

AN ICE AGE QUARRY-WORKSHOP
The West Athens Hill Site Revisited

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The West Athens Hill Site Revisited

by
Robert E. Funk
New York State Archaeologist (Emeritus)
Anthropological Survey,
New York State Museum

New York State Museum Bulletin 504
2004

The University of New York
The State Education Department

© The New York State Education Department, Albany, New York 12230

Published 2004

Printed in the United States of America

Copies may be ordered from:

Publication Sales

3140 CEC

New York State Museum

Albany, New York 12230

Phone: (518) 402-5344

FAX: (518) 474-2033

Web address: <http://www.nysm.nysed.gov/publications.html>

Library of Congress Catalog Card Number: 2004101578

ISBN: 1-55557-173-5

ISSN: 0278-3355

Cover Illustration:

New York State Museum's "Ice Age Hunters: New York's First People" life group.

EDITORIAL ACKNOWLEDGEMENTS

On September 19, 2002, just a few short days before his untimely and unexpected death, Bob Funk gave Beth Wellman for editing the manuscript that now constitutes this book. In the intervening months, a number of individuals have played important roles in bringing manuscript to publication. Bob's son Al allowed me to access Bob's home office to look for notes, photographs, and maps associated with the West Athens Hill site and the manuscript. Beth Wellman worked tirelessly in initial editing, assembling and identifying figures and photographs, and checking proofs during the publication process. David Anderson, Jim Bradley, Jim Petersen, and Art Spiess all provided many useful comments and suggestions on the manuscript. Ted Beblowski scanned and electronically edited the various line drawings and photographs. Jack Skiba checked proofs and managed the publication process. Leigh Ann Smith designed the cover. And, of course, Jim Petersen wrote a wonderful foreword placing Bob's research at West Athens Hill into a larger context of Paleoindian research in the Northeast. I extend sincere thanks to everyone who made this publication happen. I think Bob would be very pleased.

John P. Hart
April 2004

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FOREWORD:

WEST ATHENS HILL, THE PALEOINDIAN PERIOD, AND ROBERT E. FUNK IN NORTHEASTERN PERSPECTIVE

By James B. Petersen

INTRODUCTION

It is a distinct honor to write the foreword for this highly significant publication on the West Athens Hill Paleoindian archaeological site, a report by the late Robert E. Funk, Emeritus State Archaeologist of New York. I knew Bob for more than 25 years and he had a very substantial impact on my early development as an archaeologist, as he did for many others, avocational and professional archaeologists alike. Bob's high energy, positive attitude, good humor, and generosity are legendary. He had a lot more research that he wanted to get done at the time of his premature passing, including a few old projects and various new ones as well. Nonetheless, Bob has left this world a better place because of his presence, kindness, and many works.

Bob Funk had finished the bulk of the work needed to see his reanalysis and expanded reporting of the West Athens Hill site ready for publication prior to his untimely death. Nearly everything had been completed for the present volume as another in a series of influential archaeological publications by the New York State Museum (NYSM). Bob's landmark volume on Hudson Valley prehistory (Funk 1976) and the equally legendary volume concerning Native American "settlement patterns" in New York State and the broader

region, with his mentor and predecessor as New York State Archaeologist, William A. Ritchie (Ritchie and Funk 1973), were both published by the NYSM.

I have recently heard from my colleague Jim Bradley that Bob was planning to undertake a broader systematic review of all available Early Paleoindian (fluted point) period evidence in the Hudson Valley. Pieces of this project were already done. Sadly for all of us, Bob did not live long enough to see this bigger project through to fruition, and it would have been undoubtedly another highly significant scholarly contribution to regional, national, and international archaeology on a level well beyond New York State.

This foreword has been designed to serve several distinct purposes. First, I present a personal overview of the Paleoindian period (and presumed antecedents) in northeastern North America, or the "Northeast," to contextualize recent literature and perspectives that Bob did not necessarily have the time (or inclination) to include in his publication on West Athens Hill. Secondly, I briefly summarize the significance of the West Athens Hill site and its importance to Paleoindian studies in general. Finally, in closing I present a brief personal tribute to Bob and Bob's spirit.

The reader is left to judge how well these goals are achieved, but if nothing else, there

can be no doubt about the significance of Bob Funk's Paleoindian (and other) archaeological research in New York State. This is just one more reason to celebrate Bob's life and his notable contributions to the study of archaeology related to northeastern Native Americans.

THE PALEOINDIAN PERIOD IN NORTHEASTERN NORTH AMERICAN PREHISTORY: PROCESS AND PARTICULARS

Background and Terminology

As with various other areas of North American archaeology related to Native Americans (or "First-Nations people" in Canada), the study of the Paleoindian period has been practically revolutionized in the past 25–30 years. A significant and substantial number of these gains have been made in the "Northeast," which is defined here as the area covered by Volume 15, *Northeast*, of the Handbook of North American Indians, broadly speaking a "culture area" (Trigger 1978). The Northeast thus roughly extends from about the Mississippi River eastward to the Atlantic coast on an east–west axis, and from about the mouth of the Ohio River near the Kentucky–Tennessee border and North Carolina–Virginia border northward to the southern margins of the Canadian Shield on a north–south axis. The Plains culture area borders the Northeast to the west, while the Subarctic and Southeast bound it to the north and south, respectively.

In fact, it is arguably the case that archaeological and paleoenvironmental research over the past 25–30 years have transformed our collective knowledge of the Paleoindian period proportionally more in the Northeast than in any other part of North America. The Northeast is no longer poorly known in terms of the Paleoindian period generally, at least not in relative terms. The case was rather different in 1973 when Ritchie and Funk published their seminal volume, *Aboriginal*

Settlement Patterns in the Northeast, including the first substantial reporting of West Athens Hill by Funk (pp. 9–36). The same might be said when Bob (Funk 1976:205–229) presented an extensive overview of Paleoindians in New York State and elsewhere, as well as his (Funk 1978:16–19) broader overview of early regional prehistory in the Handbook of North American Indians.

At the time, just a few major Paleoindian sites were known regionally (e.g., Barnes, Bull Brook, Debert, Holcombe, Plenge, Potts, Reagen, Shoop, and Williamson). While still important for understanding Paleoindian variability, these early studied sites represent a very small sample. Moreover, at the time there was very little sense of internal Paleoindian chronology, just a handful of questionably appropriate radiocarbon dates, and essentially no subsistence data at all to speak of for the region. Comparative researchers had to look at evidence from far afield in their Paleoindian syntheses, including the Plains and Southwest areas.

Now, 30 years later the Northeast has produced more substantial Paleoindian evidence that is of national and international significance, leading many researchers from beyond the region to look here for help in understanding Paleoindians generally. Evidence from both the American and Canadian portions of the Northeast has become important, even essential, for understanding Paleoindians on a continental scale, along with broader issues such as the peopling of the Western Hemisphere during the late Pleistocene epoch. In part, this "revolution" is reflected in comparison of fluted point distribution studies over the past 20–30 years or so, reflecting how the sheer numbers of fluted point discoveries have increased in the Northeast and elsewhere too (cf. Anderson and Gillam 2000; Brennan 1982). But distribution studies only tell part of the story, since the quality of Paleoindian characterization and contextual data have been greatly enhanced in the Northeast and the contextual data have enabled great strides in different areas, as

described below. In correlation with better contextual data, we have gained significant new information about absolute dating of Paleoindian sites in the Northeast and unfortunately, new knowledge about dating problems too. Advances in regional dating are especially striking when data from the far Northeast are compared to the paucity of radiocarbon-dated Paleoindian sites in most other portions of North America. For example, the Southeast and even the Midsouth and Midwest are still very poorly dated for the Paleoindian period (e.g., Goodyear 1999; Lepper 1999).

Notable Paleoindian and other early sites in the broad Northeast now include a few dated stratified sites such as Meadowcroft Rockshelter, Cactus Hill, Shawnee Minisink, Templeton, and Thunderbird. Stratified sites of this antiquity are very rare, however, and instead we must typically depend on the isolation of early components in shallow, partially disturbed contexts. Some of the most notable recent discoveries of the latter type include Adkins, Arc, Cummins, Fisher, Hiscock, Israel River, Lamb, Nobles Pond, Parkhill, Rimouski, Thedford, Vail, and Varney Farm. These and other sites now allow suggestion of a three-four part sequence for the span of the **Early Paleoindian period**, ca. 11,000–10,000 B.P., or the time characterized by diagnostic fluted points of one type or another. Likewise, at least a two-three part **Late Paleoindian period**, ca. 10,000–9000/8500 B.P., has been defined, in correlation with unfluted lanceolate points. In addition, some researchers now recognize a **“Pre-Clovis” period** (or another terminological equivalent) that preceded the advent of fluted point manufacture before 11,500–11,000 B.P. and thus, the Early Paleoindian period per se. (These and all other radiocarbon dates are left uncalibrated here, due to a lack of an absolute calibration convention, the fact of date compression for some portions of the overall period, and to allow direct comparison with dates reported by Funk.)

Contrasted with present recognition of chronological subdivisions and temporal vari-

ability, not so long ago only a single commonly used designation, the “Paleoindian period,” was recognized, and this was generally equivalent to what we can now call the Early Paleoindian period based primarily on diagnostic fluted points, given evidence then available. Moreover, a long occupational hiatus during the early-middle Holocene was once suggested for the immediate post-fluted point period in northern portions of the Northeast due to environmental restrictions, ca. 10,000–5000 B.P., but this has been since refuted. Recent identification of Late Paleoindian and later (“Archaic”) evidence has filled in the putative hiatus, but not everyone fully agrees on the details (cf. Bradley 1998; Funk 1977, 1978, 1993, 1996; Mason 1981; Petersen 1991; Petersen and Putnam 1992; Robinson 2001). Brief discussion of temporal periods both before and after the Early Paleoindian period is included here, as Bob Funk briefly mentions in the present publication. Of these, the earliest, preceding period is by far the most tentative.

The “Pre-Clovis” period is conjectural for many analysts, and elsewhere it has been called the “Early Lithic Stage” (or period) by Bob Funk, following broad precedent (Funk 1993:142–143), among various other names. The “Pre-Clovis” period as used here applies to still rare and enigmatic, but now seemingly incontrovertible, evidence for early human presence in the Northeast, at least in southerly areas, before the Paleoindian period proper. Recognition of a “Pre-Clovis” period in the Northeast will be considered heresy by some, but available evidence requires recognition of some sort of cultural manifestation before the time of fluted points, but it is not more formally named here. Thus, there were at least two and likely three recognizable temporal subdivisions of early prehistory in the Northeast before the subsequent “Archaic” and “Woodland” periods (Funk 1993:134–140), dated ca. 9000/8500–3000 B.P. and ca. 3000–500/400 B.P., respectively.

Obviously, we need to be primarily concerned here with early prehistory as it pertains to the context of West Athens Hill. Besides

broad chronological periods, more substantial Paleoindian evidence from the Northeast now helps us refine other aspects of Paleoindian lifeways per se, filling in some but not all of the details. These data include new recognition of both broad and regional technological data on different scales, regional variations in diagnostic artifacts, long-distance mobility and/or interaction (of some sort), and other issues discernable primarily through the study of stone ("lithic") artifacts, long the hallmark of Paleoindian studies in general. New settlement pattern and subsistence data have been accrued for the Northeast over the past 25–30 years, though these are still very limited. I go on to these and other matters, drawing from past personal syntheses dealing with Paleoindian developments and variability (e.g., Petersen 1995:208–214; Petersen, Bartone, and Cox 2000), along with the work of various colleagues, selectively cited, and broadly updating these as appropriate.

Paleoenvironments and Paleoindians in the Northeast

To begin, I need to again strike a cautionary note concerning Paleoindian studies in general and those in the Northeast in particular. As with all archaeological research, we need to continually critique various interpretations derived from our ongoing research and continually refine our perceptions, in spite of many recent promising discoveries (e.g., Gramly and Funk 1990:25–26; Ritchie and Funk 1984:2–3). For example, we might ask again, How well do we understand the origins of Paleoindians and the Paleoindian period in general? What can be said about its duration and variability in time and space? Can it be profitably subdivided, spatially and temporally? What do we think we know and what do we really know about settlement and subsistence regionally? What do we know about other cultural "subsystems" such as mortuary patterns, etc.?

Paleoenvironmental conditions certainly influenced or even determined some details of

Paleoindian life ways, namely subsistence, mobility, and aspects of technology, among others. Changing paleoenvironments were formative within the context of late Pleistocene and early Holocene climatic fluctuations. Modern conditions became much more typical after the onset of the Holocene. Greater stability pertained thereafter (Carr and Adovasio 2002:2–3; Chapdelaine and LaSalle 1995; Custer 1996:97–100; Dent 2002:68–71; Dineen 1996; Eisenberg 1978:17–35; Ellis and Deller 1990; Funk 1976:207–212, 1993:43–62; Karrow and Warner 1990; Petersen and Putnam 1992:19–20; Ridge 2003; Storck 1988b:261–263; Tankersley 1996:21–22).

Paleoenvironments in the Northeast provide an important backdrop for Paleoindian studies, but they are not detailed here. We still need to guard against the simple assumption that hunter-gatherers strictly live at the mercy of local and broader environmental contexts, especially if in doing so we downplay or eliminate social contexts. There is a natural inclination toward environmental determinism in modeling Paleoindian lifeways, but we need to address this, the most "sacred" of "sacred cows." Otherwise we run the risk of denying any role for the historical, contingent, and functional aspects of social interaction within the broader realm of Paleoindian behavior, a point that is returned to below in the discussion of Paleoindian lithic resource acquisition.

The Early Paleoindian period, and presumably the "Pre-Clovis" period before it, witnessed the first human settlement across northeastern North America, and these pioneering circumstances surely complicate the story. Likewise, the typical assumption of very simple, almost "primordial" Paleoindian social systems in all portions of the Northeast (and elsewhere), derived in part from general "ethnographic analogy," may well underestimate these people and the nature of their lifeways.

To be explicit, I am not saying that we should avoid or throw away ethnographic analogy—in fact, quite the contrary—but for

these and other reasons, we need to proceed cautiously as we look beyond the available evidence to interpret and reconstruct various aspects of Paleoindian lifeways. However, all of our models probably represent dangerous simplifications without substantive corroboration. As many would admit, it is certainly difficult to generalize spatially and temporally for most aspects of the Paleoindian period. A significant amount, perhaps most, of the relevant evidence has been likely effaced by environmental and cultural factors over time, and we must interpret the available evidence within the context of very limited, incomplete, and biased samples.

It seems that the Northeast witnessed broad regional patterning as a more or less unitary (and contemporaneous?) set of Paleoindian developments, at least to begin with, where we have sufficient evidence for comparison. Such broad uniformity is sometimes taken as evidence that the "Clovis" fluted point makers and the Early Paleoindian period represent the earliest human occupation of North America and not the successor of some sort of "Pre-Clovis" occupation(s) (e.g., Kelly and Todd 1988; Tankersley 1998a). Alternatively, the Clovis-type fluted point and its broader technological repertoire may just represent the first in a long series of widespread recognizable archaeological "horizon styles," with Clovis arising out of earlier, still somewhat amorphous "Pre-Clovis," occupation(s). Although not necessarily as widespread as Clovis, many other horizon styles, including later Paleoindian ones, variably characterized all subsequent Native American regional and continental prehistory, until the arrival of Europeans and other intruders historically.

Paleoindian Dating and Chronology

Absolute dating and related chronology building for the Paleoindian period have witnessed significant progress over the past few decades in the Northeast. Apparently, we will never have a plethora of reliable absolute dates for Paleoindian sites and site samples

because of oft-disturbed archaeological contexts. In addition, the recently recognized problem of date compression during one or more portions of this temporal span (e.g., ca.10,600–10,200 B.P.) means that full temporal resolution of chronological subdivisions by radiocarbon dating may be impossible (Curran 1996:5; Fiedel 1999; Goodyear 1999:434–435; Levine 1990; Spiess, Wilson, and Bradley 1998:238; Wilson and Burns 1999:233).

The Early Paleoindian period is much better dated than the Late Paleoindian period regionally. Most analysts now recognize distinctive Late Paleoindian period manifestations in different portions of the region, unlike only 20 years ago. The putative "Pre-Clovis" period that preceded the Paleoindian period proper is much less clear relative to both the Early and Late Paleoindian periods regionally. Nonetheless, significant gains have been made here too, depending on one's views about acceptance of "Pre-Clovis" evidence generally (Adovasio 1998; Adovasio, Boldurian, and Carlisle 1988; Adovasio, et al. 1998; Adovasio with Page 2002; Goodyear 1999:435–436; Goodyear and Steffy 2003; McAvoy and McAvoy 1997:176–181, Figures 5.65, 5.68, and 6.1, Table 6.7). Problems inherent in radiocarbon dating and the difficulty of isolating cultural remains in reliable, single-component contexts continue to plague chronology building for all of these periods, however.

Through the efforts of R. Michael Gramly, Vance Haynes, James Bradley, Arthur Spiess, and others, the chronology of the Early Paleoindian period in the Northeast has been increasingly better resolved (Curran 1996; Haynes, et al. 1984; Levine 1990; Spiess, Wilson, and Bradley 1998:232–238; Tankersley, et al. 1997:Table 3). Some analysts have suggested a single, generally uniform chronological sequence for the Early Paleoindian period all across the Northeast (e.g., Gramly and Funk 1990:21–22). Others recognize subregional differences. For example, Bradley, Spiess, and others, using a combination of absolute dates and inference, have produced a

three–four part chronological sequence for the Early Paleoindian period, specifically for New England and the adjacent Maritime Provinces. This sequence includes the Bull Brook–Debert/Vail–Neponset/Michaud–Nicholas phases and point types (Bradley 1998; Spiess, Wilson, and Bradley 1998:Table 6).

A generally similar sequence for the Early Paleoindian period, again with three (or four) temporal subdivisions, was previously established by Chris Ellis, Brian Deller, Peter Storck, and others for the lower Great Lakes. This sequence includes the Gainey–Parkhill–Crowfield phases and Gainey–Barnes–Crowfield point types. However, it has yet to be reliably dated in Ontario and Michigan, and most other nearby areas (e.g., Curran 1996:3–4; Deller and Ellis 1992; Ellis and Deller 1990, 1997, 1998; Lepper 1999:370, Table 3; Simons 1998; Storck 1998). The three phases are tentatively dated: Gainey, ca. 11,000–10,700 B.P.; Parkhill, ca. 10,700–10,500 B.P.; and Crowfield, ca. 10,500–10,400 B.P., or later. Still other partially fluted and unfluted points (e.g., Holcombe) seemingly followed Crowfield, after ca. 10,400–10,200 B.P., until ca. 10,000 B.P. (Curran 1996; Deller and Ellis 1988:255–258; Tankersley, et al. 1997).

Notably, a selected average of three dates from the Paleo Crossing site in northeastern Ohio places the earliest style, Gainey, at ca. $10,990 \pm 75$ B.P., but this is somewhat equivocal due to other, considerably older dates for the same context there (Brose 1994:64–65; Lepper 1999:382). At the Arc site in western New York, Gainey/Clovis lithics have been broadly dated older than $10,370 \pm 108$ B.P. (average) and younger than $11,700 \pm 110$ B.P., but this is an indirect and imprecise association (Tankersley, et al. 1997). In any case, the three–four part sequence has direct relevance for West Athens Hill, as discussed below where the first and perhaps the second subdivision of the Early Paleoindian period, with Gainey and Barnes (Cumberland) types recognized by Bob Funk in the present publication.

Looking more broadly at the earliest dates for the Early Paleoindian period, it minimally

began by ca. 11,000 B.P. in the Northeast proper. It seemingly did not begin much earlier, if at all, before this, in spite of what some have claimed (cf., Bonnichsen, Keenlyside, and Turnmire 1991; Bonnichsen, et al. 1985; Curran 1996:4; Custer 1996:94–97, 2001:69–71; Gramly and Funk 1990:6; Haynes, et al. 1984; Keenlyside 1991:164–166; Spiess, Wilson, and Bradley 1998:232–238). This starting date of ca. 11,000 B.P. is slightly later than what most recognize as reliable dates for the earliest “Clovis”-related dates in the Plains and farther south and west, although the inception of Clovis is argued about there too.

Terminal dating of the Early Paleoindian (fluted point) period in the Northeast is a bit confused by available dates for fluted points and the succeeding unfluted lanceolate points of the Late Paleoindian period. However, the last fluted points were seemingly made by ca. 10,200 B.P.–10,000 B.P., and this seems a reasonable estimate for the termination of the Early Paleoindian period in general (Bradley 1998; Curran 1996; Custer 2001:71; Petersen 1995:208; Spiess, Wilson, and Bradley 1998; cf. Tankersley 1996:22, Figure 2.2).

Not all of the available dates for the Early Paleoindian period in the Northeast are equally reliable. Many individual dates and even suites of dates are potentially rejected by at least some analysts under careful scrutiny (e.g., Brose 1994:64–65; Curran 1996:4–7; Grimes 1979:113; Levine 1990). Thus, we must be ever vigilant about the temptation toward “radiocarbon literalism,” and erroneous and suspect absolute dates must be separated from reliable ones in building local and regional chronologies for the Paleoindian period, as well as others.

For example, this situation pertains to a well-known date of $12,530 \pm 370$ B.P. obtained for caribou remains from the same stratum as an Early Paleoindian fluted point and other late Pleistocene fauna at Dutchess Quarry Cave no. 1. Located near the Walkill River in southernmost New York State, this putative association was identified during the 1960s (Funk, Fisher, and Reilly 1970; Funk, et al.

1969; Kopper, Funk, and Dumont 1980). At one time, it was used to tentatively suggest that the Early Paleoindian period began earlier in the Northeast than in other areas of North America (e.g., Funk 1976:210–211, 1978:16; Snow 1980:121,135).

The Dutchess Quarry Cave association has been (and sometimes still is) erroneously used to help establish the beginnings of early fluted point manufacture across the continent. To his credit, Bob Funk was long suspicious of this association and his later reanalysis, along with paleontologist David Steadman, clearly established that the Dutchess Quarry association was not a reliable one. Other caribou, extinct peccary, and extinct giant beaver bones from Dutchess Quarry caves no. 1 and no. 8 were ultimately assayed with 11 AMS dates between $13,180 \pm 70$ B.P. and $11,670 \pm 70$ B.P. during Steadman and Funk's reanalysis. It now seems obvious that all of these, and perhaps others, were deposited well before the fluted point, and the original date has been rejected for the Barnes-like (or "Cumberland") fluted point (Funk and Steadman 1994:53–55, 73).

Regardless of the precise details in the Northeast, most analysts in the West agree that the Early Paleoindian Clovis type was first made as early as ca. 11,500 B.P. and it lasted until ca. 10,900 B.P. in the southern Plains and Southwest. After ca. 10,900 B.P., the "Folsom" type replaced the Clovis type in the West. Folsom is a smaller, gracile, and more fully fluted type that never occurred in the Northeast, or only on its far-western margins. Parenthetically, the Barnes point type of the Parkhill phase in Ontario and nearby, including New York State, may be broadly related to the Folsom type. In any case, most reliable dates related to Clovis-type fluted points cluster in the period ca. 11,200–10,900 B.P. on the southern Plains (Boldurian and Cotter 1999:118; Collins 1999:40; Haynes, et al. 1984; Holliday 1997:177; Justice 1987:17–21, 27–30; Stanford 1991:2, 1999:289–295, Table 2; Tankersley 1998a).

