bifaces were extremely rare. However, a series of late stage quartz bifaces were found and these artifacts are thought to represent tools which were made elsewhere, brought to the quarry, and then discarded as new tools were manufactured. No diagnostic artifacts were recovered from the site.

**Cooch Complex.** The Cooch Complex consists of a quarry site (7NC-D-108) and a potentially related base camp, the Cooch's Bridge Site (7NC-D-1). The quarry site (7NC-D-108) was initially discovered by Elwood Wilkins and was subjected to limited test excavations as part of a cultural resource survey of the proposed Route 896 Corridor (Lothrop and Custer 1986). Located along a small unnamed tributary of the Christina River on the eastern slope of Iron Hill, this quarry site is associated with outcrops of brown jasper. Test excavations recovered large jasper nodules from weathered-in-place regolith and much of the jasper at the site is not suitable for stone tool production. Artifacts at the

site include large flakes, much amorphous debris, and a single late stage biface reject.

The base camp (7NC-D-1), known as the Cooch's Bridge Site, is located in the floodplain of the Christina River within 500 m of the quarry site. Collections maintained at the Island Field Museum include a few primary and secondary jasper bifaces that may be manufactured from the local jasper outcrop. A stemmed point and several Minguannan ceramic sherds indicate a Woodland I-Woodland II occupation of the site. A grooved axe was also included in the collection and the site may be a base camp habitation site.

**Broad Run Quarry.** The Broad Run Quarry (36CH49) is located on a low knoll overlooking Broad Run, a tributary of the White Clay Creek. Discovered by Elwood Wilkins, the site has been extensively disturbed by sod farming activities over a number of years. The only known outcrop of Broad Run Chalcedony is adjacent to the quarry, which is the northernmost component of the Delaware Chalcedony Complex. Artifacts recovered from the site include debitage, debris, and rejected primary bifaces of the distinctive translucent Broad Run Chalcedony.

#### Quarry-Related Reduction Sites

Listed below are a series of sites which produced numerous artifacts manufactured from local materials of the Delaware Chalcedony Complex. Most of the sites are within 3 km of the outcrops (see Figure 1), but some are more distant. These sites are listed because they are thought to be related to the quarry sites in that people who procured lithic materials at the quarries then took these materials to more comfortable locales to complete the process of stone tool manufacture. In most cases, the sites listed here are not clearly related to an individual quarry site; however, in some cases a direct relationship can be hypothesized based on proximity and the range of materials recovered.

**Hitchens Site.** The Hitchens Site (18CE37) is located on a low knoll approximately 60 meters north of an unnamed tributary of the West Branch of the Christina River. The site yielded ten primary jasper biface rejects and two secondary jasper biface rejects. Utilized and worked tools were also present. The majority of the debitage consists of yellow jasper, black chert and red jasper, while quartz and ironstone flakes are present in low frequencies. The jasper and chert debitage is similar to the quarry material at 18CE65. Eight diagnostic projectile points were recovered, including a bifurcate point and stemmed and notched points, although only two points were manufactured from jasper or chert. The range of projectile points indicates an Archaic-Woodland I occupation of the site.

The Hitchens Site is located 2 km north of the Iron Hill Cut Quarry (18CE65), and it appears that the Hitchens Site represents a lithic reduction and short-term habitation/processing site

associated with the Iron Hill Cut Quarry. The proximity of the site to the quarry, as well as the presence of high frequencies of jasper and chert debitage matching the quarry material offers support for considering the site as part of the Iron Hill Cut Quarry utilization system.

**Bumpstead Site.** The Bumpstead Site (18CE162) is located on a low knoll approximately 20 meters north of an ephemeral stream bed. The surface of the site produced two primary and two secondary jasper biface rejects and five flake tools. Eight diagnostic projectile points, which were manufactured of local chert and jasper, were also recovered and included stemmed and notched points indicative of a Woodland I occupation. The predominant material at the site is a black chert containing numerous inclusions. All but one of the projectile points, however, were made from a glossy red jasper with a texture indicating possible thermal alteration. One primary biface reject and a small amount of debitage of this red jasper were also recovered.