For some analysts, "Clovis"-type points never occurred in the Northeast, but others

recognize the earliest northeastern fluted points as being quite close to western Clovis points on the basis of technology and stylistic form. Clovis points are sometimes even seen pan-continently (Gardner and Verrey 1979; Justice 1987:21, Map 1; Tankersley 1994:95–96, 1998a, 1998b:10; Tankersley, et al. 1997). For example, the Gainey phase and related point type, ca. 11,000–10,700 B.P., is a Clovis-related development in southern Ontario and nearby areas, as is the Bull Brook phase and type in New England, though perhaps both are slightly later (Bradley 1998; Curran 1999; Deller and Ellis 1988; Spiess, Wilson, and Bradley 1998).

Unless there was some sort of "Pre-Clovis" occupation in the Western Hemisphere, the development of the Clovis-type fluted points must have occurred something like the "next year" after the ancestral Natives arrived in North America (as I jokingly tell my students). Clovis points do not reliably occur on the Siberian side of Beringia, although lanceolate bifaces and core and blade industries are known in eastern Siberia at some earlier time (Derev'anko 1998:221–286, Figures 180–191; Mochanov and Fedoseeva 1996:Figures 3.1–3.6; West 1996:553–556, Figure 12.2).

For some analysts these Siberian bifaces and core and blade forms are linked with early remains in the Western Hemisphere, as at Meadowcroft Rockshelter. An unfluted lanceolate biface and blades date between and earlier than, respectively, $12,800 \pm 870$ B.P. and $11,300 \pm 700$ B.P. at Meadowcroft (Adovasio 1998; Adovasio, Boldurian, and Carlisle 1988:50–52, Figures 1–6; Adovasio with Page 2002:154–160; Carr and Adovasio 2002:7–13). Surely, some amount of time passed between the time Native Americans first set foot on modern-day North America and the invention of Clovis-type fluted points and a broader technological inventory. The question is just how much time passed; was it effectively only a short time, or was there a substantial "Pre-Clovis" period, some longer time between the arrival of the first people and the appearance of Clovis-type fluted points?

Where *bona fide*, the presence of “Pre-Clovis” sites at the extremities of the Northeast and just beyond suggests that Early–Paleoindian–period fluted point makers were not the first colonists of the whole region, at least not in the middle and southerly, non-glaciated portions. Obviously, however, early “Pre-Clovis” people could not have lived in the far northern and eastern portions of the Northeast such as much of New York State until after the late Pleistocene ice variably ablated and water barriers came and went, generally from south to north. Local ablation of late Pleistocene ice apparently occurred after ca. 15,400 B.P. at Newburgh, New York, in the lower Hudson valley, ca. 12,600 B.P.–12,500 B.P. near Albany, and by 11,700–11,400 B.P. near the international border between Vermont and Quebec (Ridge 2003:33–36, Figure 3.8; Snow 1980:102–109).

The first recognizably widespread occupants of much of the region, including New York State, only occurred with the advent of the Early Paleoindian period by about 11,000 B.P. Extensive areas of southern Canada were still uninhabited by people during the Early Paleoindian period, however, apparently because of continuing environmental restrictions. Earlier “Pre-Clovis” occupation was physically possible in the more southerly, non-glaciated portions of the Northeast and other areas that were deglaciated early on, depending on local environments and potential food sources. Such evidence has yet to be reliably recognized anywhere to the north and east of southwestern Pennsylvania where Meadowcroft is located.

The poorly known Late Paleoindian period clearly developed out of and followed the Early Paleoindian period upon abandonment of fluted point manufacture, beginning sometime around 10,200–10,000 B.P., but only in the northernmost portions of the Northeast. Elsewhere to the south, the Early Paleoindian period was directly followed by a brief Late Paleoindian period or it went directly into the Early Archaic period, as described further below. New York State seemingly was the

scene of both contemporaneous Late Paleoindian developments, toward the Lake Ontario–St. Lawrence drainage in the north, and very earliest Early Archaic evidence to the south in the Susquehanna Valley and near the coast.

Distinctive elongated lanceolate, parallel-flaked, and unfluted Late Paleoindian projectile points and related remains only rarely occur in northern New York State. They are known from at least the middle Hudson Valley northward and across the state to the west and northwest, including at least one such isolated find rather close to West Athens Hill (Funk and Schambach 1964:90). They also occur in northern New Jersey and elsewhere nearby (e.g., Kraft 1973). Early Archaic remains were seemingly directly coeval with Late Paleoindian remains before 9000 B.P., occurring near the coast at Staten Island, in the lower Hudson, and in the New York portions of the Susquehanna and Allegheny valleys and southward (Funk 1991:Table 1, 1993:175, 180–188; Ritchie and Funk 1973:38–39).

Bill Ritchie (1953, 1957, 1969:17–19) tentatively identified Late Paleoindian remains early during his Paleoindian research. By the 1950s and 1960s, Ritchie had recognized scant Late Paleoindian evidence in mixed contexts at the Brewerton site in upstate New York, among multiple Paleoindian components at the Reagen site in Vermont, and elsewhere nearby, as in Ontario and New Hampshire. Additionally, Funk, along with a few others (e.g., Kraft 1973; Mason 1962; Prufer and Baby 1963), long ago recognized Late Paleoindian remains. These investigators based this attribution on a small number of generally isolated finds of distinctive projectile points regionally. Like others, Bob suggestively postulated a northern orientation toward the Great Lakes for the Late Paleoindian finds (Funk 1976: 228–229, 1978; Funk and Schambach 1964:90; Ritchie and Funk 1973:7). Available samples were so insubstantial, however, that they were afraid to generalize about their discoveries.

The Late Paleoindian period has been dated at just a few sites in the Northeast. In its

briefest span, where it is represented at all, as probably pertains in New York State, the Late Paleoindian period spanned a few hundred years just before or after 10,000 B.P., as noted above. However, in more northerly areas the Late Paleoindian period surely extended from about 10,000 B.P. to 9000 B.P. or perhaps later (Doyle, et al. 1985; Ellis and Deller 1990:54–55; Jones 2003; Petersen, Bartone, and Cox 2000:115–119; Stanford 1991; Wright 1995). Some have argued that it lasted as late as 8000 B.P., at least in the most northern and eastern portions of its distribution, as on the Gaspé in Quebec and later still to the north (Chalifoux 1999; Chapdelaine 1994; Dumais 2000; Dumais, La Roucher, and Poirier 1996; Wright 1995).

Regardless of when the Late Paleoindians ultimately disappeared and were replaced by/developed into something else, they were ultimately followed everywhere south of the Subarctic (Canadian Shield) by one Archaic manifestation or another, using different projectile point forms. Most typically, bifurcate base points or an equivalent point type provide the earliest unequivocal evidence of the Early Archaic period, dated ca. 8500–8000 B.P., in the northern areas where the Late Paleoindian period pertained (e.g., Thomas 1992). Within the northern areas of the Northeast, the Early Archaic period only emerged roughly within the time span from 9000 to 8000 B.P. In contrast, the Early Archaic period clearly emerged much earlier, by ca. 10,000 B.P., in more southerly and westerly portions of the Northeast such as in the Mid-Atlantic, Pennsylvania, and the Midwest. Very little, if any, evidence of the Late Paleoindian period, as defined here, is known in the latter locales.

As was apparently the case in New York State, fluted points in more southerly areas of the Northeast and farther south were followed directly by what is generally recognized as the earliest of the Early Archaic evidence. These included Dalton (alternatively said to be Late Paleoindian or Early Archaic), Kirk, Palmer, and other point types, which were followed

by bifurcate points later on. The Early Archaic also saw the onset of “ground stone” tools and other new technological and subsistence innovations in some cases. Some spatial overlap likely occurred between Late Paleoindian and very early Early Archaic remains within a broad east–west zone across the Northeast. This zone of overlap seemingly included northern Ohio, southernmost Ontario, portions of New York State, northern New Jersey, Pennsylvania, and elsewhere (Ellis and Deller 1990; Funk 1977, 1978, 1991, 1993; Lantz 1984; Lepper 1999:377–380; Morse 1998; Petersen, Bartone, and Cox 2000:Figure 1; Tankersley 1996).

The Early Archaic period per se endured from ca. 10,000 B.P. (or 9000 B.P.) to ca. 8000 B.P. (or 7500 B.P.), with dating variation depending on regional (and investigator) differences. The subsequent Middle Archaic (ca. 7500–6000 B.P.) and Late Archaic (ca. 6000–3000 B.P.) periods constitute the balance of the preceramic period in the Northeast (Funk 1993:175–198; Lepper 1999; Petersen 1991, 1995:214–222; Petersen and Putnam 1992; Ritchie and Funk 1973:37–51; Robinson 1992, 2001). I should reiterate that the “Pre-Clovis” and Late Paleoindian periods, as conceived of here, were at best enigmatic and little known or completely unknown in the Northeast as recently as 25–30 years ago, depending on whom one checks. Thus, these chronological units (and most others) are at best “works in progress.”

Paleoindian Lithic Technology, Lithic Analysis, and West Athens Hill

Not surprisingly, we are on more secure ground when examining Paleoindian technology, specifically lithic tool technology, given the durability of these non-perishable remains. However, what about the perishable industries related to wood and other plant fibers, skins and furs, and bone and antler? Beyond the lithic tools, what was the full nature of Paleoindian hunting gear? Did the Paleoindians have any accessory travel equip-

ment such as snowshoes, sleds, or toboggans? What did their houses consist of, how big were they, and were they variable across different environments of the Northeast, from the southern areas such as the Ohio Valley and the Mid-Atlantic to northern ones such as New York State, New England, and around the Great Lakes? We have few answers yet, but ethnographic analogy can be judiciously employed here, as for interpreting West Athens Hill.

I remember having my breath taken away when I first saw the newly installed diorama of the West Athens Hill Paleoindians at the NYSM during the late 1980s, I believe. There it was for the first time for me: a comprehensive picture of the Early Paleoindian period in 3-D and full size, as if I was there at West Athens Hill too, and not just lithic tools!

I am still drawn to the stone toolmaker sitting near the West Athens Hill chert outcrops (on the left side of the diorama) and a woman and several children processing a dead caribou (in the right foreground). The composition is balanced by the central hunter who points up the valley toward an approaching caribou herd, with a light scatter of trees across the expansive landscape and the Helderberg Escarpment and the Catskill Mountains in the far distance. For me, this was the very first time that I could fully visualize Paleoindian lifeways in such detail. The West Athens Hill scene has surely already affected multiple generations of visitors to the NYSM, much like the diorama of the Paleoindian fire maker at the Royal Ontario Museum in Toronto and the newer, larger Paleoindian caribou hunting and butchering diorama at the Pequot Museum in Connecticut.

Unfortunately, in this case we have little else besides the lithic artifacts, limited local paleoenvironmental data, and ethnographic analogy, borrowing from historically known hunter-gatherers, to inform us about this scene at West Athens Hill around 10,800 years ago. Therefore, much of the close detail in the West Athens Hill diorama is by necessity the

product of inference and conjecture. Some critics would have a field day with the underlying assumptions represented in this wonderful diorama (e.g., male tool knapper and hunter, woman processing the caribou, small size of the group, etc.). However, no matter the coarse, inferential nature of our reconstructions, we should not be stultified by the lack of direct evidence in making such public interpretations, and our models obviously need to include both evidence and imagination. Recognizing this, we still need to assess and reassess our maximization of the evidence, mainly lithic tools and the debris of lithic tool manufacture.

Obviously, all the lithic artifacts, including tools (sometimes the only specimens called “artifacts” by Funk and others) and flakes/debitage, are an important foundation in Paleoindian research. Likewise, perhaps the most important part of Funk’s work at West Athens Hill is his extensive discussion of the lithics, in no small measure because West Athens Hill was a lithic material acquisition, or “quarry-workshop,” site, where high-quality Normanskill chert was quarried. The combined archaeological samples surely represent an incomplete but broadly representative set of the inorganic artifacts employed and/or produced by the Paleoindians at West Athens Hill. Parenthetically, Funk does us a great service by systematically comparing the West Athens samples with various other relevant Early Paleoindian ones from local and regional contexts in the present publication.

Unlike some analysts of his generation and others too, Bob usefully recognized that the West Athens Hill lithic samples represent a continuum of production stages. In other words, the archaeological specimens represent different points in a cyclical, not simply linear, process of acquisition, production, use, reuse, and discard, rather than an “assemblage” of all equally finished tools in the sense of a fixed, final “tool kit.” However, as we see in Funk’s data and the reconstructed diorama at the NYSM, a host of other domestic activities were also undertaken at West Athens Hill,

representing more than just stone procurement and tool production. For the most part the lithic “reduction” activities can be sorted out from these other activities, as Funk has profitably done in the present case. Lithic technology and assemblage composition are obviously of primary importance at many Paleoindian sites, even where site contexts have been extensively disturbed by natural and cultural post-depositional factors and not preserved in a pristine state, nor directly dated reliably, as seen at West Athens Hill and most other Paleoindian sites.

Thus, the analysis of lithic technology has been one of the most productive aspects of recent Paleoindian research in the Northeast, yet it cannot be exhaustively reviewed here. Even this aspect of recent research is rather complicated, however. The analyst of Paleoindian (and other) lithic technologies faces problems of preservation, raw material source identification (often only done macroscopically and therefore tentative), adequate sample sizes (in light of typically small to modest-sized samples), and reconstruction of the reduction processes. Paleoindian tool samples consist of almost inevitably mixed, incomplete, broken artifacts and partial rather than whole assemblages (Gramly and Funk 1990:19–24).

Regional analysts have recently made very significant strides in the area of Paleoindian and other early lithic analysis and tool kit definition. Numerous examples can be cited, but sample variability is still enigmatic (e.g., Adovasio, Boldurian, and Carlisle 1988; Boisvert 1998; Carr 1989; Carty and Spiess 1992; Cavallo 1981; Cox 1986; Curran 1984; Deller and Ellis 1988, 1992; Ellis and Deller 1988, 1990, 1997; Funk and Wellman 1984; Goodyear and Steffy 2003; Gramly 1982, 1988a, 1998, 1999; Gramly and Funk 1990; Gramly and Summers 1986; Grimes 1979; Hill 2002; Jackson 1998; Jones 1997, 2003; Julig 1994; Lothrop 1989; Lowery 1989; McAvoy and McAvoy 1997; Moeller 1980; Sanders 1990; Shott 1990, 1993, 1997; Simons, Shott, and Wright 1984; Spiess and Wilson 1987;

Storck 1983, 1997; Tankersley 1995). Quite significantly, continuities can be demonstrated between the Early and Late Paleoindian periods on the basis of lithic technology alone. At the same time that projectile point and other tool forms changed morphologically and sometimes technologically within each of these two major subperiods, a remarkable degree of broad continuity is demonstrable within each subperiod and also between them (e.g., Doyle, et al. 1985; Jones 1997; Petersen, Bartone, and Cox 2000:133).

Paleoindian Regional Distributions, Lithics, and Mobility

Moving on beyond Paleoindian chronology and technology, issues of broad regional distributions and regional differences are likewise important, along with settlement pattern issues per se. First, a distinct boundary seemingly pertained across the more northerly portions of the Northeast during the Early Paleoindian period, beyond which to the north few, if any, fluted points have ever been discovered, most likely marking the approximate northernmost limit reached by fluted-point makers during the late Pleistocene epoch. This boundary must have been environmentally circumscribed and does not logically seem to have been sociocultural in origin.

For example, until last year absolutely no fluted points had ever been found in the province of Quebec, whether in southerly areas near the St. Lawrence River, the modern Subarctic, or the Arctic portions. This absence occurs in spite of a very intensive and extensive research program across much of Quebec over the past 30–40 years. It is clear that fluted points are largely absent in Quebec, probably as the result of widespread marine inundation in the St. Lawrence Valley, ice to the north, and other localized environmental restrictions at the time of fluted point manufacture. In 2003, the first notable exception to this generalization about Quebec, a single fluted point site, was discovered in the extreme southeastern uplands near Lac Megantic. This new discov-

ery is very close to the border between Quebec and Maine (and not far from the Vail and Adkins Early Paleoindian sites) (C. Chapdelaine, personal communication 2003; Chapdelaine and LaSalle 1995). Fluted points do not occur anywhere else in Quebec as far as we know, not farther east in Labrador and Newfoundland, nor anywhere farther north or to the east (into the High Arctic) (Wright 1995:24–29, Map 1).

Of comparable significance, a directly analogous northern boundary for the distribution of fluted points (and evidence of extinct megafauna) was long ago defined in the Midwest–Great Lakes region, the so-called “Mason-Quimby line,” named for those who first defined it, Ronald Mason and George Quimby. This boundary runs roughly east–west across the upper Great Lakes of northern Ontario, Michigan, and Wisconsin. As in Quebec and southern Ontario to the east, the equivalent of the “Mason-Quimby line” extends westward into the Prairie Provinces of Canada, marking the northernmost limit of known Early Paleoindian remains (and megafauna again). This boundary extends far westward close to but not fully to the Canadian Rockies, where fluted points are found much farther north within the presumed north–south “ice-free corridor.” This hypothetical corridor is modeled by some as the late Pleistocene route for the first human migrants into the continent south of Alaska and the Yukon. In fact, small numbers of Clovis-like fluted points occur all along the eastern side of the Canadian Rockies and into Alaska (Lepper 2002:81–83; Mason 1981:98; Storck 1988b:Figure 1; Wilson and Burns 1999; Wright 1995:Map 1).

Glacial ice, fresh water, marine water, and other peri-glacial ecological conditions may have restricted the regular presence of Early Paleoindians in northern areas over much of this huge region. Notably, Late Paleoindian developments, as defined here, ultimately occurred well north of the “Mason-Quimby line,” or the equivalent northern limit of fluted points elsewhere, including portions of

southern Quebec, northern Ontario and Michigan, and beyond. Once glacial ice had finally retreated and food resources allowed habitation, subsequent Late Paleoindian occupation extended into portions of the modern Subarctic and the southern margins of the Arctic, to the west of Hudson’s Bay, for example (Wright 1995:96–99, Map 1). Broadly speaking, Late Paleoindian remains thus reached a more northerly distribution than did fluted points in substantial portions of the continent. However, as noted above, Late Paleoindian developments never extended very far (perhaps 300–400 km) to the south of the “Mason-Quimby line” in the Northeast, at least not to the east of Lake Michigan, probably because of contemporaneous Early Archaic populations in many places after ca. 10,000 B.P.

Thus, Early and Late Paleoindian remains do not have the same geographic distributions in the Northeast, and they spatially overlap across a relatively narrow zone in northerly portions. This particular area of overlap includes an east-west zone of southern Ontario and northern Ohio, much of upstate New York, a bit of Pennsylvania, New Jersey and all of New England (Petersen, Bartone, and Cox 2000; Wright 1995). Curiously, the southern edge of both the Late Paleoindian zone of distribution and the zone of overlap closely parallel the farthest extent of Pleistocene glaciation in the Northeast (Gardner 1989:11). Again, it would be difficult to eliminate the likelihood of environmental influence on Late Paleoindian developments in this case, but seemingly distinctive socio-cultural factors may well have been relevant too, given the apparent contemporaneity of Early Archaic populations in the region.

Another broadly recognizable Paleoindian distributional pattern in the Northeast pertains to differences between Early Paleoindian sites, site sizes, lithic usage, and presumed mobility to the north and south of the extent of maximum Pleistocene glaciation regionally. This hypothetical boundary, an organizational distinction variably defined by David Meltzer,

William Gardner, and others, has been called by some the “biotic Mason-Dixon line.” It divides Early Paleoindian sites found in the north within the extent of maximum glaciation from those to the south and beyond the reach of glaciation (e.g., Gardner 1983:53, 1989, 2002:98–100; Goodyear 1999; Lepper 1999, 2002:81–83; Meltzer 2002:163–164; Meltzer and Smith 1986). This second east–west boundary is situated well to the south of the “Mason-Quimby line” and it marks regional distinctions between northern and southern portions of the Northeast (and farther beyond to the south), correlating with paleoenvironmental differences during the Early Paleoindian period.

This rough boundary was also at least partially environmentally determined and may have marked broad scale differences in the sociocultural foundations for some of the earliest Paleoindians during the Early Paleoindian period based on differences in subsistence adaptations and resultant settlement patterns from north to south. In the glaciated area to the north, including southern Michigan, southern Ontario, New York State, New England, and the Maritime Provinces, a greater range of Paleoindian site types and certainly site sizes has been recognized, for example.

In this northern, glaciated zone, Early Paleoindian sites are sometimes quite large, though small sites seem to occur more commonly. This pattern pertained at least for the earliest portion of the Early Paleoindian period before the widespread establishment of closed forests. Unfortunately, we know too little about the Late Paleoindian period to characterize and compare it in this way. Also of note, many sites of Early (and Late, as far as we can tell) Paleoindian vintage in the glaciated northern zone are single–component, short-term occupations, or substantially so, with occupation redundancy, if present, mostly confined to other Paleoindian components, rather than later ones.

In the non-glaciated portions of the Northeast to the south, however, virtually all Early Paleoindian sites are regularly small,

fewer site types are seemingly represented, and often times known sites include multiple components, with Archaic and Woodland occupations mixed in, as presently understood. These distinctions between the north and the south suggest that one or more factors differentiated these two zones across the Northeast, from the Great Lakes eastward to the present Atlantic coast, during the Early Paleoindian period.

Logically, analysts like Gardner, Meltzer, and others have suggested that late Pleistocene paleoenvironments differed between these broad zones, producing different subsistence practices and settlement patterns from north to south. Large Early Paleoindian sites, sometimes consisting of contemporaneous aggregation, occur in the northern glaciated areas where the landscape was initially open, with tundra or more likely tundra parkland present at the time of occupation, and caribou hunting pertained, at least when and where “pioneer” occupation was characteristic. In this view, migratory caribou and perhaps other large game helped determine subsistence and settlement in the northerly occupied portions of the Northeast for the Early Paleoindians, at least initially.

In marked contrast, more closed forests were present during all of the late Pleistocene epoch in the non-glaciated southern portions of the Northeast and farther south into the Southeast *per se*, albeit the forests changed under different paleoenvironmental conditions and different plant and animal resources would have been available. For example, species not found together today sometimes co-occurred in the non-glaciated areas due to ecological compression, as we know from paleontological analysis of late Pleistocene deposits in caves and natural traps (Adovasio with Page 2002:50; Funk and Steadman 1994; Lepper 1999:366). More importantly, large, gregarious herd animals were not common within the continuously forested areas, and this circumstance had direct effects on the nature of Early Paleoindian subsistence in this generalized model.

Instead, in non-glaciated areas more typically solitary game species such as deer, elk, and moose would have been emphasized by the Early Paleoindians, and other foods such as small game, plants, and fish, would have required different landscape utilization patterns than those seen in the north. Such differences would have directly affected Early Paleoindian mobility and potentially other factors as well, including patterns of lithic raw material acquisition, for example (Carr and Adovasio 2002:Table 7; Custer 1984:48–60, Figures 6 and 7; Dincauze 1993a:283–285, 1993b; Ellis et al. 1998:152–154, Gardner 1983, 1989:24–34, Figure 5, 2002; Goodyear 1999:433–435, 441–444; Lepper 1988, 1999:374–376; Meltzer and Smith 1986; Spiess, Wilson, and Bradley 1998). This latter point, concerning lithic raw material acquisition, is returned to below, especially as it pertains to West Athens Hill.

Distribution issues related to smaller-scale, intraregional spatial differentiation and tentative recognition of distinctive populations during the Early Paleoindian period have been addressed by various researchers in the Northeast with variable success. These differences have been primarily identified using typological, tool sample composition, and especially lithic raw material variation. For example, Paleoindian analysts typically differentiate between “local” and “non-local” (or “exotic”) lithic raw materials in some comparative fashion (for example, those found farther than 40 km away from a given site are non-local, “exotics” [Gould and Sagers 1985:119; Meltzer 1989:31]). Regardless of the precise definition of local vs. non-local, there are generally two ways to broadly explain the presence of exotic lithics within a given sample: “direct” acquisition, in conjunction with some degree of group mobility, and “indirect” acquisition, or some form of transfer from one group to another.

Macroscopically distinctive quarry sources are generally assumed in these discussions, leaving aside the issue of secondary sources for the most part, as well as the reliability of source

identifications. Regardless, most analysts of Paleoindian lithic distributions assume that virtually all lithics were obtained through direct acquisition for one reason or another, except perhaps in the most extreme cases. The assumption that macroscopic identifications are reliable may be most problematic. Thus, analysts typically reconstruct far-reaching, long-distance group mobility to explain the presence of non-local/exotic lithics at Early Paleoindian sites, whether coupled with (or “embedded” in) subsistence or not. These lithic distributions serve as the foundation for establishing the territorial range of individual groups (Curran and Grimes 1989; Deller 1989:Table 8.4; Ellis 1989:146; Lothrop 1989; Meltzer 1989:12–13, 31, Table 2.2; Seaman 1994; Spiess and Wilson 1989:95, Table 4.1; Storck 1988a; Storck and von Bitter 1989).

A minority of analysts have casually alluded to or explicitly recognized the likelihood of some, perhaps typical, exchange of “exotic” lithics during the Early Paleoindian period in the Northeast and elsewhere (e.g., Frison 1988:94; Gramly and Summers 1986:98; Hayden 1982; Petersen 1995; Snow 1980: 139–141, 152; Tankersley 1989:Table 11.3, 1990:292, 1995:45, 1998b:16). This topic deserves detailed consideration beyond what it can be given here because the practice of Paleoindian lithic exchange would necessarily confound models of group mobility and group territories, but few analysts are so daunted.

In fact, more or less precise band territories for the Early Paleoindian period have been suggested for New York State and nearby areas, as well as New England and the Maritime Provinces, among others. In some cases, these are more akin to what are called “style zones” based on points and specific individual settlement patterns based on lithic raw materials. For example, Gramly (1988c) and Spiess and others (Spiess and Wilson 1987, 1989; Spiess, Wilson, and Bradley 1998) have recognized important spatial subdivisions in New York State, New England, and adjacent areas. In the most concrete local example, Gramly (1988c:269–270, Figure 1)

has posited the existence of three Paleoindian “culture areas, or at the least, regions” in New York State.

Gramly’s three territories are correlated with three “seasonally transhumant bands” of Early Paleoindians in New York State (Gramly 1988c:265, Figure 1). The first of these Early Paleoindian “bands,” the westernmost, had a range that extended from western New York State into Ohio and Pennsylvania, based on visually distinctive Flint Ridge and other Ohio lithic materials. The central “band” employed primarily Onondaga cherts from upstate New York, among others, but with southward links to the Susquehanna Valley in Pennsylvania. The third Early Paleoindian “band” in Gramly’s model was situated within the Hudson and Mohawk valleys, as marked by common usage of Normanskill and other Hudson Valley cherts.

This latter territory included the West Athens Hill chert source and occupation site within a broader territory centered on the Hudson valley (Gramly 1988b:Figure 1). Of note, the vast majority of the lithic tools (not debitage) at West Athens Hill, roughly 98 percent, were seemingly made from the immediately available (and thus very local!) Normanskill chert. Non-local exotics at West Athens Hill include distinctive Pennsylvania jasper from the southeastern part of the state, western Onondaga chert from western upstate, and Upper Mercer chert from eastern Ohio. Not all of these exotics are easily accounted for within a direct acquisition model, as previously discussed by Funk (1976:205, 223–226).

Spiess and others have comparably suggested the existence of “a New England–Maritimes Paleoindian region” used by “two or more distinct bands” on the basis of fluted point stylistic variations and lithic raw materials there (Spiess and Wilson 1989:82). These and other data beyond New York State and Maine have been used to model an overall series of “lithic supply zones,” or band territories, from Nova Scotia to Indiana and others southward. The latter include the Mid-

Atlantic region of Delaware, Pennsylvania, and Virginia (e.g., Custer and Stewart 1990:Figure 9; Lowery 1989; Seeman 1994:Figure 2).

In Ontario, similar evidence of differentially represented lithic materials has been comparably used to suggest different band preferences and even the use of some lithics as conscious (ethnic-like) group markers. These patterns also apparently changed during the span of the Early Paleoindian period and later in Ontario, with a reduction in scale and thus, presumed mobility over time (e.g., Deller 1989; Ellis 1989; Ellis and Deller 1997:12, 14–15; Storck 1984, 1988a; Storck and von Bitter 1989). The possibility of limited exchange is also suggested in Ontario (e.g., Ellis and Deller 1990:54). Is it possible that these changes over time represent transformations in intergroup exchange for some reason, rather than a reduction in mobility?

These and various other analysts have generally assumed that lithic raw materials and tools were transported by Early Paleoindians largely, if not solely, through direct acquisition of some sort. Individual Paleoindian groups (or representatives thereof) directly acquired their needed lithic materials themselves, either at a primary source such as West Athens Hill or from a secondary source such as cobbles found in drift or till. In other words, this model assumes that the Paleoindians who directly acquired various lithic raw materials were also the same ones that ultimately used them to fashion needed lithic tools. This model is also commonly applied to Early Paleoindians in other areas well beyond the Northeast (e.g., Goodyear 1989; Meltzer 1989). This model of direct acquisition of lithics is typically related to and underpins overall reconstruction of wide-ranging mobility among Paleoindian hunter-gatherer groups.

Many researchers acknowledge that exchange (or trade) of lithic raw materials may be relevant in the most extreme cases where exotic lithics occur far from their geological sources. This explains, for example, the

presence of Knife River chalcedony, or chert, from North Dakota at the Lamb site in New York State (Gramly 1988b, 1999), or Alibates chert from Texas in western Pennsylvania (Lantz 1984; Tankersley 1990). However, more local lithic materials, recovered say 200–300 km from their expected sources, are typically related to direct acquisition (e.g., Curran and Grimes 1989; Deller 1989; Deller and Ellis 1988; Ellis 1989; Ellis and Deller 1997; Gramly 1982; Spiess and Wilson 1989).

Many analysts thereby relate Paleoindian lithic acquisition to hunter-gatherer annual subsistence rounds and thus, lithic acquisition was embedded within subsistence mobility, following the ideas of Lewis Binford (1979) (e.g., Gramly 1980:828–829, 1988c:267–270). However, not all see lithic raw material acquisition as part and parcel of the subsistence round, but instead it may have been “disembedded,” or “uncoupled,” with a separate, specialized direct acquisition strategy or strategies at work (e.g., Seeman 1994; Spiess and Wilson 1989:89, 97). Of related interest, the pattern of long-distance lithic acquisition and transport in the northern portions of the Northeast, whatever the mechanism, apparently contrasted with more southerly portions of (and farther southward beyond) the Northeast in correlation with greater and lesser degrees of mobility, as noted above. So, if we were to model the presence of non-local, exotic lithics as at least the partial product of Paleoindian exchange, rather than mobility alone, we would need to account for rather different exchange patterns between northerly and southerly areas.

In more northerly areas of the Northeast, support for direct acquisition of lithic materials over long distances is drawn from the form of the distribution (or shape of the “fall-off curve”) of Paleoindian lithic materials over distance, where it is said to be quite steep or sharp, rather than gradual. Gradual fall-off lithic frequency distributions are believed to pertain archaeologically where “down-the-line” exchange is represented and a sharp fall-off supposedly represents direct acquisition

(e.g., Ellis 1989; Meltzer 1989). However, it is reasonable to question what effect the small number of identified sites and the much smaller number of studied sites with adequate samples would have.

Leaving aside the reliability of source attributions in the first place, a sharp falloff might be the only pattern discernible without an adequate set of lithic samples drawn from a geographically extensive and statistically significant number of sites. This and other aspects of the argument suggest that the predilection to interpret exotic lithics as evidence of far-ranging mobility may be akin to environmental determinism, perhaps in reality “lithic determinism,” among regional researchers. Some of these readily propose the centrality of lithics for the Paleoindians and even explicitly call it just that (e.g., Carr 1989:21; Ellis and Deller 1997:12; Gardner 1983:57, 1989:24–34, 2002:97–100). Lepper (2002:85) correctly notes, however, that: “lithic determinism is illusory. It is a function of how the archaeological record formed, not a reflection of Paleoindians having tethered their foraging radius to a chert [or another] quarry.”

A predilection toward lithic determinism among Paleoindian analysts is understandable because there is little else in the archaeological record besides lithics to work with in the formulation and resolution of research questions. Most analysts apparently believe that Early Paleoindians would not have been present in sufficient numbers to have exchange partners in the Northeast (and elsewhere). Very limited, widely spread groups may well have been characteristic among the very first Paleoindian pioneers in the Northeast. Pioneering must have come to an end in most areas relatively quickly, perhaps only a few generations or less than 100 years, a brief instant when compared to the full duration of the Early Paleoindian period, spanning 1,000 (uncalibrated) years or so. Once the earliest Paleoindian pioneers filled much or most (even all) of the extent of their ultimate distribution, exchange and other forms of interaction would be logically expect-

ed as a means of maintaining social connections, exchanging marriage partners, etc., some or all of which must have been critical for survival.

Suffice it to say here, a process of information exchange was relevant over immense distances during the Early Paleoindian period and later as well. Such interaction is obviously manifested by a strong degree of common projectile point stylistic change over time (e.g., Clovis/Gainey to Folsom/Cumberland/Barnes types, etc.) and other innovations across much of eastern North America, along with similar coeval developments during both the Early and Late Paleoindian periods. Although still incompletely understood, these more or less synchronous changes may have been linked to intergroup exchange of lithics and perhaps perishable items as well.

This exchange of information and tangible objects apparently diminished progressively over time, especially with the onset of the Late Paleoindian period and thereafter, with the ultimate reduction of point style distributions across broad regions, but it nonetheless persisted with a strong degree of synchronicity. Lithic raw material utilization became progressively more localized as well during this same temporal span. By the onset of the Early Archaic period, lithics were mostly local, at least in the far Northeast, even while synchronous stylistic changes continued to a large degree across the region (Petersen 1995).

Ethnographic analogy is variably appropriate and useful within the context of broad Paleoindian research, but here is a case when it seems potentially quite useful and even critically important. Apparently, differences in geography and time have led most Paleoindian researchers to dismiss ethnographic analogy as irrelevant in modeling lithic raw material distributions in the Northeast. Nonetheless, they are willing to employ analogy for modeling other factors such as tool production and use, subsistence, general mobility, and social structure, among others (e.g., Custer and Stewart 1990:310–315; Funk 1976:226–228; MacDonald 1968:129–134;

Ritchie and Funk 1973:336; Seaman 1994:283–284; Shott 1997:215).

Hunter-gatherer evidence drawn from around the globe may be relevant for Paleoindian lithic acquisition studies in spite of cautionary tales to the contrary. Ethnographically and archaeologically recorded Arctic hunter-gatherers and Aboriginals from Australia seem appropriate here. This is the case based on severe environments, resultant far-ranging mobility (for reasons other than lithic acquisition), a relatively limited tool kit (albeit no fluted points!), and ethnographic records of lithic usage, including extensive exchange (Hayden 1979; Loring 2002:166; Shott 1997:215; see Funk 1976:226). Among both Arctic and Australian hunter-gatherers, the propensity for information sharing as a mechanism of risk minimization fostered interaction networks intraregionally and interregionally long ago, cumulatively spanning Australia and large areas within the Arctic and beyond prehistorically (Loring 2002; Lourandos 1997:40–43).

Paleoindian Settlement Patterns

Recognizably bounded, if sometimes huge, lithic utilization territories for Early Paleoindians have enabled many researchers to refine their sense of Early Paleoindian settlement patterns per se in the Northeast. In fact, it is no longer fashionable to call Paleoindians “free wandering” in terms of their settlement patterns and instead, they are more often designated as “restricted wandering,” although whether loosely or tightly restricted is an open question (cf. Ritchie 1983:30; Ritchie and Funk 1973:336; Snow 1980:128–129, 150; Storck 1988a:247).

Suggestion of “central-based wandering,” where territories are limited in size and a central base serves as a focal point, has been briefly suggested but quickly rejected for Paleoindians (Funk 1976:224–227). Regardless of the precise terminology, at present Early Paleoindians are more or less uniformly recognized as having lived within large but ulti-

mately fixed geographic territories, at least for those in “second generation,” non-pioneer mode. This minimally pertained in the northernmost areas of the Northeast inhabited at the time, including New York State (e.g., Dincauze 1993a; Ellis and Deller 1990, 1997).

In light of the uncertainty about Paleoindian group mobility and/or exchange on multiple levels, it should come as no surprise that local aspects of settlement patterns are poorly known in the Northeast for both the Early and Late Paleoindian periods, including both northern and southern areas. This observation pertains to most intrasite and intersite analyses. Contemporaneity is a central problem both within and between sites, in other words. The degree of coeval residential aggregation versus long-term composite occupation at any given site, the degree of local and regional mobility, and other variables remain poorly known unless evidence of contemporaneity can be established. Similarities in point forms, broader tool sample composition, and raw materials are all used, however, to help establish (roughly) contemporaneous components at some Paleoindian sites. Many available reconstructions of Paleoindian settlement patterns are still likely to be illusory. As Ritchie and Funk (1984:3) aptly pointed out in their review of an important collection of Paleoindian studies 20 years ago, “in our opinion the search for the single occupation remains an elusive chimera.”

Significant effort has been expended over the past few decades in delineation of intrasite settlement patterning through careful excavation and documentation at particular sites. This is certainly very important and commendable work, and definition of internal site settlement patterns has proven to be highly rewarding. Discrete Paleoindian activity areas are demonstrable in some cases (Carty and Spiess 1992; Deller and Ellis 1984, 1992; Ellis and Deller 2000; Funk 1976:222–223; Gramly 1982, 1984, 1988a; Gramly and Lothrop 1984; Grimes 1979:Figure 4; Grimes, et al. 1984; Seeman 1994; Spiess and Wilson 1987; Spiess, Wilson, and Bradley 1998:Figure 13).

Artifact (and rare feature) distribution data provide a means for comparison within and between sites, as in the present case at West Athens Hill, among others. Nonetheless, the shallow, non-stratified, near surface condition of nearly all such sites means that cultural and natural post-depositional disturbance has oftentimes partially or extensively compromised the archaeological contexts, accounting for the paucity of reliable radiocarbon dates. For example, I strongly suspect that a significant degree of post-depositional disturbance, both natural and cultural, pertains at West Athens Hill. Even though West Athens Hill has never been plowed, the shallow, largely rocky context must have enabled various forms of natural disturbance to alter the artifact distribution to some (large?) degree. The putative artifact “clusters” at West Athens Hill may be more fortuitous than real, especially between the two major strata in Area B. Funk clearly recognized this during his reanalysis of “clusters” at West Athens Hill between the 1970s and the present publication. In fact, the case might be made that supposedly discrete artifact clusters overlapping spatially between the strata at West Athens Hill are, in fact, precisely the same clusters across strata, with artifacts differentially and variably transported by natural agents between them.

Likewise, the still enigmatic nature of Paleoindian site location parameters across the landscape means that most sites likely remain to be discovered and/or have been permanently lost through disturbance. The very antiquity of Paleoindian sites and known environmental transformations over a long span suggest that many have been destroyed by contemporaneous and later natural landscape alterations such as rising lake and ocean levels, river channel migration, and other forms of erosion. Still other sites certainly lie deeply buried, especially in the non-glaciated portions of the region (e.g., Goodyear and Steffy 2003; McNett 1985). It seems unlikely that we will ever fully understand the complete range of Paleoindian site types and inter-

site settlement patterns, given the modest roster of sites currently known across the region for all major period subdivisions (Early and Late) and subperiods thereof.

Yet, 30 years ago Ritchie and Funk (1973:5, 333–334) were able to define at least four Paleoindian site types in New York State and the broader Northeast, including “quarry-workshops,” “small camps,” “major, recurrently inhabited camps,” and “rockshelter or cave camps.” Obviously, the “quarry-workshop” Paleoindian site type was directly modeled after West Athens Hill (Ritchie and Funk 1973:5, 333–334). Still other Paleoindian site types have been variably recognized in the Northeast since 1973. Supplemental site types include, but are not limited to, “kill-butchery,” “burial sites and caches,” and “isolated finds,” if one chooses to call the latter category sites per se (Gramly and Funk 1990:13–19). Various other permutations exist as well (e.g., see Carr and Adovasio 2002:29–34; Custer 1996:107–110; Ellis and Deller 1990:51–52, 60–61; Gardner 1983:53–56; 1989:24–34; Lepper 1988:39–41; Tankersley 1996:26–27, 32–33, 35). More work remains to be done to fully explore Paleoindian distribution evidence and settlement patterns on multiple levels, both within and between sites.

Paleoindian Subsistence Patterns

Some researchers think that they are on firmer ground when discussing Paleoindian subsistence patterns in the Northeast. As with absolute dating in the different areas, several precious discoveries regarding Paleoindian subsistence have been recently made, but this topic is still hampered by poor preservation of nearly all subsistence remains in nearly all cases. In each case from Early Paleoindian contexts of varying sorts, caribou and possible caribou remains are now known from the Whipple site in New Hampshire and Bull Brook in Massachusetts, as well as Udora in Ontario and supposedly Holcombe in Michigan. Beaver remains have been identified from Bull Brook, and Arctic fox and hare

are known from Udora (Curran 1984; Spiess, Curran, and Grimes 1985; Storck and Spiess 1994). As noted above, the very early association of caribou and Early Paleoindian remains can now be dismissed for Dutchess Quarry Cave (Funk and Steadman 1994).

To the south, the deeply stratified (and thus very rare) Early Paleoindian levels at the Shawnee Minisink site on the Delaware River in Pennsylvania preserve evidence of fish and various potential plant foods. The plants include acalypha (*Acalypha virginica*), amaranth (*Amaranthus* sp.), “blackberry” (*Rubus* sp.), buckbean (*Menyanthes trifoliata*), chenopod (*Chenopodium* sp.), hawthorn (*Craetagus* sp.), smartweed (*Polygonum* sp.), and winter cress (*Barbarea orthoceras*). At least the fish and hawthorn plum remains originated in a hearth dated to 10,590 ± 500 B.P. (Dent and Kaufmann 1985:72–73, Table 5.2; McNett 1985:17–19, Figure 2.3).

At the stratified Hedden site in southern Maine, a set of Early Paleoindian floral samples has been recently identified from a context buried under aeolian sands. The Hedden floral sample, directly dated to 10,580 ± 60 B.P. and 10,500 ± 60 B.P., includes seeds of bristly sarsparilla (*Aralia hispida*), bunchberry (*Cornus canadensis*), bramble (*Rubus* sp.), and grape (*Vitis* sp.). Only the grape fragment was unequivocally associated with cultural remains, but all were likely associated with the Early Paleoindian occupation (Asch Sidell 1999:197, Tables 12.1 and 12.5; Spiess, et al. 1995).

On the western margin of the Northeast as broadly defined here, white-tailed deer (formerly reported as caribou) was identified, along with more tentative caribou, elk, or moose at the Cummins site near Lake Superior in northern Ontario. Blood protein residue on 12 lithic artifacts and soil samples also tentatively demonstrated bison, and deer, rabbit, and rodent families (Julig 1994:214). In northern Wisconsin toward the Great Lakes, the Late Paleoindian (to Early Archaic) Deadman Slough and Sucices sites produced white-tailed deer, black bear, beaver, porcu-

pine, several turtle species, fish, and other mammal remains, as well as mussel shells. A broad generalist adaptation is obviously reflected, at least in the case of the Wisconsin evidence (Kuehn 1998).

Beyond these few relatively recent identifications, there are no well-grounded reconstructions for Paleoindian subsistence in the Northeast, although many researchers have guessed at relevant subsistence patterns in different portions of the region, as briefly described above. It is certainly tempting to model Paleoindian subsistence based on evolving knowledge of late Pleistocene and early Holocene vegetation and other regional biota, but this is inevitably speculative, since knowledge of the biota is imperfect and factors of cultural selectivity must pertain as well.

In one very notable case, Gramly (1982, 1984, 1998) has reconstructed a possible “kill” site, presumably for caribou, at the Early Paleoindian Vail site in western Maine. Very close nearby, Gramly (1988a) has further identified a “meat cache” at the contemporaneous Adkins site, presumably for storage of caribou meat. These are plausible but by no means airtight suggestions. Nonetheless, the “kill” site hypothesis for Vail seems virtually certain based on conjoinable fluted point fragments found widely separated between the presumed killing and habitation areas, and specific details of local geomorphology. We cannot be absolutely sure what animals were being dispatched at Vail, but some sort of herd animal seems most likely, given the local topography and paleoenvironments at the time. Caribou logically seem to be the best fit.

Gramly is not the only analyst of Early Paleoindians and Paleoindians generally that has postulated an emphasis on caribou. Various others have previously suggested a Paleoindian caribou focus, both Early and Late, especially in the glaciated northern portions of the Northeast. There is a paucity of direct evidence, however (e.g., Chapdelaine 1994; Davis 1998:200; Doyle, et al. 1985; MacDonald 1968:140; Mason 1981:99; Petersen, Bartone, and Cox 2000:131; Ritchie

and Funk 1973:335; Spiess, Wilson, and Bradley 1998:224–226; Storck 1984). For example, witness the West Athens Hill diorama at the NYSM, with caribou centrally featured in spite of the complete absence of subsistence remains from the site. In non-glaciated areas to the south, various other large game species such as deer and elk have been mentioned as possible but unproven focal resources within an overall more generalized range of subsistence resources (Dincauze 1993a:281; Lepper 1999). Meadowcroft preserves evidence of white-tailed deer in “Pre-Clovis” contexts, however (Adovasio, Boldurian, and Carlisle 1988; Carr and Adovasio 2002:8).