**McCandless Site.** The McCandless Site (18CE163) is situated approximately 100 meters north of 18CE162. Although very similar to 18CE162, the site contained higher frequencies of black chert, only one primary biface reject of yellow jasper, and no jasper debitage. Seven black chert primary biface rejects in a wide range of sizes were recovered. In addition, one late stage stemmed projectile point, rejected due to minor damage during the finishing process, was recovered. Also present was a carefully worked unifacial scraper with a pressure flaked graver tip, suggesting that hunting/processing activities also took place at the site. The site represents a reduction site similar to that at 18CE162.

**Messina Site.** The Messina Site (18CE164) is located on a well-drained slope of a knoll 100 meters west of the same ephemeral stream associated with the Bumpstead and McCandless Sites. The Messina Site differs from other nearby sites because it exhibits a wider range of jaspers and cherts, although black chert is most common. The three primary biface rejects recovered at the site were made of yellow jasper. Three black chert stemmed projectile points were also found. One of the chert points was discarded into a fire, with resulting pot-lidding and surface crazing. Another point appears to have been rejected during the process of final edging. This site also yielded a grooved axe which, along with the points, indicates a Woodland I occupation.

**7NC-D-5.** This site is located in the floodplain of the Christina River 2 km north of Chestnut Hill. Table 1 shows a summary of the collection from the site on file at the Island Field Museum. Diagnostic projectile points indicate a Woodland I and Woodland II occupation and Woodland II Minguannan ceramics are also present in the collection. The large number of primary biface and stemmed point rejects of jasper show that processing of local lithic materials was a major activity at the site. Some processing of quartz also took place at the site.

Table 1: 7NC-D-5 Catalogue

Artifact Type	Raw Material						TOTAL
	Jasper	Quartz	Quartzite	Argillite	Ironstone		
Primary Biface Reject	10	3	-	-	-	13	
Secondary Biface Reject	12	-	-	-	-	12	
Secondary Biface Discard	3	11	1	1	3	19	
Flake Tool	3	-	-	-	-	3	
Stemmed Point Reject	25	4	-	-	-	31	
Stemmed Point Discard	1	9	-	2	2	14	
Broadspear Discard	-	1	-	-	-	1	
Triangular Discard	-	1	-	-	-	1	
TOTAL	54	29	1	3	7	94	

**7NC-D-3.** Located on a small knoll overlooking an ephemeral tributary of the Christina River, this site is within 2 km of the Iron Hill Cut Quarry. Table 2 shows a summary catalogue of a collection from the site curated at the Island Field Museum. There are numerous primary and secondary jasper bifaces present in the collection indicating that biface reduction was an important activity at the site. The diagnostic projectile points indicate a late Paleo-Indian through Woodland II occupation of the site.

**7NC-D-19.** This site is located 200 m east of 7NC-D-3 in the floodplain of Persimmon Run, a tributary of the West Branch of the Christina River. Table 3 shows a summary catalogue of a collection from the site maintained at the Island Field Museum. The diagnostic projectile points indicate a Woodland I-Woodland II occupation of the site. The large amount of jasper debitage and rejected jasper bifaces and cores indicate that biface reduction was an important activity at the site. As was the case with other reduction sites, a number of quartz artifacts were also present indicating reduction of this material as well.

**7NC-D-8,20,26.** The Island Field Museum contained a mixed collection of artifacts from these three sites, which are located on low knolls overlooking the East Branch of the Christina River. These sites are 4.5 km north of Chestnut Hill and have been destroyed by the construction of a housing development. Table 4 shows a summary catalogue of the collection. Woodland I and Woodland II occupations are present at the site. Numerous rejected bifaces of jasper, black chert, and quartz are present and indicate reduction of all three raw materials at the site.