Likewise, concerted efforts have been made in the Northeast to link at least the Early Paleoindians to predation on “megafauna” such as mastodons, mammoths, and others that went extinct at the Pleistocene-Holocene transition, but virtually no one has been successful to date due to contextual and interpretive problems (e.g., Dincauze 1993a:281; Lepper 1999:374; Mason 1981:69–70, 99–101; McAndrews and Jackson 1988; McDonald 1994; Snow 1980:117–122). The Kimmswick site in Missouri is the closest unequivocal Paleoindian association with “megafauna” to the Northeast, where Early Paleoindian (true) Clovis points were intimately associated with mastodons (Graham and Kay 1988; Kay 1998).

However, the presence of Paleoindian and presumed Paleoindian artifacts and extinct fauna in New York State, Ohio, Kentucky, and Wisconsin, for example, is suggestive (Ellis, et al. 1998:158–159; Tankersley 1996:27–28). The Martins Creek site in Ohio has mastodon remains associated with lithic flakes, while the Schaefer mammoth in Wisconsin was associated with a fragmentary biface, a flake, and a date of $10,960 \pm 100$ B.P. (Brush and Smith 1994; Overstreet, Joyce, and Wasion 1995). The Burning Tree mastodon in Ohio, dated ca. $11,390 \pm 80$ B.P. to $11,660 \pm 120$ B.P., is interpreted as having been butchered, but there are no associated artifacts and this interpretation is quite conjectural (Fisher, Lepper, and Hooge 1994), among various others.

Probably one of the best candidates for a bona fide association of extinct fauna and Early Paleoindian remains in the Northeast is the Hiscock site, a spring side association of cultural artifacts and primarily (solely?) natural accumulation of faunal and botanical remains in western New York State. More than 50 vertebrate species have been identified from deposits of late Pleistocene and Holocene age at Hiscock, including at least eight mastodons thus far, along with caribou, elk, moose of some sort, California condor, and others in the Pleistocene deposits. Dates between ca. 11,200 B.P. and 10,200 B.P., among others, were roughly associated with the mastodons, other fauna, and various artifacts.

A minimum total of seven lithic tools at Hiscock includes six Early Paleoindian fluted points and a scraper. Another 13 (+) bone artifacts are also generally associated, of which several worked mastodon bones, a rib, and a vertebrae have been AMS radiocarbon dated to $10,990 \pm 100$ B.P. and $10,810 \pm 50$ B.P. These intriguing discoveries are problematic because of the complex deposition, erosion, and redeposition at Hiscock, and thus, none of these associations are completely unequivocal. For example, it is possible that Early Paleoindians were acquiring bones of naturally deceased animals and not killing them there. Continued research hopefully will provide unequivocal evidence of Early Paleoindian predation of megafauna and/or other species at Hiscock, potentially adding significant new data about Paleoindian subsistence (Ellis et al. 1998:158; Laub 1995:27, 2000; Laub and Haynes 1998:32–34; Laub, et al. 1988:76, Table 1; Steadman 1988:Table 1; Tankersley 1998b:11–12).

Evidence from sites like Bull Brook, Whipple, Udora, Shawnee Minisink, and even Meadowcroft seem to support the idea of a generalist subsistence adaptation for Early Paleoindians in different portions of the Northeast, but the relevant data are very slim, to say the least. There seems to be no empirical evidence to support the idea of a large

game emphasis to the exclusion of other food sources, even in the far northern portions of the Northeast where various analysts have come to suspect it. Likewise, there is precious little, if any, evidence to support an emphasis on now extinct “megafauna” anywhere in the broad Northeast. Thus, in reality we cannot say conclusively if the Early Paleoindians were “focal” or “diffuse,” emphasizing large game or a broad spectrum of food resources. We are only a little better off for the Late Paleoindians on and near the Upper Great Lakes where generalist patterns are quite obvious.

Paleoindian Mortuary/Ritual Patterns

Mortuary and other ritual aspects of the Early and Late Paleoindian periods in the Northeast are also poorly known. Discrete lithic artifact caches are sometimes interpreted as mortuary goods related to burials where the human remains and all other organics have been destroyed by the ravages of time. Some sites preserve cremated human bones with lithics, as at the Late Paleoindian Renier site in Wisconsin, and others preserve human bones without lithics, as at the Late Paleoindian Cummins site in northern Ontario. Still others preserve heat fractured or otherwise broken lithics but no human remains, with and without red ocher (e.g., Julig 1994; Kuehn 1998:464; Mason 1981:117–120; Walthall 1999). Rather cautiously, lithic tool caches without human remains have been sometimes attributed to “sacred ritual” behavior but not necessarily mortuary ritual for the later portions of the Early Paleoindian period. This pertains at the Crowfield and Caradoc sites in southern Ontario (Deller and Ellis 1984, 2001:279–281; Wright 1995:56).

Neither Early nor Late Paleoindian burials with preserved human remains are known from New York State, the New England–Maritimes area, or the Mid-Atlantic area, but at least one lithic cache like those in southern

Ontario is known in New York State. The Lamb site in the western upstate area produced a cache of 18 lithic artifacts, including eight fluted Gainey points and 10 other lithic bifaces (“knives” and “preforms”), which are assigned to the earliest Early Paleoindian, Clovis-related occupation. No bones or red ocher survived at Lamb, but the cache was interpreted as a disturbed single human burial (Gramly 1988b, 1999:35–37, 94; Gramly and Funk 1990:16).

If correctly identified, the Lamb site cache is the oldest known burial in much of the Northeast. Another comparably small cache, related to the Parkhill phase based on Barnes points, is known from the Thedford II site in southern Ontario. The excavators did not designate it as a burial, but it seems similar to, if slightly younger than, the cache at the Lamb site. Similar caches may have been present at Bull Brook in eastern Massachusetts, but these are even less certain than Thedford II (Deller and Ellis 1992:99–100; Gramly and Funk 1990:16, 19).

From the standpoint of anthropological archaeology, it would be very useful to learn more about the caching, “sacred ritual,” and/or possible mortuary behavior of the Early Paleoindian period in the Northeast. From the typical Native American standpoint, however, this will be very difficult, if not impossible, under liberal interpretation of the Native Graves Protection and Repatriation Act, where all prehistoric human remains are off limits for analysis. Regardless of this issue, in undertaking any sort of future Paleoindian research, whether habitation or otherwise, we should strive to work as collaboratively as possible. As seen at Hiscock, Dutchess Quarry, Meadowcroft, and elsewhere, collaborative and interdisciplinary research teams, involving earth scientists, natural historians, and anthropological archaeologists, seem to be the best hope we have for advancing northeastern Paleoindian research.

THE SIGNIFICANCE OF WEST ATHENS HILL

Bob Funk’s research at West Athens Hill and other Paleoindian sites largely speaks for itself. The significance of West Athens Hill should be quite obvious to the reader by this juncture, given how it fits into a broader analysis of the Early Paleoindian period in the Northeast. Reiteration of all of this is unnecessary, but it may be worthwhile to summarize this topic before the reader moves on to the substance of Bob’s report proper.

First of all, the present publication on West Athens Hill is important for providing the scientific underpinning of the influential Paleoindian diorama at the NYSM, as described above. The powerful vignette represented in the NYSM diorama was obviously directly centered on Bob’s Paleoindian research at West Athens Hill, as well as his broader anthropological vision, and the efforts of the talented NYSM exhibition staff. Now, we have a more complete idea of what evidence Bob and others had to work with in constructing the diorama.

Second, it should be obvious that there are very few comprehensive and detailed reports for sites of Early Paleoindian vintage anywhere across the Northeast. Thus, the details of Bob’s work, along with others, at West Athens Hill are significant in and of themselves, regardless of his precise interpretations or anyone else’s for that matter. Archaeological research in the region will not progress without substantive data for this or any other period of prehistory or history. Various analysts have drawn on Bob’s earlier summaries of his West Athens Hill research in their own analyses (e.g., Eisenberg 1978:136–137, Figures 21–25; Ellis 1989:Table 6.1; Gramly 1980:828–830; Meltzer 1989:34–35, Table 2.2; Moeller 1980:Table 20; Snow 1980:138–140, Table 3.2). Now, we have a more complete site report that can be used in future studies.

Comprehensive published site reports have begun to appear for a small number of

Early Paleoindian sites in the Northeast. Although of different scope, focus, and completeness, these include reports for Early Paleoindian sites in Connecticut, Kentucky, Maine, Michigan, New Jersey, New York State, Nova Scotia, Pennsylvania, and Ontario, for example, but these number less than 20. Parenthetically, comprehensive published site reports for Late Paleoindian sites are even more rare regionally. Taken together with those previously published by the “pioneer” regional analysts, we can begin to sense some of the exciting research topics inherent in Paleoindian research generally. Bob’s recent reanalysis of West Athens Hill is thus highly significant in building on his previous work there, his other valuable publications, and also the work of many other colleagues.

Third, the West Athens Hill research is significant in terms of its examination of what Bob, alone and with others, called a “quarry-workshop” in an overall classification of Paleoindian site types. Bob explicitly argued that West Athens Hill was also a habitation site, or “camp,” in contrast to other Paleoindian site types, as noted above. However, his contribution here partially stems from the site type classification itself. It also partially stems from a more basic recognition that not all Paleoindian sites were equivalent in setting, size, and function, thereby helping Bob (and Bill Ritchie) to prompt a positive and ongoing trend of defining Paleoindian variability in the Northeast.

Moreover, “quarry-workshop” sites have been subsequently recognized elsewhere in different areas of the Northeast, in part given the importance of the West Athens Hill research. Northeastern Paleoindian lithic raw material acquisition of different sorts has recently been studied at various places besides West Athens Hill. These other Paleoindian “quarry-workshop” locales include Munsungan Lake in Maine, Israel River in New Hampshire, and Fossil Hill in Ontario, among others. The Flint Run and Williamson locales in Virginia are also germane here, but all of these lithic sources are

rather different (Boisvert 1998; Bonnichsen, Kennlyside, and Turnmire 1991; Eley and von Bitter 1989; Gardner 1974, 1989; Hill 1997; Pollock, Hamilton, and Bonnichsen 1999; Spiess, Wilson, and Bradley 1998; Storck and von Bitter 1989).

Still another aspect of the importance of Bob Funk’s work at West Athens Hill stems from his recognition that this site logically preserves evidence of the direct acquisition and reduction of a notable lithic material, Normanskill chert, as well as inferred domestic activities. Bob here largely follows the lithic analysis format of his previous description of West Athens Hill (Ritchie and Funk 1973:9–36; see also Funk 1976:205–207, 212–228, Table 31), among others. Again, in the present volume Bob broadly describes the process of lithic reduction and resulting “artifacts” (read tools) and debitage (flakes, shatter, etc.) at West Athens Hill in terms of a dynamic set of reduction processes, or “stages,” as noted above.

More might have been done with this research topic, but Funk’s processual model exists in contrast to other archaeological classification approaches that have been applied to descriptions of Paleoindian (and other) lithic samples, generally interpreting them in static fashion, much like a comprehensive, contemporaneous tool kit or assemblage. In the static case, lithic samples are seen (implicitly or explicitly) as consisting of more or less fixed sets of all equally “finished” or otherwise equivalent items (e.g., Ritchie 1953, 1957; Shott 1997; Wilmsen and Roberts 1978; see Funk 1976:Table 31). As noted above, such artifacts are either “knives,” “scrapers,” “points,” and “drills,” among many other categories. Static lithic analysis models are useful in their own right and sometimes said to be more “objective” than processual taxonomic ones, but it is not necessarily so, as often witnessed by their own conjectural taxa (Shott 1997:203–204).

Visualizing lithic reduction, use, and discard as a set of processes, representing a series of reduction “stages,” was still innovative in

the 1970s (e.g., Callahan 1979; Collins 1975) when Bob employed it at West Athens Hill and it continues to be so today, even though it has a much older heritage. Funk has again made this a useful part of the present volume on West Athens Hill, even if we might dispute a few of the reduction stage assignments. Some analysts have recently argued that lithic reduction is, in reality, more of a continuum, rather than a set of “stages” (Shott 1996). The “stage” approach thus simplifies reality somewhat arbitrarily but systematically, as is typical in other taxonomies.

Nonetheless, Bob’s analysis generally demonstrates that reduction stage models help the analyst identify artifacts that entered the archaeological record at different points in the complicated nexus of reduction, use, reworking, recycling, discard, etc. Thus, they help to define just which of these and other activities took place at a given site. At West Athens Hill, this general approach (and differentiation of local from non-local, “exotic” chert) enables recognition of the fact that it was more than a lithic workshop, however. The Early Paleoindian occupation of West Athens Hill was also the scene of other domestic habitation activities and potentially also used as a lookout (both nicely portrayed in the diorama at the NYSM).

In summary, Bob Funk’s Paleoindian research at West Athens Hill is already a landmark in northeastern and broader archaeological contexts on multiple levels. The present volume further demonstrates this point and more thoroughly presents the salient details. Funk’s work helps us to better understand the Early Paleoindian period generally and it sheds light on the role of lithic raw materials in technological, settlement, and perhaps even subsistence systems, even if we don’t fully understand the meaning of lithic distributions regionally. West Athens Hill is situated in the northern, glaciated portion of the Northeast and as such it provides a point of comparison for other sites both in northerly and southerly areas. This is a region where a great degree of mobility, long-distance movements and seem-

ingly frequent long-distance lithic transport, as well as diverse site types and sizes, presumably pertained during the Early Paleoindian period, ca. 11,000 B.P. to 10,000 B.P. These conditions were apparently different than those in other portions of eastern North America, such as the Southeast and beyond.

No evidence of a “Pre-Clovis” occupation has been identified anywhere close to West Athens Hill, although several other Early Paleoindian sites are known nearby, such as Kings Road and another site only a few kilometers away. Human occupation of all of New York State may have only begun with the Early Paleoindian period, as late as 11,000 B.P., as represented at West Athens Hill. Human colonization of this and other parts of the far northern and eastern portions of the Northeast was precluded before this time, or less likely, such evidence has yet to be recognized. The inverse correlation between glaciated areas and an absence of “Pre-Clovis” occupation is probably not coincidental. Since the whole of New York State was glaciated, it must have been available for human colonization only rather late during the Pleistocene epoch. Obviously, this matter remains to be tested through future research.

Bob Funk’s Paleoindian research at West Athens Hill helps us to define and evaluate the earliest extensive human colonization of the Northeast as it occurred during the Early Paleoindian period. This period effectively began instantaneously and synchronously, if we are reading the limited data correctly, just as early Native people spread across nearly the whole Northeast, the exception being the extreme northern portions toward the Subarctic and beyond. Areas roughly north of the “Mason-Quimby line” were apparently uninhabitable until conditions changed during the Late Paleoindian period, at which time ancestral Natives moved into the margins of the Subarctic and later even into the Arctic, but only in limited areas. The southern non-glaciated portions of the Northeast were seemingly colonized first during the “Pre-

Clovis" period, as in the Southeast, followed later in the northern glaciated areas during the Early Paleoindian period.

By this time, sufficient biotic resources had been reestablished across the southern and mid-northern portions of the Northeast to the point that people could survive and prosper there, including the mid-Hudson Valley and West Athens Hill. West Athens Hill provided the Early Paleoindians and later people with a relatively superb lithic resource, Normanskill chert (or "flint") in this case. In fact, West Athens Hill was precisely one of the local resources that made local human residence in the Hudson Valley possible under late Pleistocene conditions. It also had broader regional significance since this material has been identified at Early Paleoindian sites elsewhere in New York State, and New Jersey, Connecticut, Massachusetts, Vermont, and Pennsylvania, among potentially others.

However, we need to recognize that some other lithic material might have alternatively served instead, had Normanskill chert not been available, and we should not be lithic determinists here. In this case, Normanskill chert may be the most obvious "critical" resource to survive in the archaeological record, but it is unlikely that this or any other particular lithic material was absolutely critical to the Paleoindians. Chert and other high-quality lithics were likely related to a small but significant part of Paleoindian lifeways, as they are ethnographically known in various contexts, but the jury is still out on this matter. In any case, let's celebrate Bob's contributions to all of these fascinating topics!

A CLOSING (BRIEF) TRIBUTE TO ROBERT E. FUNK

A lot has been already said about Bob Funk in tribute, both before and after his death. Nonetheless, I will close this foreword, perhaps long overdue by this point, with a few more personal comments in tribute to this

wonderful man.

Beyond the details per se, Bob Funk and his boundless enthusiasm come through in this publication on West Athens Hill, as it should be. Though Bob was a careful and exacting scholar in his archaeological analyses and publications, he was much less restrained (unrestrained?) in his personal interactions. Generosity and enthusiasm loomed large in the man and he was informal with most people after about the first 5 or 10 seconds, treating the newcomer, student, or visiting scholar alike with boundless enthusiasm and help, when it was possible for him to provide it. Like Bill Ritchie, Bob was willing to send a "babe-in-the-woods" researcher in western Vermont (and reportedly elsewhere) any and all reprints of his archaeological publications that he could provide and I remember that he kindly gave me various publications while I was still an undergraduate student.

I had the privilege of meeting Bob very early in my involvement in archaeology, given the proximity of my ancestral home and sometimes research area in the Champlain Valley of western Vermont. As many may know, the Hudson and the Champlain valleys constitute a single interlinked and more or less continuous north-south lowland area, or travel corridor, from the Atlantic coast near New York City to the St. Lawrence Valley near Montreal. For those of us who work in the area, we know that archaeological manifestations sometimes changed significantly over the distance of this north-south corridor, some 600 kilometers overall. However, a variable synchronicity pertained over much of the region, especially in the northern two thirds or so, from the mid-Hudson Valley northward through the entire Champlain Valley to the St. Lawrence River, during the entire span of Native American prehistory and early history. Coastal New York, around the lower Hudson and Long Island Sound, for example, was typically another world for the Native people, at least as it is seen archaeologically.

Bob Funk and Bill Ritchie before him recognized the interconnections between the

Hudson Valley and the Lake Champlain and Richilieu drainage to the north. None of the local and regional Native people lived in social isolation, and extensive east–west contacts along the Great Lakes–St. Lawrence River drainage were matched by comparable contacts north–south between the Hudson Valley and Lake Champlain and the St. Lawrence Valley. Perhaps that’s why Bob and Bill looked to the north and east to Vermont (and many other places) for comparative archaeological information, and perhaps that explains their generosity to Vermont researchers, but I don’t think that’s all that there was to it. Instead, this was the manner of both of these men, quite clearly Bob and Ritchie too. Both of them helped anyone who could establish an earnest interest in the details and/or broad patterns of regional prehistory. From personal contact and reports, I know that Ritchie was a bit autocratic, but Bob was not in the slightest. The exchange between them was humorous on the few occasions when I had the privilege of seeing them interact.

It would be hard to say who “won” in some of the exchanges that occurred between Ritchie and Funk. Bill Ritchie would have been dominant and sometimes dismissive, whereas Bob would have let Bill get his way as a general survival strategy, sometimes challenging and nibbling around the edges of Ritchie’s ideas, but in the end having the conviction to express his differences, sometimes in print. In reality, these two people did quite well together over more than a 20-year period, both in person and in melding differences in their writings, but preserving some degree of (mostly Bob’s) dissension, as occasionally seen in the 1973 settlement pattern volume.

From my own observations and colleagues’ accounts, Bob Funk and Bill Ritchie were clearly friends. In Ritchie’s absence, I have heard Bob defend Ritchie’s views and his own personal concordance on various things, establishing that they had a lot invested in a wide array of research topics together. These ranged from Paleoindian to protohistoric

issues, anything Native American and archaeological in other words (e.g., Funk 1996; Ritchie and Funk 1984). Bob was also strongly enough a positivist and a “true” scientist to recognize where Ritchie had incorrectly interpreted one aspect or another of regional prehistory, as I heard him say. Ritchie was prescient on innumerable topics (as was Bob) regarding regional prehistory, nearly all of the major issues that we still face. However, the relative dating of Lamoka vis-à-vis the Laurentian tradition, and the Adena “migration” are good examples of Bob’s dissension, for example, with quite good reason.

I am not precisely sure when I first met Bob, but I think Louise Basa introduced us at a New York State Archaeological Association meeting in 1976, but one slightly later and characteristic vignette will nicely sum up Bob as a human being, or so I hope. Bob was to be the principal (“banquet”) speaker at the spring meeting of the Vermont Archaeological Society (VAS) in April 1979, and I was assigned to pick him up and bring him to the VAS meeting. This was because we had met several years before and we were corresponding by that time, and he was already sending me reprints of his articles and offering useful advice.

When I phoned Bob at his hotel room ahead of time, he asked me to delay a little bit so that he could take an invigorating morning jog around Burlington and I was happy to accommodate him, our important guest speaker, in most any way that I could. Well, I finally arrived to pick him up at the appointed time. Bob was freshly showered, smiling from ear to ear, and ready to enthusiastically talk about (as it happened to be this time) Middle Woodland archaeology. Once again he gave me another stack of fascinating reprints—wow, what a guy, I remember thinking—reprints for a lowly undergraduate student like myself, but that was Bob. And his VAS talk was great too. We will miss him for many reasons, but I think his generosity, boundless enthusiasm, and good humor loom largest for me.

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PROLOGUE

The little band was tired after hours of climbing over ridges, fording streams full of high, rushing water, and padding quietly through mist-shrouded forest groves in search of new hunting grounds. The sun was setting behind the high, gray stone escarpment that loomed not far to their left, and lengthening shadows threw a chill into their very bones. There were only about 25 people, including women and children as well as men. Some were elders. A few very small children were carried by their mothers, while older children trudged along with the adults. They closed up their caribou hide garments to keep out the breeze and then their leader, motioning for them to stop walking, began looking for a place to camp for the night. They finally decided on a dry, level site near a small brook. Fires were started and some meat from the last successful hunt was cooked and eaten. After building hasty lean-tos beneath the pale moon, they lay on the hard ground and went to sleep, only occasionally stirring as the howls of wolves and the cries of other creatures echoed through the darkness.

The next morning, the people were awakened by a familiar sound. Some distance away an enormous, long-nosed animal was making snuffling noises as it chewed on tree branches and twigs. While the band prepared for the day's tasks, some of the male hunters checked the contents of skin pouches. They were worried about their dwindling supplies of weapon points and roughed-out blanks of hard, shiny stone that was pried from a bedrock exposure farther down the great river they were following. After some debate, two parties of hunters picked up their spears and set out from the camp, one party headed far-

ther up the narrow valley bottom, the other up the slope of the high hill to their right, opposite the escarpment. The sun rose above the hill as the hunters disappeared into the woods. Just then, squealing erupted as women trapped and killed two small, furry animals that lived along the creek. They had also caught some fish and began preparing their catches for a mid-morning meal.

The second party of hunters returned hours later, calling out gleefully. They had not found any game, but proudly showed off a skin pouch full of green and gray colored stone that was ideal for the manufacture of their weapon points and other stone tools. They had discovered a large, rich source of the material on top of the hill. After the other hunters returned, the fittest members of the band ascended the hill to stand on the summit, gazing out at the stone scarp and the cloud-wreathed mountains far beyond it. They could even look down into the valley where they were camped.