**Brennan Site.** The Brennan Site (7NC-D-71A) was located during a Phase I/II survey of the proposed Route 896 Corridor (Lothrop and Custer 1986) and is located on a small knoll overlooking the headwaters of a low-order ephemeral stream more than 12 km south of Iron Hill. Surface-collected and excavated artifacts from the site consist almost exclusively of jasper cores, bifaces, and extensive debitage. The range of cores and flakes is similar to that of other reduction sites even though the Brennan Site is more distant from the quarry. The surface collection includes stemmed and notched points indicating a Woodland I occupation. However, subsurface testing did recover debitage from buried soils of early Holocene age which could indicate a late Paleo-Indian or Archaic occupation of the site.

## DISCUSSION

The archaeological sites associated with the outcrops of the Delaware Chalcedony Complex encompass a wide range of activities and span the entire time span of local prehistory. Table 5 summarizes the time periods and activities at the reduction sites and Figure 2 shows a sample of the diagnostic artifacts from the sites. Quarry sites are not included because activities are limited and no diagnostic artifacts were recovered from these



Table 2: 7NC-D-3 Catalogue

<u>Artifact Type</u>	<u>Raw Material</u>							<u>TOTAL</u>
	<u>Jasper</u>	<u>Quartz</u>	<u>Quartzite</u>	<u>Chert</u>	<u>Argillite</u>	<u>Rhyolite</u>	<u>Iron</u>	
Primary Biface Reject	57	4	1	-	-	-	2	64
Secondary Biface Reject	45	25	3	-	-	-	11	84
Flake	51	71	-	-	-	-	5	127
Flake Tool	9	-	-	-	-	-	-	9
Core and Core Fragment	14	-	-	-	-	-	-	14
Stemmed Point Reject	5	1	-	-	-	-	-	6
Stemmed Point Discard	1	14	4	1	10	2	4	36
Notched Point Reject	1	-	-	-	-	-	-	1
Notched Point Discard	1	18	1	-	-	-	2	22
Triangular Point Reject	1	1	-	-	-	-	-	2
Kirk Point Reject	1	-	-	-	-	-	-	1
Bifurcate Point Reject	2	-	-	-	-	-	-	2
<b>TOTAL</b>	<b>188</b>	<b>134</b>	<b>9</b>	<b>1</b>	<b>10</b>	<b>2</b>	<b>24</b>	<b>368</b>

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Table 3: 7NC-D-19 Catalogue

<u>Artifact Type</u>	<u>Raw Material</u>		
	<u>Jasper</u>	<u>Quartz</u>	<u>TOTAL</u>
Primary Biface Reject	38	5	43
Secondary Biface Reject	-	35	35
Flake	403	100	503
Flake Tool	9	-	9
Core and Core Fragment	21	-	21
Stemmed Point Reject	2	10	12
Stemmed Point Discard	2	12	14
Notched Point Discard	1	10	11
Broadspear Discard	1	-	1
Triangular Reject	2	-	2
Triangular Discard	1	1	2
<b>TOTAL</b>	<b>480</b>	<b>173</b>	<b>653</b>

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Table 4: 7NC-D-8,20,26 Catalogue

<u>Artifact Type</u>	<u>Raw Material</u>						<u>TOTAL</u>
	<u>Black Chert/Jasper</u>	<u>Quartz</u>	<u>Ironstone</u>	<u>Quartzite</u>	<u>Argillite</u>	<u>Rhyolite</u>	
Primary Biface Reject	18	4	1	-	-	-	23
Secondary Biface Reject	22	21	6	-	-	-	49
Flake Tool	4	-	-	-	-	-	4
Core and Core Fragment	1	-	-	-	-	-	1
Straight Stem Reject	11	24	4	-	-	-	39
Straight Stem Discard	5	5	2	1	4	-	17
Notched Point Discard	3	3	-	-	1	-	7
Triangular Point Discard	3	1	-	-	-	-	4
Bifurcate Point Discard	1	-	-	-	-	-	1
Fishtail Point Discard	1	-	-	-	-	-	1
Broadspear Discard	-	1	1	-	-	2	4
<b>TOTAL</b>	<b>69</b>	<b>59</b>	<b>14</b>	<b>1</b>	<b>5</b>	<b>2</b>	<b>150</b>

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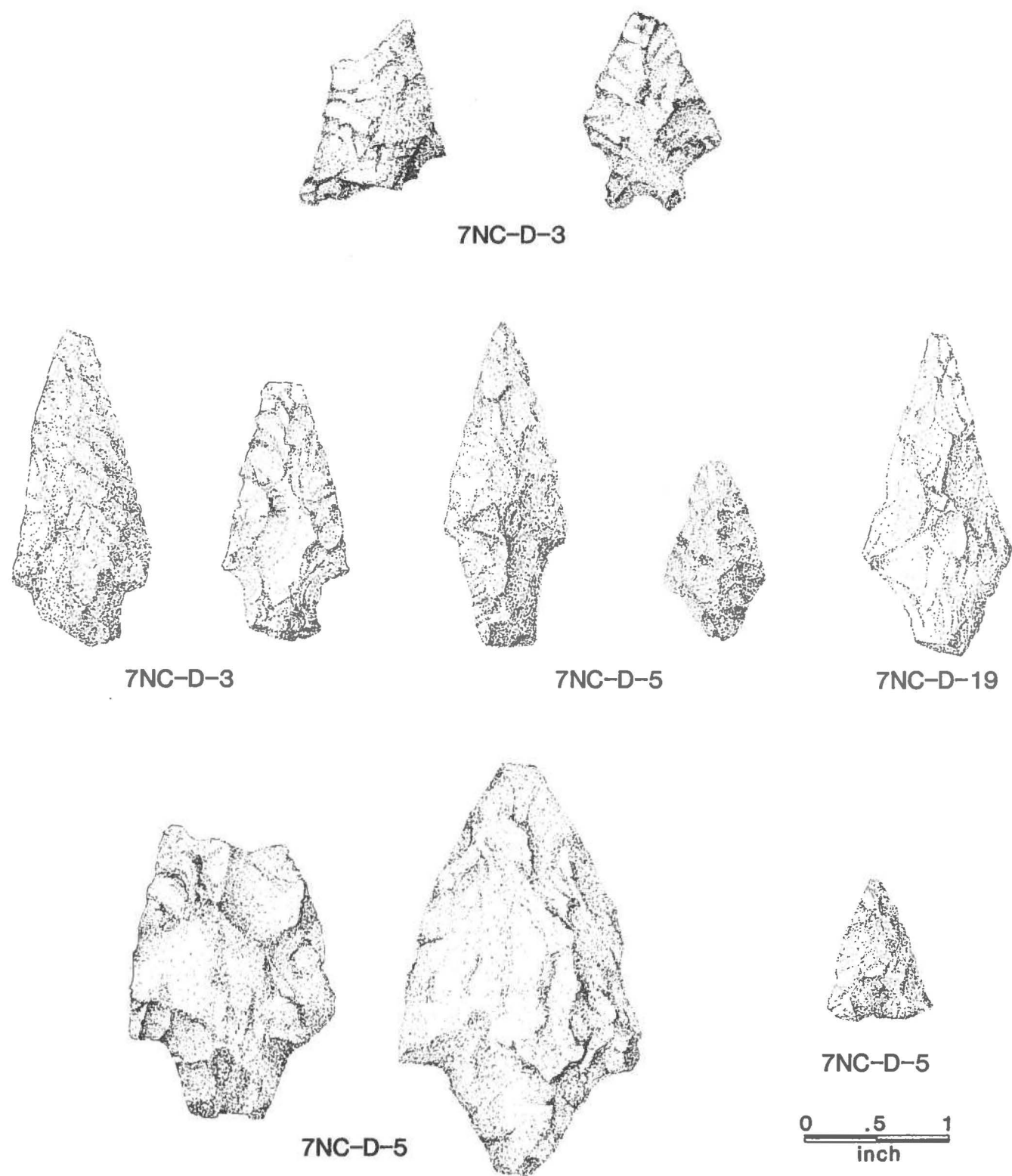
Table 5: Summary Site Descriptions