Men and women began filling bags, sewn from small animal skins, with fragments quarried from the high-quality stone that lay just under the carpet of leaves. Using cobble hammers and antler flakers, others began reducing cores to the proper size and shape for weapon points and knives. Two broken points, still on their wooden shafts, were discarded and fresh new ones fastened in their place. One of the women, who had wandered off, called out in a puzzled tone, and people walked over to join her. She showed them some stone artifacts that were unlike any made by the band. There was a brief flurry of excitement; had other beings, perhaps very different from the people of the band, visited the hill long before and

made tools and weapons from its outcropping stone?

At dusk, the group descended the hill and returned to their camp. There two adventurous boys reported finding different kinds of toolstone, gray and black, at the base of the

cliffs. The following morning, the people broke camp and went on their way. But in later years, and on many occasions, others like them climbed to the hilltop to collect toolstone, manufacture stone artifacts, and admire the scenic view.

INTRODUCTION

At this writing (August 2002) it has been 32 years since the writer completed field work at the West Athens Hill quarry-workshop site in Greene County, New York (Funk 1972, 1976; Ritchie and Funk 1973: 9–36). It was the first Paleoindian site I excavated and by far the most productive, even though I had the good fortune of investigating several other sites of the period during my service at the New York State Museum.

At the time West Athens Hill was discovered by avocational archaeologist R. Arthur Johnson in 1962, only two small Paleoindian sites (not counting isolated finds of diagnostic fluted points) were on record in New York State, the Davis and Potts sites (Ritchie 1965: 19–30). Ritchie (1953) had previously reported on the Late Paleoindian Reagen site in northeastern Vermont, and Witthoft (1952) had described investigations at the Shoop site on the Susquehanna River drainage in central Pennsylvania. The Bull Brook site in eastern Massachusetts (Byers 1954, 1955) was the largest and best-known site of the period in New England. Since then many more Paleoindian sites have been discovered and excavated in New York, New England, southern Ontario, and other parts of northeastern North America. In New York the notable sites now include: Kings Road, located a few miles from West Athens Hill (Funk, Weinman, and Weinman 1969; Weinman and Weinman 1978); the nearby and as yet unpublished Swale site; the Dutchess Quarry Caves 1 and 8 in Orange County (Funk, Fisher, and Reilly 1970;

Kopper, Funk, and Dumont 1980; Funk and Steadman 1994; Steadman, Stafford, and Funk 1997); the “Hallock” site¹ in Orange County; the Zappavigna site, also in Orange County (Funk, et al. 2003); the Davis site on Lake Champlain (Ritchie 1965: 19–22); the Twin Fields site in Ulster County (Eisenberg 1978); the Port Mobil site on Staten Island (Kraft 1977); the Potts site near Oswego (Ritchie 1965: 22–30; Gramly and Lothrop 1984); the Corditaape site near Utica (Funk and Wellman 1984); the Arc site near Oakfield, Genesee County (Tankersley, et al. 1997); the Lamb site near Darien (Gramly 1999); and the Hiscock site near Byron, Genesee County (Laub, Miller, and Steadman 1988) (Figure 1).

With so much new information, our understanding of Paleoindian regional stylistic variation, settlement distribution, tool function, and lithic technology has improved considerably. Unfortunately, our understanding of chronology and developmental patterns leaves much to be desired, knowledge of material culture is confined almost entirely to stone tools, and subsistence remains are lacking on nearly all northeastern Paleoindian sites. Adverse environmental conditions over the last 10,000 years have caused the loss of food remains and artifacts made of organic substances (wood, bone, antler, hides). There are few published studies of chert quarries used by the Paleoindians, as well as the organization of work parties and the methods they developed for extracting and processing the raw material. We are still forced to rely on

¹ The name “Hallock” refers to the discoverer, the late Russell Hallock, who found several fluted points on the surface of the site. The present owner wishes to avoid publicity, therefore his name is not used here.

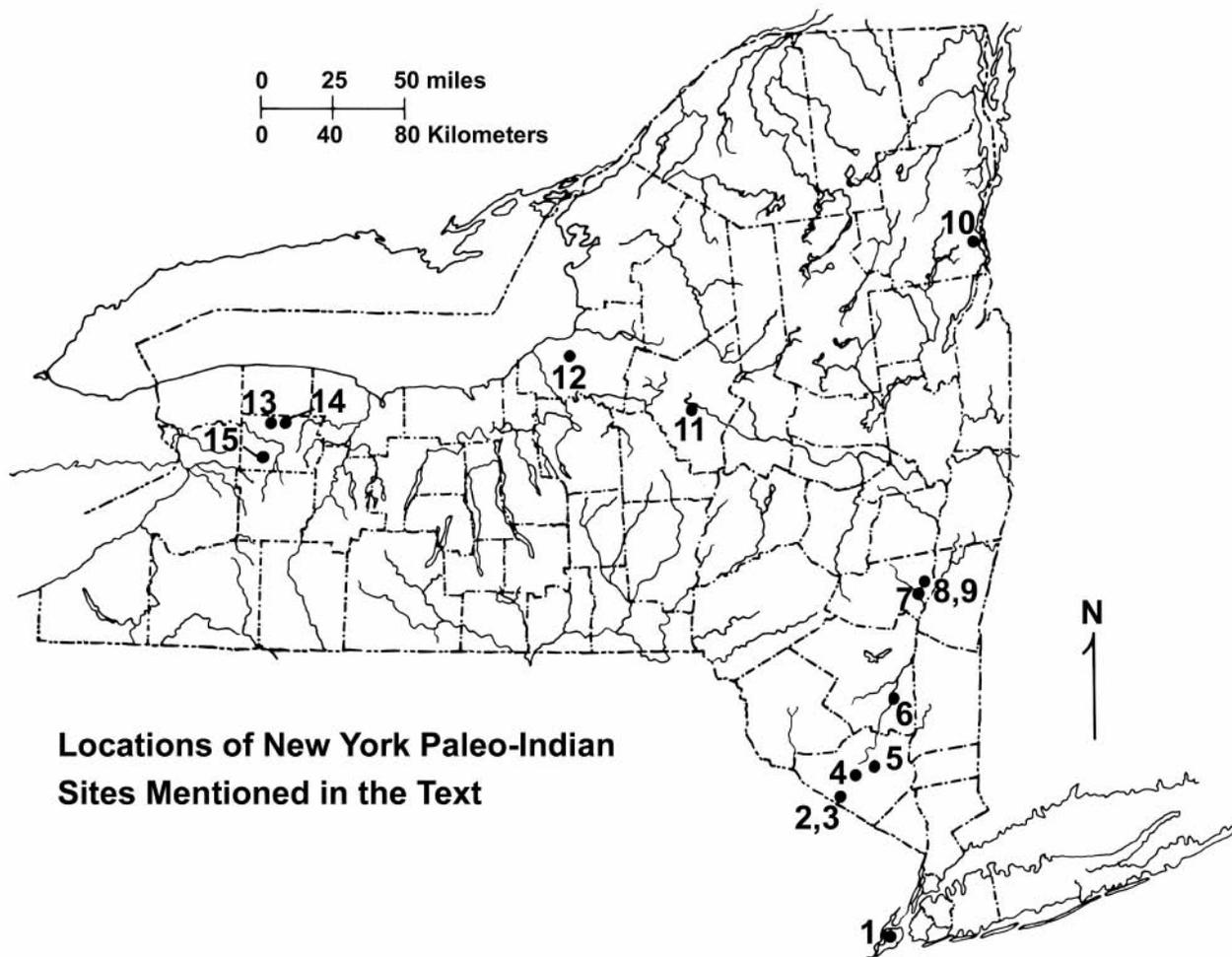


Figure 1. Map of New York State showing location of West Athens Hill and other Paleoindian sites mentioned in the text. 1, Port Mobil; 2, 3 Dutchess Quarry Caves 1 and 8; 4, "Hallock"; 5, Zappavigna; 6, Twin Fields; 7, West Athens Hill; 8, Kings Road; 9, Swale; 10, Davis; 11, Corditaipe; 12, Potts; 13, Arc; 14, Hiscock; 15, Lamb.

ethnographic analogy and outright guesswork concerning social structure, ideology, artistic activity, and religious behavior, among other topics.

This seemed like a good time to take another look at the West Athens Hill site and to place it in the perspective of our rapidly growing knowledge of the earliest occupations of the Northeast. My reevaluation includes a second presentation of the report published in Ritchie and Funk (1973), which dealt with the findings at two major loci, Areas A and B, but with a number of stylistic, grammatical, factual, and organizational changes. Also included are tables presenting

descriptive statistics for the various artifact classes, omitted from the original report at editorial request. I have also conducted more detailed analysis, including size and weight measurements, of selected quarry and workshop debris (blocks, cores and flakes) collected from Area B. But the most important change here is the addition of a detailed report on Area C, in place of the very brief summary in Ritchie and Funk (1973: 15, 35). At the time of that publication, the recovered data and materials had only been studied in cursory fashion. I have completed a detailed analysis of the artifacts from Area C, plotted their locations on the grid map, and revised the overall

site map, accurately showing the location of Area C and its contour lines in relation to Areas A and B. Also included for the first time are formal and metrical analyses of quarrying byproducts and debitage from Area C.

Following this introduction, I describe the location of the site, the history of discovery, the regional geography and geology, the site description and setting, the research goals of the project, and the details of excavation. Next

are sections on the sedimentary contexts, a summary of geological history, descriptions of artifacts from Areas A, B, C, D, E, and F, an analysis of stratigraphy, typology, and settlement patterns, a comparison with other sites, a summary of the site's position in regional Paleoindian culture, a speculative model of quarry-workshop activity, and finally a section on general conclusions.

LOCATION AND DISCOVERY

West Athens Hill is a rocky ridge located in Greene County, New York, north of the town of Catskill and about two miles west of the Hudson River. In the spring of 1962, R. Arthur Johnson, a New York Telephone Company engineer and member of the Van Epps–Hartley Chapter, New York State Archaeological Association, learned that his company planned to construct a mobile telephone relay tower atop West Athens Hill. Suspecting the archaeological potential of the ridge, Johnson visited the site several times during the clearing of trees from the summit using a bulldozer. It was evident from the large quantity of debitage littering the surface that the ridge was a chert quarry and workshop. Finally, in April 1963, Johnson was rewarded with the discovery of two fluted projectile points, one complete, the other broken in process, that clearly demonstrated the existence of a Paleoindian component on the ridge. He also found several end and side scrapers of Paleoindian form.

William A. Ritchie (then New York State Archaeologist) and the writer accompanied Johnson on a visit to the site a few days after his discovery, during which a surface collection was made and several test pits excavated. A few more scrapers, utilized flakes, and several cobble hammerstones were recovered.

The results of these preliminary examinations were published soon thereafter (Funk and Johnson 1964).

Test explorations continued sporadically in 1963–1965. During most of this time, a wide assortment of scapers, knives, bifaces, hammerstones, and utilized flakes, plus several Archaic projectile points, were collected without finding more fluted points. In 1965, however, two fluted points were recovered in the hollow between the main summit knoll and two smaller adjoining knolls. The deposits in the hollow seemed only partially disturbed by the bulldozing operations, and furthermore intact areas there were stratified. Therefore, the Anthropological Survey of the New York State Museum commenced preparations for full-scale systematic investigations at the site, which took place in the summers of 1966, 1967, 1969, and 1970. Fortunately, by this time the New York Telephone Company had decided, for the time being, not to install the relay tower, the concrete foundation for which had been constructed on the main knoll in 1963.

At this writing, after some 40 years, the relay tower still has not been installed. Little has changed since the excavations, except for regrowth of trees and brush and occasional digging by artifact looters.

REGIONAL GEOGRAPHY AND GEOLOGY

The West Athens Hill site lies atop a north–south trending ridge, one of a series of linked parallel outcrops five miles long and varying in height, that reaches its maximum elevation of about 410 feet above sea level at the top of the hill. On the west it is separated from the limestone face of the Helderberg Scarp by the narrow but fairly level valley of the Hans Vosen Kill, which flows south to the parent Catskill. On the east it overlooks the mile-wide Athens Flat, through which flows the Corlaer Kill, another tributary of the Catskill. Between Athens Flat and the river are knobs and ridges alternating with level areas and the 60-foot deep main gorge of south-flowing Murderer’s Creek. From north to south, the villages of Coxsackie, Athens, and Catskill lie along the river’s west shore at the eastern boundary of Greene County.

Here the main channel of the Hudson River is generally oriented north–south, almost precisely parallel to such major New England rivers as the Housatonic and Connecticut. In its southward flow from its headwaters to the Atlantic Ocean, the Hudson River traverses four major physiographic provinces: the Adirondack Mountains, the Hudson–Champlain Lowland, the Hudson Highlands, and the Piedmont. Its waters are augmented along the way by runoff from several tributary watersheds, both inside and outside New York State.

From West Point, 55 miles north of its mouth, to Glens Falls farther north, where it debouches from the Adirondack Mountains, the Hudson valley is located within the great Ridge and Valley province of the eastern United States, also known as the Folded Appalachians (Fenneman 1938). The Ridge

and Valley Province is a belt of much-folded and faulted Paleozoic sediments, reaching from Tennessee on the south to Canada on the north, for a total length of 1,200 miles. Its width varies from 14 to 35 miles in New York State. The New York segment is 270 miles long.

The Hudson valley, the Lake George Trough, and the Lake Champlain basin together make up the Hudson–Champlain Lowland, which constitutes the New York section of the Ridge and Valley Province. The region is characterized by alternating valley floors and narrow ridges, the latter varying chiefly between 200 and 800 feet above sea level. These features resulted primarily from differential erosion of rocks of varying resistance, including shales, sandstones, dolostones, and limestones. The topography was considerably modified by glaciation during the Pleistocene epoch.

In its middle section from Catskill to Albany the Hudson Lowland is bordered on the west by an escarpment known as the Helderberg, which intervenes between the river and the Catskill Mountains. To the east, the Lowland is bordered by the Taconic Range.

Within the Hudson–Champlain Lowland, large areas are covered by glacial drift. Many hills and terraces, especially along the east side to the river, are composed of drift. The Pleistocene glaciation considerably modified preglacial drainage patterns. A proglacial lake which formerly extended from the Hudson Highlands to Glens Falls, known as Lake Albany, left behind extensive sand and clay deposits that attain their greatest breadth in the area of the mouth of the Mohawk River.

Upland soils of the region are characterized as "brown gravelly and stony loams," derived from glacial drift. Defined soil types in hilly terrain include the Lackawanna Stony Loam, the Dutchess Stony Loam, and the Cossayuna Stony Loam. The soils atop West Athens Hill conform to the Cossayuna Stony Loam, which was derived from Hudson valley sandstones, shales, slates, and limestones and occurs below an elevation of 1,000 feet. But the flat, low-lying areas between the river and the Helderberg Escarpment are covered by compact, clayey silts deposited by glacial Lake Albany. The resultant soils are "light brown silty loams" and are classified as Vergennes Clay (Smith 1954).

At Poughkeepsie in the mid-Hudson valley the average annual temperature is 50.9 degrees Fahrenheit, and the average annual precipitation is 40.8 inches. Average annual runoff is 20 inches, and average annual discharge along the Hudson River is 14,400 cubic feet per second in this area (Carter 1966).

Native vegetation of the Hudson valley south of Glens Falls conforms to the chestnut-oak-yellow poplar zone of the Southern Hardwood Forest. The flora of immediately surrounding uplands, including the Catskill and Taconic Mountains, are classified with the Northern Hardwoods, characterized as birch-beech-maple-hemlock (Braun 1950).

At the time of local European intrusion during the early 17th century, the regional hardwood forests supported a great variety of fauna, including such familiar species as white-tailed deer, black bear, elk, beaver, woodchuck, raccoon, otter, bobcat, gray fox, timber wolf, squirrel, fisher, muskrat, turkey, ruffed grouse, and many others. Migratory birds, including Canada goose, were plentiful in season. The deer, elk, and bear, as the largest animals, produced the most meat per individual and were therefore the mainstays among game, in all aboriginal periods except that of the Paleoindians, who occupied a rather different habitat, when caribou and extinct megafauna were locally present.

The Hudson and its tributaries ultimately

abounded in such fresh-water food fish as brook trout, small-mouth bass, and walleyed pike, but the largest amounts of protein were provided by spring runs of shad, alewives, herring, striped bass, and other anadromous species in what must have been astronomical numbers. Popular in later periods was the Atlantic sea sturgeon, which often exceeds 100 pounds in weight. This species was confined largely to tidal portions of the Hudson (Brumbach 1986; Smith 1985).

As far upstream as Stony Point, where Hudson River salinity is fairly high, oysters thrived and were consumed in vast quantities by the prehistoric Indians, especially those of the Archaic stage (Udell 1962; Weiss 1971). Farther upriver, under fresh-water conditions, there were extensive beds of river mussels, also utilized by the Indians. Plant foods were diverse and abundant, including mast products such as acorns, beechnuts, hazelnuts, chestnuts, walnuts, and butternuts.

The environmental setting in New York, as first encountered by Europeans, had persisted with relatively minor variations through the long time span of the Holocene epoch. The situation was rather different at the close of the Pleistocene epoch as the climate began to warm up. During glacial retreat from the mid-Hudson region about 15,000 years ago, the land was first colonized by tundra plants such as lichens, sedges, grasses, and dwarf willows. The succeeding forest cover, first dominated by spruce and fir around 12,000 years ago, gave way to a pine-oak assemblage, which by 7500 years ago was finally replaced by the mixed hardwoods dominant in the area today. This succession is indicated by pollen spectra (Connally and Sirkin 1970, 1971, 1986; Cox 1959; Newman, et al. 1968; Sirkin 1965).

During late phases of glacial retreat from the Hudson valley, between about 15,000 and 10,000 years ago, glacial Lake Albany attained a maximum elevation of over 330 feet. The summit of West Athens Hill was an island in the lake. The water levels began dropping after 14,000 years ago, and the modern drainage system was established by 10,300

years ago (Connally and Sirkin 1986; Dineen 1986, 1996). Paleoindians had probably entered the valley by around 11,000 years ago.²

The fauna comprised many species no longer present in the state, including mammoth, mastodon, caribou, giant beaver, giant sloth, dire wolf, moose-elk, horse, and bison (Fisher 1955; Martin and Klein 1989; Ritchie 1965: Figure 3). Most of these animals were extinct by 10,000 B.P. Others, such as the caribou and musk ox, were able to survive by following the retreating ice northward to their present subarctic and arctic habitats in Alaska and Canada.

The area of present-day Greene County was of great interest to prehistoric Indians because of the abundant sources of chert, some of high quality, exposed in bedrock outcrops. This helps to explain the unusually high frequency of chert quarries and workshops and the considerable abundance of sites of all periods. West Athens Hill and Flint Mine Hill are the best-known quarry-workshop sites in the region (Brumbach and Weinstein 1999; Parker 1924; Ritchie and Funk 1973).

At first glance, the bedrock geology in Greene County (Figure 2) appears to be relatively simple and straightforward (Goldring and Cook 1943; Isachsen, et al. 1991; Ruedemann, Cook, and Newland 1942). Indeed, the stratigraphy west of the Hans Vosen Kill is fairly easy to read (Figure 3). At the base of the Helderberg carbonate sequence is the Early Devonian Rondout Formation, deposited around 408 million years ago. Stacked atop the Rondout, from older to younger, are the Coeymans/Manlius, Kalkberg, New Scotland, Becraft, and Alsen limestones. Capping this pile are Middle Devonian rocks, more discontinuously represented west of the escarpment and east of the Catskills. These comprise the Tristates Group. From early to late this group consists of the Glenerie, Esopus, Carlisle, Schoharie, and

Onondaga formations. The Onondaga formation is dated to around 390 million years ago. The Glenerie and Onondaga are limestones, the Esopus and Carlisle are shales, and the Schoharie is mixed limestone and shale.

Overlying the Tristates, but occurring entirely west of the Helderberg, are shales and sandstones of the Hamilton Group, major bedrock formations of the Catskills. These are not known to produce cherts, and Middle and Late Devonian lithologies will not be further described here. Beneath the Helderberg Group is an unconformity, meaning there was an erosional or depositional gap between the Helderberg and much older underlying strata. Those strata directly beneath the Helderberg cuesta are Ordovician shales, graywackes, siltstones, and limestones. The Early Ordovician Deepkill formation is about 500 million years old and directly underlies the Normanskill Group, which is comprised of the sequential Indian River, Mount Merino and Austin Glen formations. Thrust faulting prior to the deposition of the Helderberg Group rendered the structure of this period rather complex. Rocks originally deposited east of the Hudson River's present channel were pushed westward during the Taconic orogeny, intruding into local formations and producing a melange of different units from several time periods (Brumbach and Weinstein 1999; Isachsen, et al. 1991). The severe folding and fracturing of units in the area of Greene County east of the scarp is partly obscured by outwash overlain by the planar deposits from glacial Lake Albany that lie over and around the tilted and upthrust Ordovician rocks.

Chert occurs in the Deepkill, Indian River, and Mount Merino formations. The great bulk of cherts at West Athens Hill, Flint Mine Hill (Brumbach and Weinstein 1999; Parker 1924), and other quarries of the region derive from the Mount Merino. Because the variable, but usually gray, green, black, and red cherts of the Mount Merino have traditionally been

² All radiocarbon dates listed here are uncalibrated; in other words, they are presented in *radiocarbon years*.