<u>Site</u>	<u>PI</u>	<u>A</u>	<u>WI</u>	<u>WII</u>	<u>Biface Prod.</u>	<u>Point Prod.</u>	<u>Quartz Prod.</u>	<u>Size</u>
18CE66	-	-	X	X	X	X	-	L
7NC-D-1	-	-	X	X	X	-	-	L
18CE37	-	X	X	X	X	X	X	L
18CE162	-	-	X	-	X	-	-	S
18CE163	-	-	X	-	X	-	-	S
18CE164	-	-	X	-	X	X	-	S
7NC-D-5	-	-	X	X	X	X	X	L
7NC-D-3	X	X	X	X	X	X	X	L
7NC-D-19	-	-	X	X	X	X	X	S
7NC-D-71A	?	?	X	-	X	X	X	S

X = Present                      L = Large  
 - = Absent                        S = Small

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FIGURE 2  
Diagnostic Artifacts



sites. A preliminary ranking of site size and collection complexity is also included in Table 5.

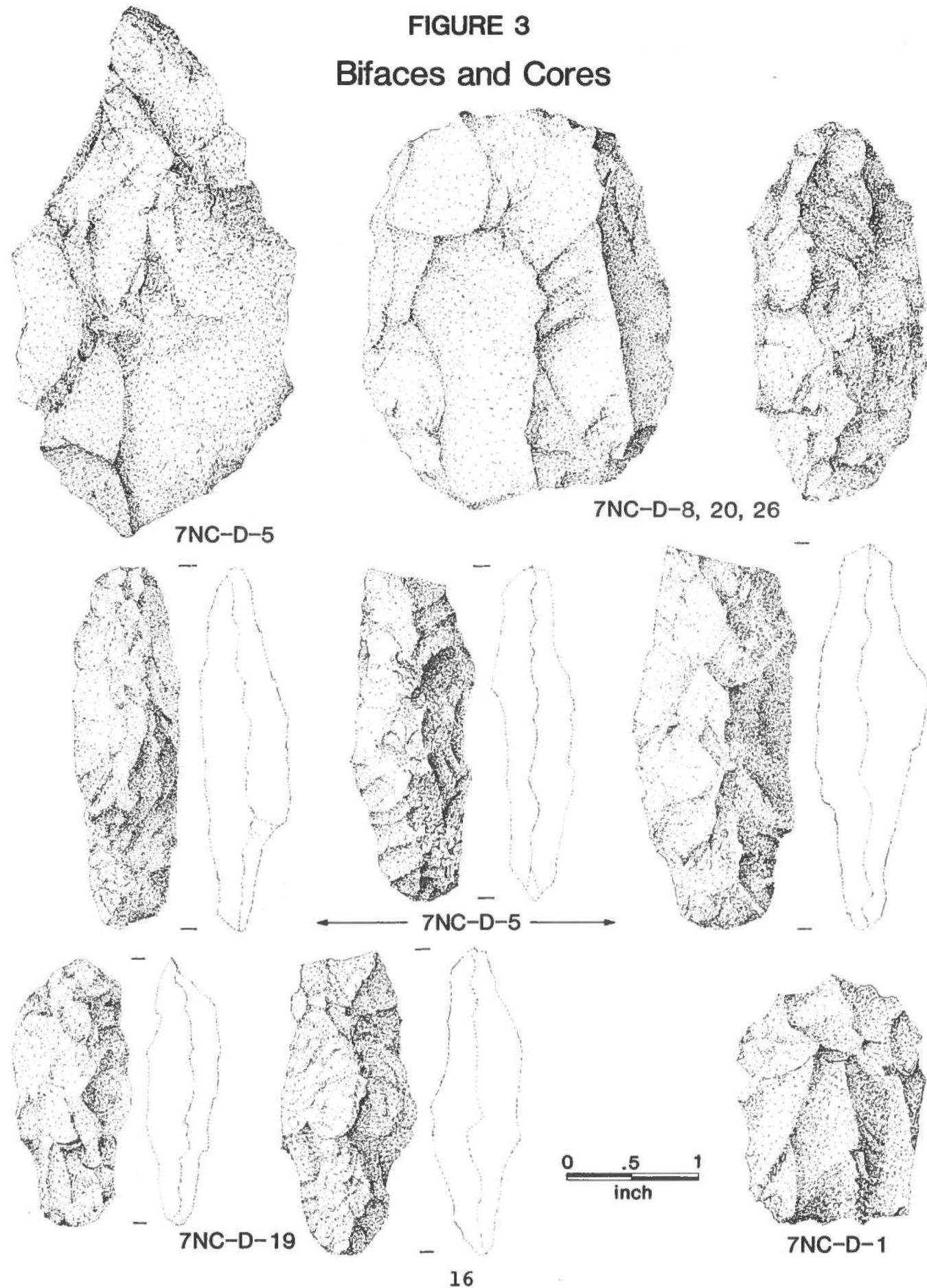
Paleo-Indian Period (ca. 15,000 BC-6500 BC) use of the quarries and related reduction sites is indicated by artifacts from 7NC-D-3. Although Paleo-Indian artifacts are present at only one site, the area of the Delaware Chalcedony outcrops is a major locus of fluted point finds (Custer 1984; Custer, Cavallo, and Stewart 1983). A fluted point was recovered from 7NC-D-18, which is within 200 m of two quarry-related base camps (7NC-D-3 and 18CE37); and another fluted point was recovered from 7NC-D-15, which is within 1 km of the Iron Hill School Quarry Site (7NC-D-34). An additional major Paleo-Indian site within 500 m of the Iron Hill School Quarry is the Everett Site (7NC-D-21). The Everett Site produced a fluted point, early notched Kirk and Palmer points, and a variety of cutting and scraping tools, all made from local cherts and jasper. These tools, and the association of the Everett Site with a poorly drained bay/basin feature, suggest that it is a hunting site or base camp maintenance site. In addition to the site locations, analysis of the dimensions and morphology of fluted points from the Delaware Chalcedony Complex area indicate that many of the fluted points are either large, early stage rejects or very small late stage discards. The presence of these types of points are typical of quarry-related locations (Gardner and Verrey 1979). Thus, there are several lines of evidence to indicate Paleo-Indian use of the Delaware Chalcedony Complex.

Archaic Period (ca. 6500-3000 BC) utilization of the area of the outcrops is indicated by the presence of bifurcate points at 5 quarry-related sites. The area around the Delaware Chalcedony Complex also contains many sites with bifurcate points (Custer 1986).

Stemmed points of the Woodland I Period (ca. 3000 BC-AD 1000) are the most numerous diagnostic artifacts found at sites associated with Delaware Chalcedony Complex outcrops, and are present at all of the quarry-related sites listed in Table 5. Woodland I sites are widespread throughout the northern Delmarva Peninsula (Custer and Wallace 1982; Custer 1984) and the proliferation of Woodland I components at Delaware Chalcedony Complex sites reflects this general trend. Woodland II components are present at seven of the eleven sites and are the second most common component at Delaware Chalcedony Complex sites.

It is difficult to identify special features of lithic technology for individual time periods at the quarries and related sites. However, one important observation can be made. During the Woodland I Period, a large number of stemmed point rejects are noted at some reduction sites indicating that points were being produced in addition to bifaces (Figure 3). At the same time, quartz was also being reduced to produce stemmed points at the quarry reduction sites. Because staged biface production is thought to be related to the highly curated lithic

FIGURE 3  
Bifaces and Cores



technologies associated with high degrees of mobility (Binford 1979), the manufacture of projectile points directly at the reduction sites may indicate less highly curated lithic technologies during Woodland I times. The use of quartz may also indicate less discriminating lithic preferences during Woodland I times.

The relationships among the sites of the Delaware Chalcedony Complex can be considered to understand the spatial organization of lithic resource procurement. For the most part, only initial procurement and limited early stage biface production took place at the quarry itself. When suitable camping locations were nearby, secondary reduction activities took place within 500 m of the quarry. Examples of these types of reduction/base camp sites include 7NC-D-1 and 18CE66. In other cases, secondary biface reduction took place 2-3 km from the quarries at sites like 18CE37, 7NC-D-5, 7NC-D-3 and 7NC-D-19. The more distant reduction sites seem to be associated with the outcrop/quarries found farthest from the major drainages. Thus, it can be noted that groups utilizing the quarries were willing to transport early stage bifaces and blocky cores, which were produced at the quarry, up to 3 km to a suitable camping spot for further reduction.