Bedrock Formations in Greene County, New York

▲ = West Athens Hill

Legend

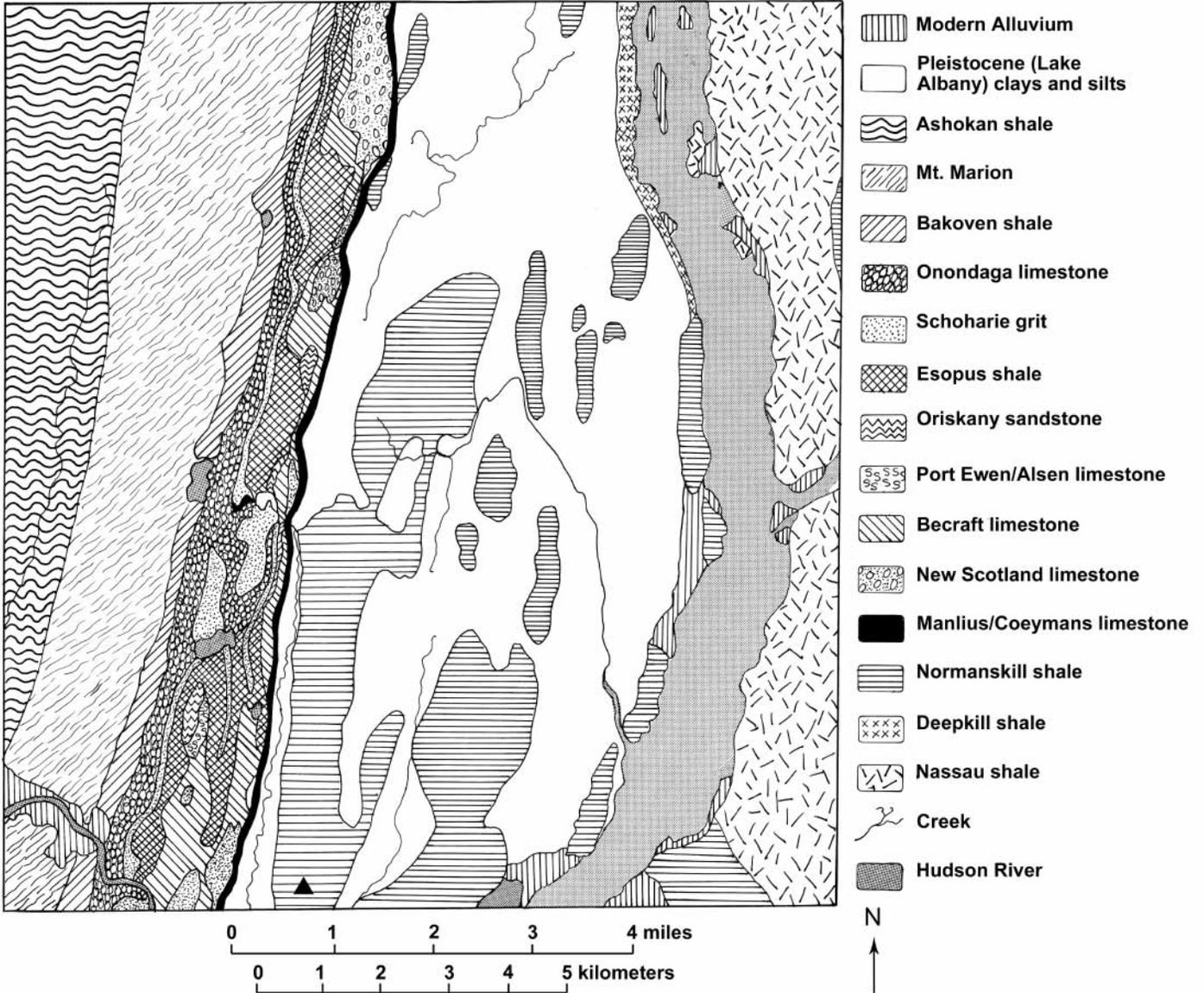


Figure 2. Geologic map of the middle Hudson Valley, showing the major bedrock types including the Helderberg series and the Normanskill formation. Chert occurs in the Normanskill, Kalkberg, New Scotland, Becraft, Alsen, Glenerie, Esopus, Schoharie, and Onondaga formations.

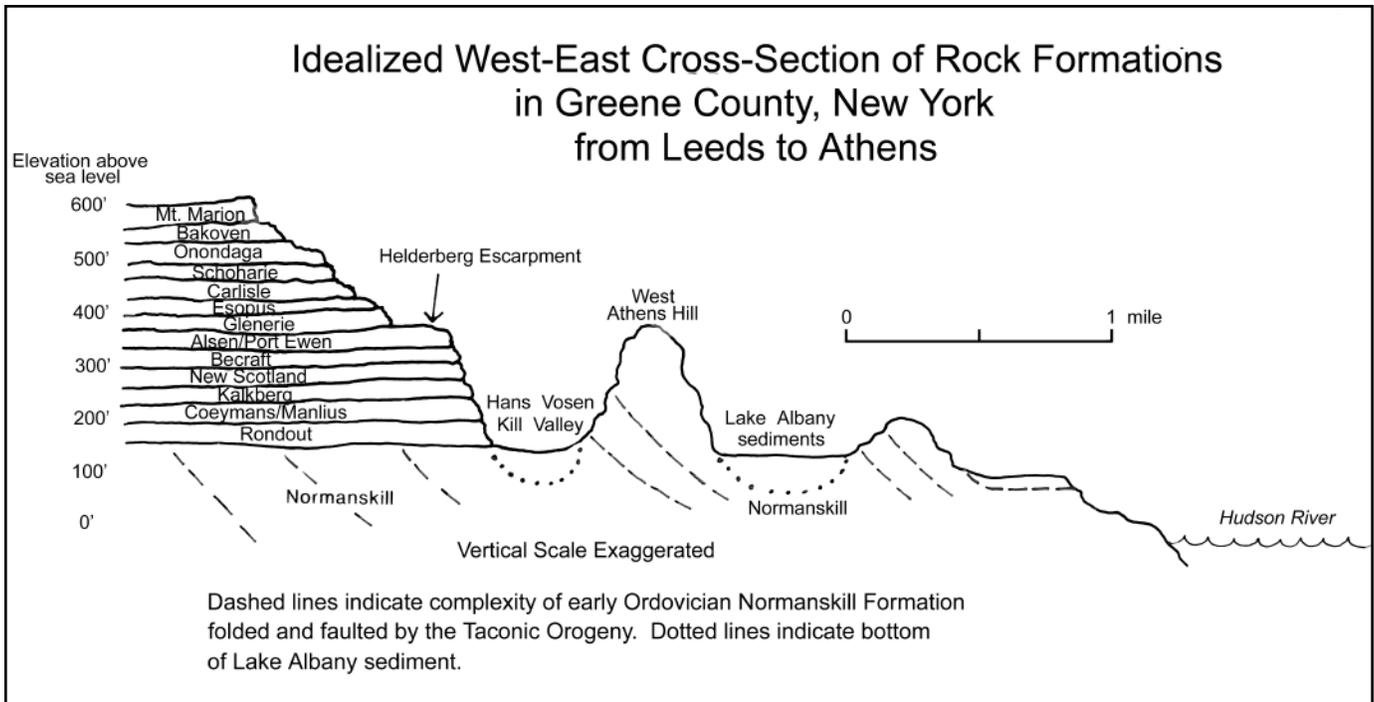


Figure 3. Idealized west to east cross-section of bedrock formations in the vicinity of West Athens Hill, from the Mount Marion shales at Leeds, to the Tristates series, to the Helderberg escarpment, to the Normanskill formation underlying, and in places, projecting above, Lake Albany sediments, ending at the village of Athens on the Hudson River.

assigned to the Normanskill formation of Ruedemann, Cook, and Newland (1942), that usage of Normanskill is continued here, although some writers now prefer the term "Mount Merino" (Brumbach and Weinstein 1999). As noted above, the term "Normanskill" is also inclusively used by Isachsen et al. (1991) to denote a group that begins with the Indian River Formation, followed by the Mount Merino Formation, and concludes with the Austin Glen Formation.

Not usually mentioned by researchers are extensive quantities of readily available, high-quality cherts derived from the weathering of the Helderberg escarpment. These consist predominantly of the dark blue to deep black, homogeneous, relatively dull surfaced Kalkberg chert, which occurs as innumerable blocks in the deep talus at the foot of the scarp. This chert could easily be confused with the dark gray to black Normanskill variety. Cherts occurring above the Kalkberg zone in the New

Scotland, Becraft, and Alsen formations may also occur in the talus. These cherts tend to be gray in color. Other chert sources lie at the top of and west of the escarpment, and these are largely Onondaga cherts, of the "eastern" variety, that is, the material is relatively dull and uniform in surface appearance, with subdued mottling confined chiefly to areas of gray interspersed with brown. This variety contrasts vividly with Onondaga of the western New York or "Divers Lake" variety, which is characterized by a lustrous surface, and brighter colors occurring in mottled areas of gray, brown, and blue. Native quarries and workshops occur in areas west of the New York State Thruway. Kalkberg, Onondaga, and other locally available cherts only rarely occur in Paleoindian assemblages in the mid-Hudson valley, because Normanskill/Mount Merino chert was apparently preferred. The Appendix presents descriptions of the major cherts occurring on eastern New York sites.

SITE DESCRIPTION AND SETTING

The summit of West Athens Hill is reached by a gravel road that ascends the relatively gentle south slope from U.S. Route 9W (Figure 4). From the highest point atop the main knoll one commands a fine westward view of the picturesque valley of the Hans Vosen Kill and the Helderberg Escarpment. The New York

State Thruway runs along the top of the escarpment, just behind its rim; and looming in the background is the skyline of the Catskill Mountains (Figure 5). The eastward view is partially blocked by remaining trees on the hill, but on a clear day it is possible to catch glimpses of the rolling terrain between the hill

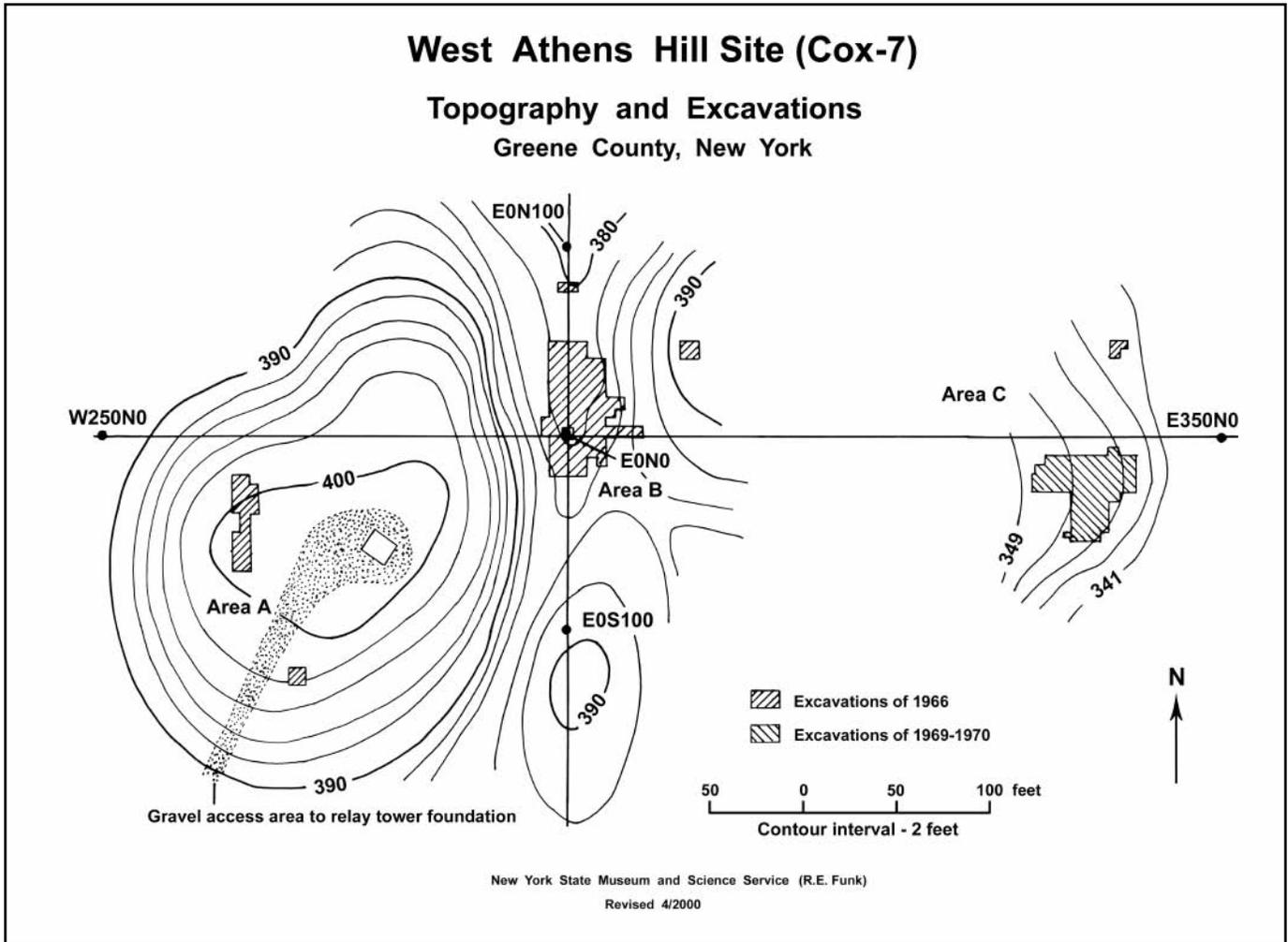


Figure 4. Map of the West Athens Hill site, showing major loci (Areas A, B, and C) and excavated areas.



Figure 5. View looking west from the summit (Area A) at West Athens Hill, showing the Hans Vosen Kill valley, the Helderberg escarpment, and the Catskill Mountains in the background.

and the Hudson River, which is 2.3 miles distant from West Athens Hill. Trees also screen the north and south lines of sight.

Most of our explorations took place on the summit area, which was littered with chert and some artifacts resulting from the bulldozing operation, and in an adjoining small hollow. The elevation of the main knoll is around 410 feet. At the base of the main knoll's eastern slope is the aforementioned hollow, on the east side of which are two small wooded rises. The crest of the northeastern rise has an elevation of 392 feet. The lowest part of the hollow is 380 feet above sea level. On the north side the hill drops rather steeply to a low saddle between it and the next prominent rise. East of the small rises is a gradually steepening slope to a topographic bench, which at elevations of 339 to 350 feet overlooks a steep decline to

U.S. Route 9W. Significant quantities of chert wastage are to be found on all of the upper slopes and benches.

Bulldozer disturbance was most extensive on the main knoll, where a considerable volume of topsoil had been pushed over the edge along with trees. Bedrock projects above topsoil here in many places, occasionally displaying veins of chert. The ledge also reaches the surface on the less disturbed, fairly steep east slope of the knoll, as well as on the slopes and tops of the two minor knolls and the bench. Most areas of the site were probably never covered by more than a thin, patchy topsoil mantle like that present in undisturbed loci today. The excavation locus named Area B was the chief exception, due to somewhat thicker deposits overlying bedrock.

Massive quantities of shale were removed by commercial quarrying on the east and south sides of West Athens Hill. These activities apparently did not damage prehistoric cultural resources, since no chert is known to exist in the rock units at those lower elevations.

The forest cover of the ridge and its companions consists mainly of oak, maple, cedar, ash, and associated species of the Southern Hardwoods (Braun 1950). Since the summit was cleared in 1962, sumac and other shrubs and grasses have thrived on the site. No springs have been observed on the sides of the West Athens Hill, and the nearest stream is hundreds of yards distant from its base. Water may, however, have been available to the prehistoric Indians from springs which have not been active for centuries.

RESEARCH GOALS

No research design was specifically formulated for West Athens Hill as reported in Ritchie and Funk (1973). The investigations were subsumed under the overall research design of the settlement pattern project. Nevertheless, an *implicit* set of research goals was as follows:

1. To determine the importance of the Paleoindian component(s) relative to later occupations on the site;
2. To determine whether parts of the site were stratified, thus contributing to the separation and delimitation of components;
3. To acquire a representative sample of artifacts associated with the Paleoindian component(s);
4. To gather information on quarry technology and other on-site activities;
5. To find and collect organic material suitable for radiocarbon dating;
6. To find and collect faunal and floral remains representing subsistence practices;
7. To gather sedimentological, palynological, pedological, and other data that might assist in reconstruction of the late Pleistocene environment; and
8. To place the site in the context of regional subsistence-settlement patterns for the Paleoindian period.

As shown on later pages, we were partially successful in meeting all of these goals.

EXCAVATION

The total area of the West Athens Hill site comprises about two acres (about 8,100 square meters), not counting possible extensions on the steep slopes or immediately adjacent low ground and rises. Because our explorations were to be focussed on the hollow between knolls, our north-south baseline, or EO line, was set up there (Figure 6). This line almost precisely bisected the area to be excavated within the hollow, which has a similar orientation. A grid of 10-foot squares was established in the hollow, which was designated as Area B. The grid system was extended to the main knoll, west of the concrete tower foundation. This area, which yielded most of the surface-collected objects on the site, was referred to as Area A.

Areas A and B were excavated by the writer and a small State Museum crew in the summer of 1966 and the fall of 1967. In August 1969, and again in 1970, I returned for a few days with another crew to open a number of squares on the narrow topographic bench that overlooks Route 9W. This bench at West Athens Hill is referred to as Area C. Small loci, designated Areas D, E, and F, were tested on top of, and to the north and east of, the main hill in 1970.

Due to the shallowness of bedrock and the predominant stony composition of the surface deposits, the grid stakes employed were pointed steel rods 21 inches long and 3/8s of an inch in diameter. These rods could be driven vertically into the ground, including bedrock crevices, with some degree of accuracy. A transit and tapeline were used to emplace the grid. The baseline was oriented one degree east of north. Each stake was

capped by a partially perforated wooden block, on which its number was painted. Elevations were read at the ground surface adjoining all stakes plus a series of scattered points, using the transit, and a plane table map was made. The contour map of West Athens Hill (Figure 4) is based on these data.

In Area B, 20 whole and 7 partial 10-foot squares were excavated, for a total area of 2,300 square feet or 207 square meters (Figure 4). This area includes 2,250 square feet opened by the close of work in late July 1966, plus 50 square feet within a test area dug in the fall of 1967. Portions of sections E0S10, E0N10, W10N10, and E0N0 had been disturbed by unauthorized amateur digging prior to the 1966 season.

In Area A, 5 whole and 5 partial squares were excavated for a total area of 700 square feet (63 square meters). In addition, a number of small areas had been dug by R. Arthur Johnson during testing from 1963 to 1965. In



Figure 6. View of excavations in Area B, looking north.

Area C, 13 whole and 9 partial squares were excavated for a total area of 1,735 square feet, or 156 square meters.

Field methods were as follows. Brush was first cleared from the gridded areas. Where the topsoil, Stratum 1, still existed it was removed by troweling down either to bedrock or to the top of Stratum 2, the yellowish-brown layer. Where Stratum 2 existed, it was excavated to culturally sterile levels or, in some instances, to bedrock. With a few exceptions the exact horizontal and vertical position of artifacts was recorded, noting any unusual associations. The exceptions include some surface finds, and occasional items which were inadvertently thrown into level bags along with debitage.

Since Area A had been skimmed by bulldozer, and thin topsoil directly overlay bedrock in most places, little debitage besides utilized flakes and cores was saved, in the belief that distributional studies of workshop activity would not be feasible for Area A. Parts of Area B had been bulldozed or dug by collectors. This fact and the sheer difficulty of saving and transporting the masses of chert wastage encountered in the hollow excavations led us to select only a few squares from which all cultural material would be saved. Screening was not a regular part of field technique, but samples were collected by careful

troweling. At the end of the 1966 and 1967 field seasons, and again at the close of the 1969 and 1970 investigations, several hundred pounds of workshop debris had been hauled away to the State Museum laboratory, in addition to artifactual material and soil and charcoal samples.

Soil samples and pollen samples were taken from exposed cross-sections at various places in Areas A, B, and C. Charcoal of possible Paleoindian origin was collected assiduously, but there were several burned tree stumps on the site with charred roots penetrating deeply into the ground. Possible features were carefully recorded. Balks were left between squares in Areas B and C until all profiles were drawn. Photographic records in black and white and color were made wherever appropriate.

Much to our disappointment, no hearths, storage pits, refuse bone, plant food remains or post molds were found at the West Athens Hill site. All uncalcined bone material must have long since perished in the strongly acidic soil (pH 4.5 to 5.5), but we were surprised at the complete absence of calcined bone and charred vegetal matter apart from burned tree stumps, since the occupants presumably camped and ate briefly on the hill during quarrying. The absence of confirmed hearth features poses a major interpretive problem.

SEDIMENTARY CONTEXTS

The term “context” is more applicable than “stratigraphy,” at West Athens Hill since the artifact-bearing deposits varied considerably in thickness, color, texture, distribution, and amount of disturbance, and as will be seen, in some places the vertical distribution of artifacts may be lacking in significance.

AREA A

As the site map (Figure 4) shows, the excavated squares of Area A were for the most part arranged in a rectangular north-south oriented block. Between sections W180S70 and W180S40, the sandstone bedrock was very close to the surface in Area A, and in fact was already exposed in some places. Here a thin, brown-colored topsoil, Stratum 1, in which a few weeds had taken hold, unevenly mantled the stone at thicknesses ranging from zero to four inches (0 to 10 cm). This apparent humic layer contained a high percentage of chert debitage and crushed sandstone fragments. It was probably somewhat thicker prior to bulldozer disturbance. Occasionally, small pockets of yellowish-brown soil invested shallow depressions in bedrock below Stratum 1. Artifacts were present in small quantities, occurring wholly on the surface or in the topsoil.

In sections W180S30, W170S30, and adjoining squares the yellowish-brown zone, Stratum 2, was thicker, covering the bedrock to varying depths. Here Stratum 1 varied from three to four inches (7.5 to 10 cm) deep. It contained fairly numerous chert chips, cores, a few hammerstones, and other artifacts. Stratum 2, a yellowish-brown, silty deposit with some small gravel, contained much bro-

ken sandstone, some cobbles, and chert debris in its upper five to eight inches (12.8 to 20 cm), but it graded into a homogeneous, culturally sterile silt and gravel component in its lower levels. In the northern part of Area A some tree root disturbance was evident, and possible rodent burrows were noted. Bedrock projections in Stratum 2 evinced some untouched nodules of high-grade chert. Stratum 2 displayed vague horizontal gradations in color and texture.

Some 30 feet north of the S20 line a five-foot-by-five-foot test square produced a somewhat different stratigraphic picture. This square was located on the steepening northern slope of the main knoll, hence gravity may have assisted in the natural movement of loose material from the summit. In this square, Stratum 1 and the yellowish-brown grainy deposit were separated by a layer of fine light brown, powdery soil containing chert chips but little broken stone. The yellowish-brown layer was full of rock fragments, but it was culturally sterile. The light brown, powdery stratum is referred to as Stratum 2A, because it seems to correlate with the upper portion of Stratum 2 in the nearby excavations.

In the main excavation, utilized flakes and other artifacts in Strata 1 and 2 were observed to cluster tightly around stake W170S30 when plotted on a map, suggesting a concentration within an aboriginal feature. No pit outlines, post molds, or other evidence of a feature were observed, however.

In sections W180S60 and W180S70 an interesting feature (No. 1) was excavated (Figure 7). This was an elongated, bathtub-like depression in the bedrock, filled with dark



Figure 7. View of excavations in Area A, showing presumed quarry pit, looking north. J. Cynthia Weber holds stadia rod for scale.

brown humic soil containing bits of sandstone, a few chert chips, and 16 cobble hammerstones. It measured 9 feet long, 3 feet wide, and 3.5 feet deep (274 cm by 91 cm by 107 cm). Only a few small chert inclusions were observed in the walls of the trough. Possibly it was the site of a good chert vein quarried to exhaustion by the Indians. But one might also consider another hypothesis, that the feature was used for storage. It doesn't seem likely or practical, however, for the residents to store the hammerstones in the pit in anticipation of their later use since glacial cobbles were abundant locally. There is also no evidence it functioned as a burial pit, since no human bones or mortuary offerings were

associated. It is possible, though very unlikely, that bones and offerings of organic materials had been placed in the pit along with the hammerstones but have long since decayed away.