The northernmost reduction sites (18CE162,163,164; 7NC-D-8,20,26) are something of an anomaly in that they are 5-6 km away from the nearest quarry source. These sites are also quite small and contain the largest proportions of black chert. These sites may be outlying specialized reduction sites. However, they may also be associated with a hitherto undiscovered lithic source of black chert. Extensive suburban development of the area near these sites makes it difficult to test this hypothesis.

Site 7NC-D-71A is also something of an anomaly in that it is more than 10 km from the quarries and still shows rather profligate use of lithic resources and numerous episodes of biface reduction. Because it is located in the Coastal Plain to the south of the outcrops, it is unlikely that there are any closer outcrop sources. Therefore, it is likely that 7NC-D-71A represents a specialized lithic reduction site associated with other resource procurement activities. Further research at this site will be necessary to better understand this site's role in local settlement patterns and lithic resource utilization models.

In conclusion, the Delaware Chalcedony Complex is an important and unique archaeological resource of the Delmarva Peninsula and its further study can only enhance our understanding of prehistoric technologies and lifeways.

#### ACKNOWLEDGEMENTS

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#### REFERENCES

- Binford, L. R.  
1978 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 36:255-273.
- Blackman, M. J.  
1974 The Geochemical Analysis of Jasper Artifacts and Source Material from Delaware and Pennsylvania. *Transactions of the Delaware Academy of Sciences* 5:37-49.
- Custer, J. F.  
1984 *Delaware Prehistoric Archaeology: An Ecological Approach*. University of Delaware Press, Newark.  
  
1986 Analysis of Early Holocene Projectile Points and Site Distributions on the Delmarva Peninsula. *Archaeology of Eastern North America* 14 (In Press).
- Custer, J. F., J. A. Cavallo, and R. M. Stewart  
1983 Paleo-Indian Adaptations on the Coastal Plain of Delaware and New Jersey. *North American Archaeologist* 4:263-276.
- Custer, J. F. and G. J. Galasso  
1980 Lithic Resources of the Delmarva Peninsula. *Maryland Archaeologist* 16(2):1-13.
- Custer, J. F. and E. B. Wallace  
1982 Patterns of Resource Distribution and Archaeological Settlement Patterns in the Piedmont Uplands of the Middle Atlantic Region. *North American Archaeologist* 3:139-172.
- Gardner, W. M. and R. A. Verrey  
1979 Typology and Chronology of Fluted Points from the Flint Run Area. *Pennsylvania Archaeologist* 49(12):13-46.
- Hatch, J. W. and P. Miller  
1985 Procurement, Tool Production, and Sourcing Research at the Vera Cruz Jasper Quarry in Pennsylvania. *Journal of Field Archaeology* 12:219-230.
- Lothrop, J. and J. F. Custer  
1986 *Phase I/II Archaeological Investigations of the Route 896 Corridor*. Delaware Department of Transportation Archaeology Series (In Press), Dover.
- Lovering, T. G.  
1972 Jasperoid in the United States - Its Characteristics, Origin, and Economic Significance. *United States Geological Survey Professional Paper* 710.

Pearre, N. C. and A. V. Heyl

1960 Chromite and Other Mineral Deposits in Serpentine Rocks of the Piedmont Upland, Maryland, Pennsylvania, and Delaware. **United States Geological Survey Bulletin** 1082-K:707-833.

Thayer, T.

1967 Chemical and Structural Relationships of Ultramafic and Feldspathic Rocks. In **Ultramafic and Mafic Rocks**, edited by P. Wyllie, pp. 222-239. Van Nostrand, New York.

Thompson, A. M.

1979 A Summary of the Geology of the Piedmont in Delaware. **Transactions of the Delaware Academy of Sciences** 7:115-135.

Wilkins, E. S.

1976 The Lithics of the Delaware and Nanticoke Indians. **Transactions of the Delaware Academy of Sciences** 6:25-35.