AREA B

The investigated part of the gully, or hollow, lay between the S20 and N90 lines. This area is contoured like a small trianguloid basin, narrow at the south end and broadening toward the north. It is bounded on the west by the steep eastern slope of the main knoll, and on the east by one of the smaller knolls. At its extreme south end the gully swings south-southwest, funneling into a nar-



Figure 8. West profile of section W10N0. Visible are the dark brown topsoil, stratum 1, and the underlying yellowish-brown zone, stratum 2. Debitage is visible in stratum 1 and at the top of stratum 2.

row defile. On the north, it extends to the brink of the steep slope of the hill.

The floor of the excavated area was fairly level toward the center, along the north-south baseline, but sloped upward with increasingly steep gradient to the east and west, merging with the sides of the adjacent rises. As previously mentioned, bedrock projections were fairly common on the shoulders of the knolls. Chert inclusions were visible in some of them.

Before excavation, the hollow, understandably more moist than higher elevations, was filled by a heavy overgrowth of grasses, berries, briars, and sumac, which had to be removed prior to emplacing the grid.

It was obvious in scraping off the sod and troweling into the topsoil that there was considerable variation in the extent of bulldozer disturbance. In some places the topsoil seemed untouched, firm and compact, occasionally laced by the intact roots of trees. In other areas this layer was loose, contained twigs, broken roots, and other plant debris; and fragments of sandstone and chert, once half-buried so that their exposed surfaces were weathered and clean while their buried portions were soil-stained, had been displaced and tumbled into new positions with the soil



Figure 9. West profile of section E20N0. Readily apparent is the concentration of debitage in the topsoil (stratum 1) and in the upper levels of the yellowish-brown zone (stratum 2). The sterile lower portions of stratum 2 rest on bedrock.

stains exposed facing upward. Much of this disturbance was essentially superficial, confined to the upper inch or two of Stratum 1, and can be attributed to the churning of bulldozer treads. In some squares, however, the bulldozer blade seems to have scraped or gouged into the soil, wreaking havoc with the stratification, and reaching even to the shallow bedrock in the southern sections between the S10 and S20 lines. Evidence that whole trees were torn from the ground was present in a few places. The best-preserved deposits were in the central and northern parts of the grid. Here machine damage seemed minimal.

The stratigraphic picture in Area B was basically the same as in Area A, with the important difference that the hollow was in an accumulative, rather than erosive, geological situation (Figures 8, 9, 10). Hence the deposits were thicker than on the main knoll.

Stratum 1, the dark brown humic topsoil, irregularly covered by a thin sod, varied considerably in thickness from one inch on the sloping edges of the hollow to 12 inches (30 cm) in its center. Over 50 per cent of its volume comprised chert debitage and sandstone fragments. This layer was easily distinguished from the deposits on which it rested. Most of

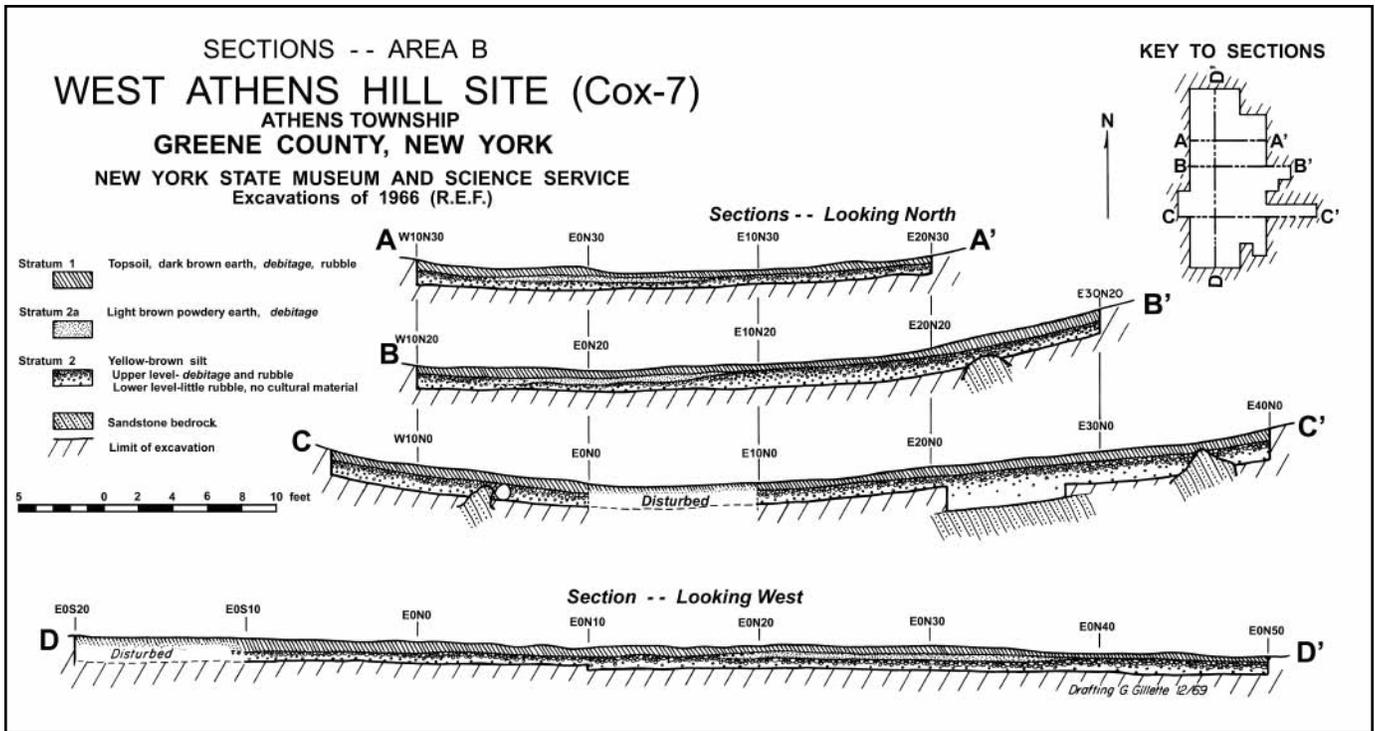


Figure 10. Stratigraphic profiles in Area B.

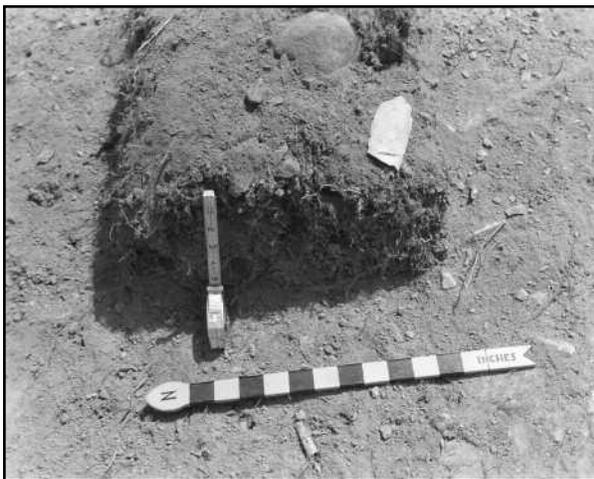


Figure 11. Fluted point uncovered in stratum 1, section E10N20.

the Paleoindian artifacts, including fluted points (Figures 10, 11), were found in it.

Stratum 2 showed a certain amount of horizontal and vertical variation in color, texture, and composition. In a majority of squares, the undisturbed zone was yellowish-brown to reddish-brown in color, and the primary con-

stituent was a silt apparently derived from the regional bedrock by glacial action. In post-glacial times some of it may have collected in the hollow through erosion and soil creep. Scattered through the silt in its lower portions were small angular fragments of sandstone, some pebbles and cobbles of exotic material, and a few natural spalls of chert. The upper few inches of the Stratum 2 generally contained a high percentage of such fragments, plus many larger slabs, and a significant quantity of debitage and artifacts. There were no sharp breaks between the upper levels and lower levels in terms of color or texture, but chert flakes, cores, artifacts, and slabs terminated abruptly when a certain plane was reached in excavation. Two squares (E10N20, E10N30) along the eastern side of the grid, located on the lower slope of the northeastern knoll, were not culturally productive. Here topsoil was thin, and only a few flakes occurred in Stratum 2.

In squares W10N20, W10N30, E0N20, and E0N30, all located in the central, flattest part

of the basin, the deposit became a bit more complicated. Within a roughly circular area about 20 feet (6 m) in diameter, Stratum 2 was separable into two easily distinguished sub-zones, 2A and 2B (Figure 10). Near the east edge of section E0N20, Stratum 2A appeared as a thin lens between Stratum 1 and the yellowish-brown, culturally sterile lower deposit, thickening to the west. This subzone, light brown in color, was a dry, powdery, loose, finely textured silt containing sandstone fragments, debitage and artifacts. It was thickest—about 6 inches (15 cm)—near the E0N30 stake. Within a radius of approximately 10 feet (3 m) from the stake on the north, south and west this enigmatic lens merged by subtle changes in color and texture into the upper, culturally productive levels of the main Stratum 2 bed. Thus, there is good reason to consider Stratum 2A as a special, localized facies of Stratum 2. It may have been truncated by bulldozing operations in sections E10N20 and E10N30. The underlying yellowish-brown zone designated Stratum 2B, devoid of cultural remains, corresponded to the lower portion of Stratum 2 in the areas where Stratum 2A was lacking.

Mineralogical examination of samples from Stratum 2 in Areas A and B was carried out in 1970 by M. Raymond Buyce, then Curator of Mineralogy, New York State Museum and Science Service. His analysis confirmed the affinities of the samples to the local bedrock. He described the sediment as fine-grained weathered sandstone and siltstone. The constituents are largely quartz, with a minor component of limonite and traces of mica.

A possible feature (No. 2) was noted in the north half of section E0N20 and the south half of section E0N30, in the central portion of Stratum 2A. Here was found a very high concentration of chert flakes and cores, a few angular rock fragments, possibly fire-cracked, and scattered flecks of charcoal, all of which were carefully collected. The concentration appeared to be about five feet (1.5 m) in diameter. Again, no pit outlines or other traces of deliberate aboriginal construction were seen.

Other possible features consisted of tight concentrations of chert wastage, largely confined to circular or oval areas about 12 inches (30 cm) across and seeming to occur in shallow depressions within the top of Stratum 2; a postmold-like feature 8 inches (20 cm) in diameter first noted at the base of Stratum 1, identified by its tan-colored fill (quite unlike the usual postmold), extending 17 inches (43 cm) into Stratum 2, nearly straight-sided in cross-section and narrowing to a blunt point at the base; concentrations of charcoal, probably of modern origin considering the unburned as well as burned wood they contained; and some irregular depressions filled with brown humic soil identical with that of Stratum 1. Only the debitage and artifact concentrations, and a handful of definitely fire-cracked cobble fragments (manifesting irregular, angular fractures and all-over reddened surfaces), were clearly the result of prehistoric human activity.

AREA C

The topographic bench locus is about 60 feet (28 m) wide and situated part way down the eastern slope of the hill. The deposits that overlie bedrock there are thinner than in the hollow (Figure 12). The dark, grayish-brown (10YR 4/2) topsoil, Stratum 1, was two to eight inches (5 to 20 cm) thick, averaging about four (10 cm). Stratum 2, of pale-brown color (10YR 7/4), varied in thickness but was rather shallow, since bedrock was encountered in every excavated square, protruding up into Stratum 1 and sometimes reaching the surface. Stratum 2 contained much rubble derived from the bedrock.

Stratum 1, consisting mainly of silt and gravel, but with some humus content, yielded large quantities of debitage and over 150 artifacts. Unlike the corresponding deposit in Areas A and B, Stratum 2 in Area C was largely devoid of cultural remains. In some excavation units, however, artifacts and debitage were occasionally recovered from apparently undisturbed upper portions of Stratum 2.



Figure 12. View of excavations in Area C, showing cross-sectioned portion of dark brown colored stratum 1, resting on yellowish-brown stratum 2. The great majority of artifacts and debitage occurred in stratum 1.

These may have been introduced into Stratum 2 from Stratum 1 by the action of tree roots, tree falls, animal burrowing, frost heaving, and the activities of prehistoric inhabitants.

The bedrock exposures were rich in chert veins. As in Area B, Stratum 2 occasionally produced pebbles and cobbles of quartzite and gneiss, apparently imported by glacial action.

Certain areas where bedrock protruded above or lay just under modern ground surface would have provided the Indians with sources of raw material for artifacts and also as platforms for stone working. In section E260S20 a mass of bedrock projected upward at an angle of about 75 degrees and contained a six-inch-thick (15 cm) vein of high-quality, greenish-gray Normanskill chert. Some of this chert had been intentionally removed, as evidenced by loose blocky fragments surrounding the outcrop. Some fragments may have been loosened by natural agents but others could not have fallen directly onto the positions where they were found. Also, they displayed irregular edges where they had been forcibly detached from the bedrock.

More impressive was the activity area in section E300S30. Near-horizontal large bedrock segments, still in situ but partially detached from the underlying matrix, displayed places where chert blocks had been

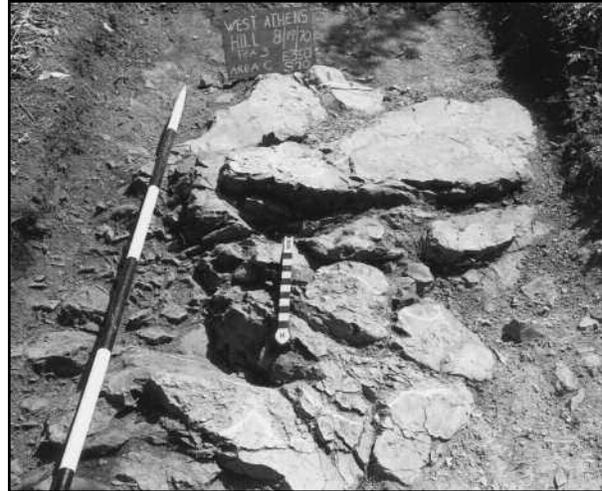


Figure 13. Exposed bedrock feature in Area C, showing irregular edges where chert was quarried off, detached fragments adjoining mass, and battered areas (outlined in chalk) used as an anvil platform.

broken off, presumably by vigorous hammering, leaving irregular, sometimes scalloped edges instead of the otherwise straight, smooth erosionally rounded edges. Detached angular fragments of chert lay around and between the slabs. The flat top surfaces of these slabs were also generally smooth except for several locations showing scarring or multiple pitting (Figures 13–15). Evidently the scarred areas were the result of hammering with cobble tools during use of the rock masses as anvils—perhaps not only for chert-knapping but for breaking open animal bones for marrow or making bone tools. Although no hammerstones were directly associated, several were found within a few feet of the outcrops.

There were no clearly defined features such as fire hearths, storage pits, or post molds, in the Area C deposits. There was some debate among the team concerning the possibility that certain angular fragments of rock could be called fire-cracked, and also whether slightly reddened soil in some units was from exposure to prehistoric fires. But it proved impossible to confidently identify hearths, fire-cracked rocks, and other such phenomena at West Athens Hill. Questions were also

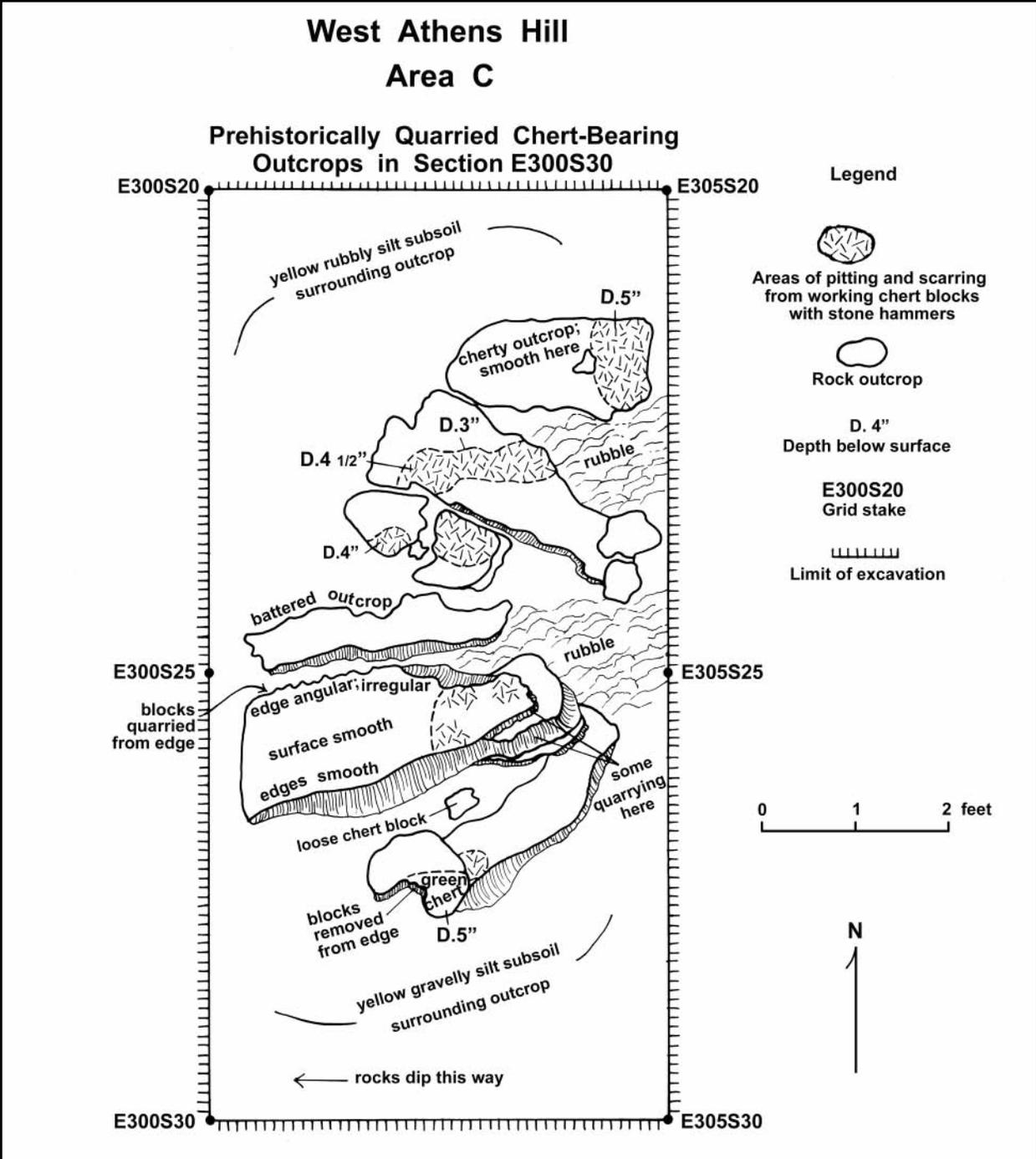


Figure 14. Map of the quarried chert outcrop in Area C.

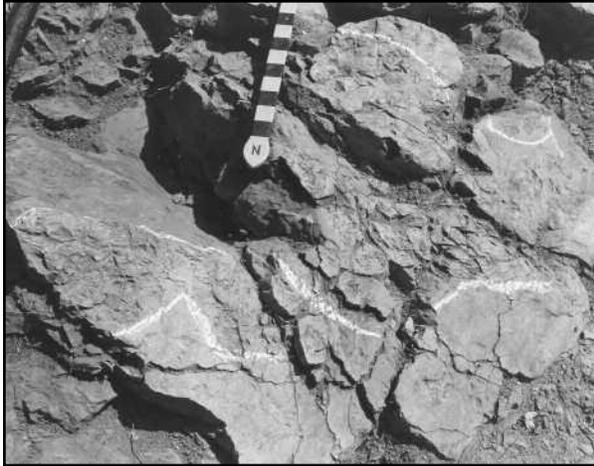


Figure 15. Close-up view of the areas on the bedrock mass showing anvil-pitting.

raised about possible cultural stratigraphy within the shallow Stratum 1 deposit in Area C, and one crew member attempted to demonstrate such vertical patterning by piece-plotting all debitage in one unit (section E300S60). My analysis of the data from that unit failed to convince me that there were real stratigraphic patterns within Area C, but one difference from other parts of the site consisted of an unusually high frequency of non-local rocks in that unit; there were boulders of fossiliferous Becraft limestone, and cobbles of Alsen and Kalkberg chert and Oriskany sandstone. G. Gordon Connally identified these and suggested they were glacial erratics, first washed into the main Hudson valley along energetic streams and then transported down the valley by glacial ice.

AREAS D, E, AND F

Area D was a five-foot-by-five-foot test square located on the northern slope of the main knoll, north of Area A. Areas E and F

were located several hundred feet north of Area C, and at elevations slightly below it. They were also well north and slightly east of the main knoll and Area B. Stratigraphy at these three loci was very similar to that at Area C. Areas E and F were quarry-workshop loci, undisturbed in historic times, and the depth of the artifact-bearing deposit varied, in some places up to 15 inches (38 cm) thick. The deposits were largely quarry debris. Referred to as Stratum 1, the cultural deposits overlay Stratum 2, the yellowish-brown sand and gravel of variable thickness, and overlying chert-rich bedrock. In Area F, there were several large, moderately deep depressions that were interpreted as Indian quarry pits. They were not a result of tree falls, and were filled chiefly with chert quarrying debris at least 15 to 20 inches (38 to 50 cm) thick. The largest depressions were approximately 20 feet (6 m) in diameter (Figure 16). Our limited tests indicated that Stratum 2 was lacking in artifacts and workshop debris, but this inference must be confirmed by more extensive excavation.



Figure 16. View of chert quarry pit in Area F.

SUMMARY OF GEOLOGICAL HISTORY

The depositional history of the West Athens Hill site after the final advance of the Wisconsin ice is interpreted as follows.³ As the glacier withdrew, it left behind an extensive mantle of pulverized shale and sandstone drift, varying in thickness, that had been derived largely from the Normanskill group of rocks north of the site in Greene County and Albany County. The occasional exotic pebbles and cobbles of quartzite and gneiss found in Stratum 2 date to this period. Immediately thereafter, weathering and erosion took effect, slowly removing some of the finer-grained sediment from the higher ground and depositing this material a little at a time in the hollow and on other areas of low, level ground. During this period, Paleoindian hunters arrived on the scene, and at various times quarried chert from bedrock exposures. They scattered chert tailings and chipping debris around the site; made, lost, and discarded artifacts; and carried out other tasks. Eventually they left, never to return, probably because their cultural pattern evolved into an as-yet-undetermined new pattern. Subsequent visits were made by Archaic and Transitional period Indians. Meanwhile, during the centuries after the disappearance of Paleoindians a pine-oak forest, then a modern deciduous forest cover, replaced the spruce-fir parkland that had established a foothold after glacial retreat (Connally and Sirkin 1971, 1986). This vegetation contributed to formation of a humus-rich topsoil, but the process

was slowed by the heavy carpet of debitage, the compact silt till sediment, and outcrops of bare rock.

In the hollow, Area B, the Paleoindian living floor was probably first established at the level of the base of Stratum 2A, or several inches below the present-day top of the yellowish-brown portions of Stratum 2. Through the years, the action of rainfall, seasonal variations in temperature, and gravity caused surficial portions of the silt to move from the side slopes toward the middle of the depression, partially covering the concurrently building layer of debitage. At the same time, lighter wind- or water-deposited dust and silt built up the lens of Stratum 2A in the central area of the hollow. On its western periphery, this material mingled and merged with the yellowish-brown silt and angular stone which was moving downslope from the main knoll. After the departure of Paleoindians, some debitage still overlay the silt deposit. Soil-forming agents, including vegetative growth and decay, bacterial action, and the movements of micro- and macro-fauna, began to bury the workshop detritus under a humus layer, but this process was not yet fully completed when the telephone company erected its relay station foundation.

The process of soil deposition inferred for Areas A and B probably applied, in large part, to Area C. However, it is a mystery that Stratum 2 in Area C was lacking an occupational zone, as contrasted with occasional

³ For assistance in interpreting geological phenomena at the site, I am indebted to glacial geologist G. Gordon Connally, who examined the deposits on August 25, 1970. He referred to Stratum 2, the yellowish-brown deposit, as a "silt till."

finds of artifacts and flakes probably intrusive from Stratum 1. Although there was less accumulation of the bench deposits over bedrock than in Area B, Stratum 2 on the level top of the summit knoll contained some cultural remains. Perhaps the local topography in Area C accounts for this situation. The topographic bench is wider than the floor of the hollow; the highest part of the bench is some 30 feet from the base of the slope behind it, within our grid area; and the bench slopes gently downward to the north. Thus, although as might be

expected the deposits at the juncture of slope and bench were thicker than elsewhere on the bench, there was no rise to the east which could have contributed sediment to the deposits, in a manner analogous to that in the hollow. Also, because there was a slight depression between the gridded area and the base of the slope, some material from the side of the hill may have washed or crept northward along the sloping bench, rather than fanning out in the area of our excavations.

ARTIFACTS FROM AREAS A AND B

Descriptions of artifacts from the 1966 excavations in Areas A and B are presented here as reported in Ritchie and Funk (1973) but with minor changes. Artifacts from Area C are described separately on later pages. The artifact illustrations originally published are included here, but they are complemented by new illustrations of representative artifacts from Area C.

Most of the material to be described is in the collections of the New York State Museum. Before his death in 1994, R. Arthur Johnson donated his own collection to the museum. In the 1960s small surface collections were also donated by Paul and Thomas Weinman and by John Forstenzer. The late John McCashion also made part of his collection available for study.

The West Athens Hill site has been looted by various people since its first discovery and subsequent publication. Some of these collectors have come from as far away as New England. It is rumored that several fluted points have been found by these individuals in the course of surface hunting and digging in various places on the site. It seems certain that the nature and extent of these finds will never be available to science, studied in detail, and added to the published record.

A total of 1,535 recognizable artifacts was recovered from Areas A and B at West Athens Hill in the five years of investigation from 1963 through 1967. This total differs from the figure of 1,493 published in 1973, because 42 items donated by R. Arthur Johnson in 1979 are reported here for the first time. They do

not appear in the following summaries and tables, but are listed at the conclusion of the chipped stone descriptions. Of the total of 1,535 artifacts, 665 are deliberately chipped stone items. An additional 685 objects are utilized flakes and cores (inclusive of 5 pieces esquillee), and there are 185 rough stone tools. No artifacts of other materials such as bone, antler, wood, or shell were found.

A small number of later prehistoric tools have been recovered from the West Athens Hill site. A drill tip and 10 projectile points or point fragments—five of which were found on the surface in Area A, while the remainder were unearthed from Stratum 1 in Area B—represent relatively late occupations. They are chiefly Late Archaic to Transitional types, and will not be further described here (Figure 17).

CHIPPED STONE

Bifaces

Bifaces were placed in four main groups, relying on several criteria.⁴ These groups represent successive stages in manufacture, modified from chert nodules, vein plates, and blocks picked up or quarried by the Indians on the site. The first two groups, Stages 1 and 2, are blanks or preforms which are relatively crude, thick, percussion-flaked objects illustrating early stages in roughing out and shaping an artifact with a finished form in mind (cf. Callahan 1979; Fitting, De Visscher, and Wahla 1966: 39–46). Stage 3 objects represent the near-final form, but in the case of projectile points and biface knives, some final modifica-

⁴ In Ritchie and Funk (1973), these groups or “stages” were designated A, B, and C.

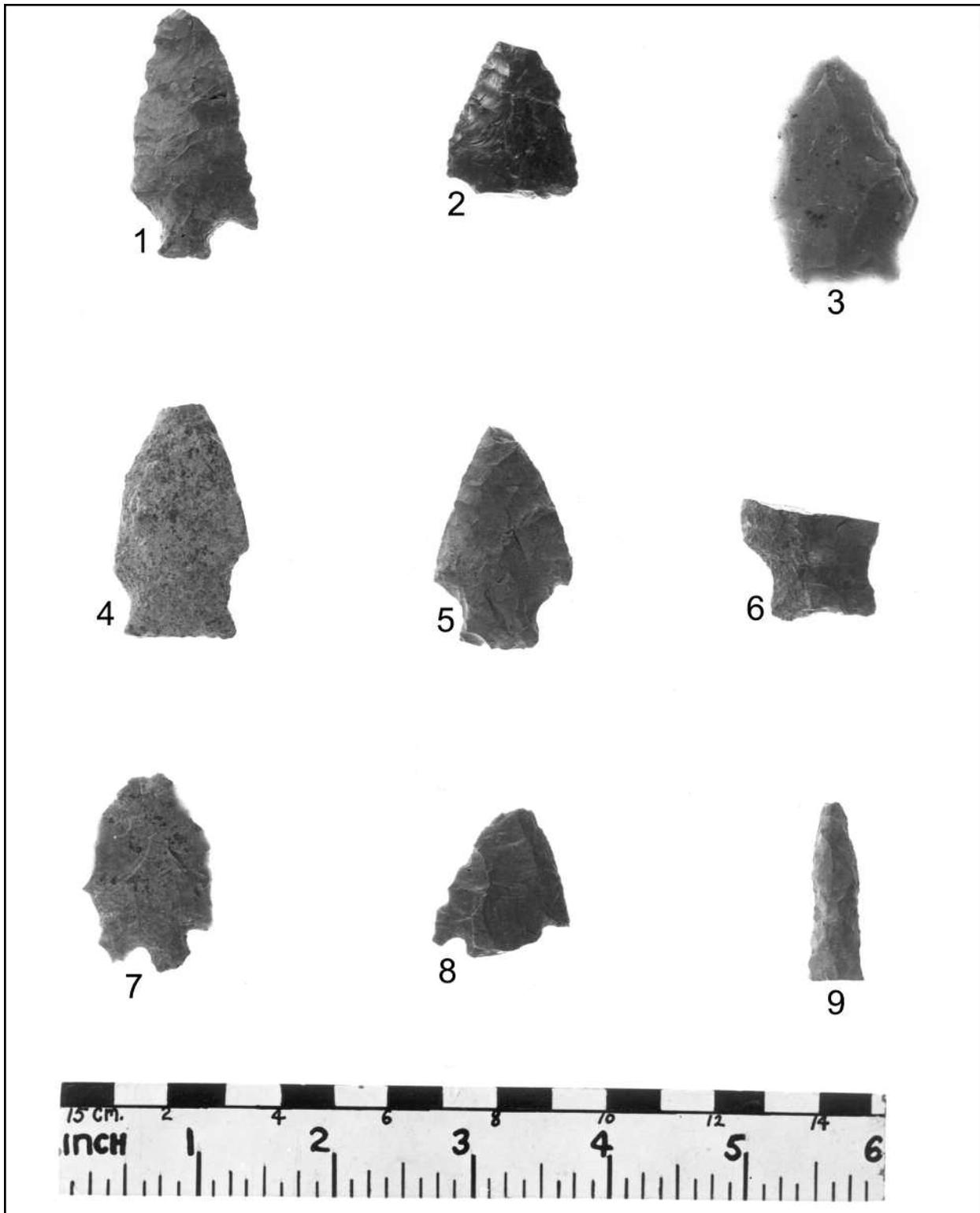


Figure 17. Archaic and Transitional projectile points and a drill from Areas A and B. No. 1, untyped expand-ed-stemmed broad-bladed point; 2, notched or stemmed, broad-bladed point lacking base; 3-6, points closely resembling the Susquehanna Broad type; 7, 8 bifurcated-base points; 9, drill tip fragment. Material: 1, 3, 5-9, Normanskill chert; 2, black chert; 4, speckled gray chert

tions may remain to be performed and the finished product is referred to as Stage 4.

All Stage 1 and 2 bifaces, and most Stage 3 bifaces, are made of Normanskill chert.

Accompanying the descriptions of the bifaces from Areas A, B, and C are scattergrams showing the relation of the variables width vs. thickness, and in some cases, length vs. width, for each group. In most cases there is a tendency for the numerical data to cluster (i.e., they are not distributed randomly, and there is a tendency to slope upward from left to right). Sometimes the clustering is tight, but in other cases it appears very loose indeed. The slope indicates that as length increases, so does width, and as width increases, so does thickness. But the width vs. thickness data on most charts suggest that the *range* of thickness stays fairly constant. These charts also appear to vindicate my original intuitive (pre-measurement) sorting of all the recovered bifaces into the several stages of the reduction process.

Stage 1 Bifaces

In this group are 96 whole or fragmentary items (Figure 18). These objects, often irregular, asymmetrical, relatively thick, and “crude,” show evidence of the first steps in reduction from a core or spall. Most are roughly ovate. Percussion chipping has left deep, broad, rather uneven flake scars, and usually there are untouched facets of the original chert

mass. Many of these bifaces might be considered “quarry blanks,” roughed out at the quarry and intended for transportation elsewhere prior to final shaping. Some represent rejects due to unreducible humps and others represent failures due to breakage during the reduction process.

Metrical data for Stage 1 bifaces are presented in Table 1. Only 15 of 53 pieces studied showed evidence of use, in the form of crushing or nibbling appearing discontinuously along the edges, usually on high points between flake scars (in rare cases the affected areas may have been intentionally prepared striking platforms for the removal of thinning flakes).

The mean width/thickness ratio of Stage 1 bifaces is 2.68. Figures 19 and 20 show the clustering of Stage 1 bifaces in the attributes of width vs. thickness, and length vs. width.

Stage 2 Bifaces

Bifaces in this group have been further reduced toward the intended end product from Stage 1 bifaces. Flaking is still by percussion, but applied more evenly, with less force, and a symmetrical, more definite form is starting to emerge. A critical factor is thickness; comparison cannot be made in terms of length, because only three Stage 2 preforms are whole (Table 2). Sixty-four objects are in the group (Figure 21). Eighteen of 52 meas-

Table 1. Summary statistics for Stage 1 Bifaces from Areas A and B.

Attribute	N	Mean	Range	Standard deviation
Length (mm)	30	74.7	52–120	17.02
Width (mm)	45	47.7	28–65	8.34
Thickness (mm)	53	17.8	9–32	4.71
Weight (g)	29	83.52	23.6–245	55.15

Table 2. Summary statistics for Stage 2 bifaces from Areas A and B.

Attribute	N	Mean	Range	Standard deviation
Length (mm)	3	73	42–107	—
Width (mm)	45	44.4	30–62	8.69
Thickness (mm)	52	13.1	8–20	2.73

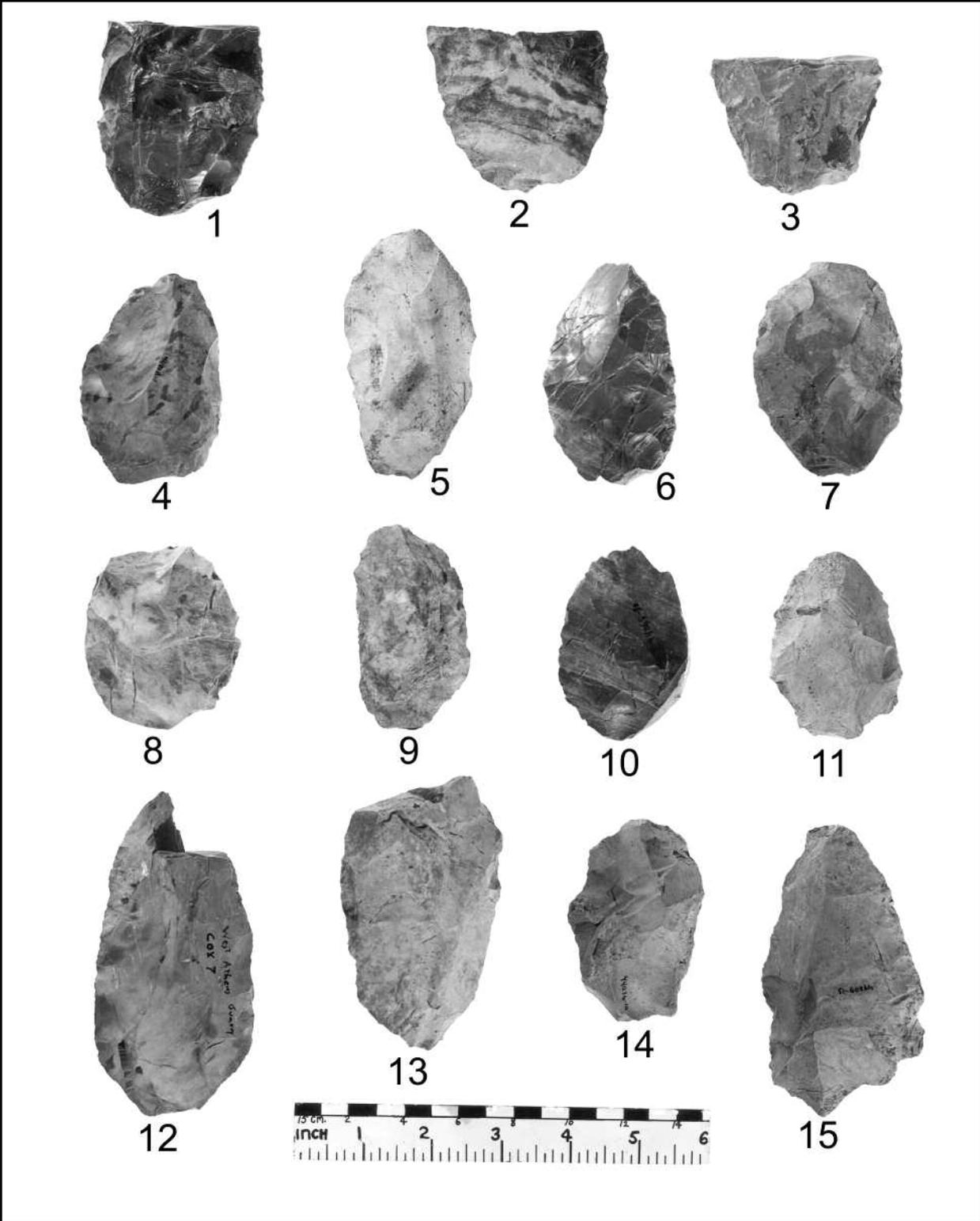


Figure 18. Stage 1 bifaces from Areas A and B. Material: all Normanskill chert.

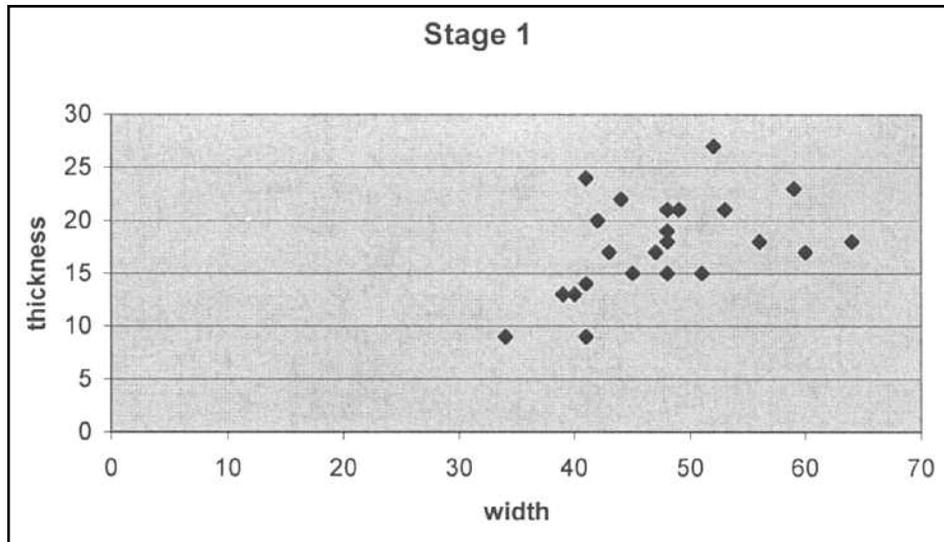


Figure 19. Scattergram of width vs. thickness for Stage 1 bifaces from Areas A and B.

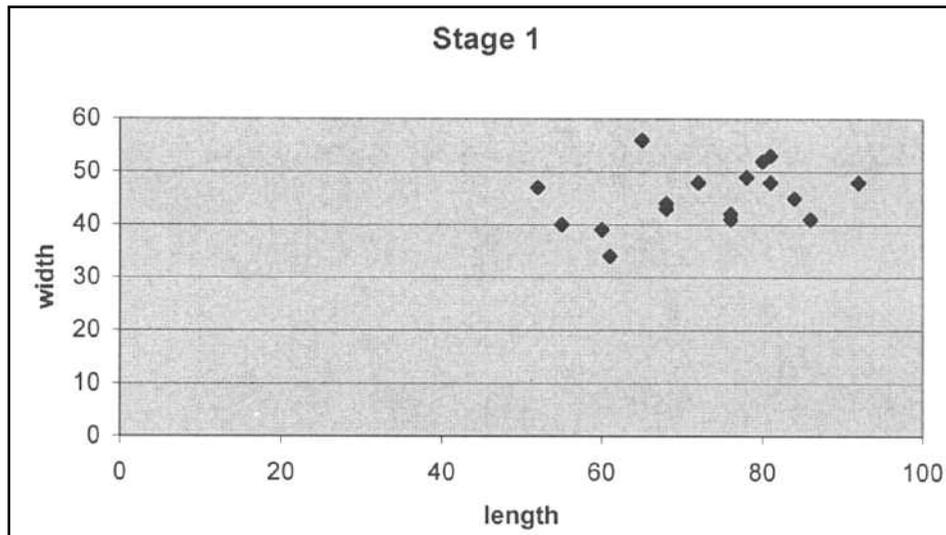


Figure 20. Scattergram of length vs. width for Stage 1 bifaces from Areas A and B.

ured bifaces of the group showed wear (discontinuous edge-crushing or abrasion) on one or both lateral edges. Because only three specimens were complete, data on the distribution by weight are not presented.

The mean width/thickness ratio of Stage 2 bifaces is 3.39. A comparison of Figure 19 with Figure 22 supports the original subjective separation of bifaces in process into stage 1 and stage 2; the chief difference is that stage 2 bifaces tend to be thinner than stage 1 bifaces.

As width increases their range in thickness remains constant at 5–10 mm.

Stage 3 Bifaces

These “advanced” bifaces represent yet another step in manufacture. Items in this group are rather symmetrical, have attained a definite shape, and are relatively thin with evenly controlled chipping. Whereas some are certainly preforms for projectile points or knives, others appear to be finished knives. In

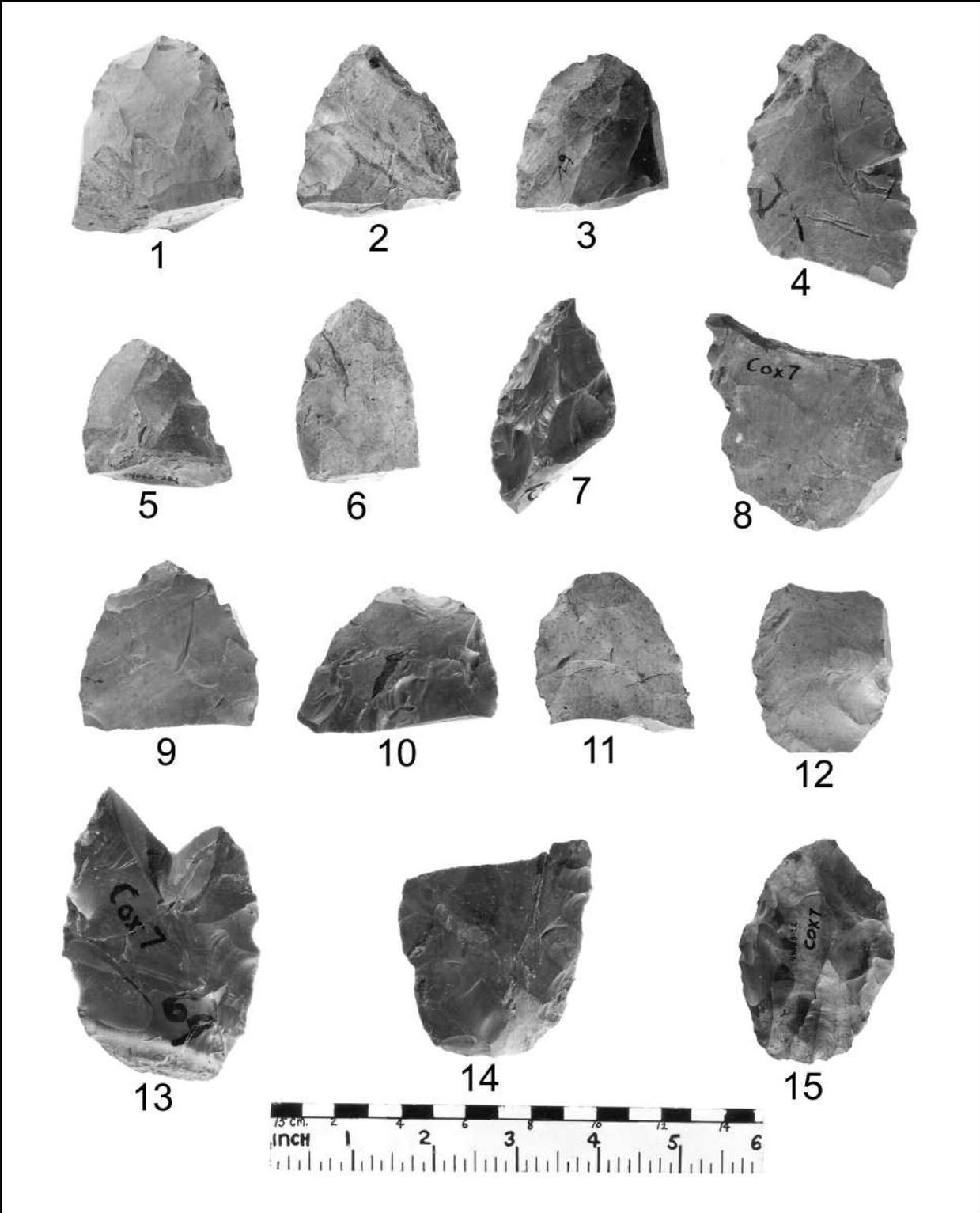


Figure 21. Stage 2 bifaces from Areas A and B. Material: all Normanskill chert

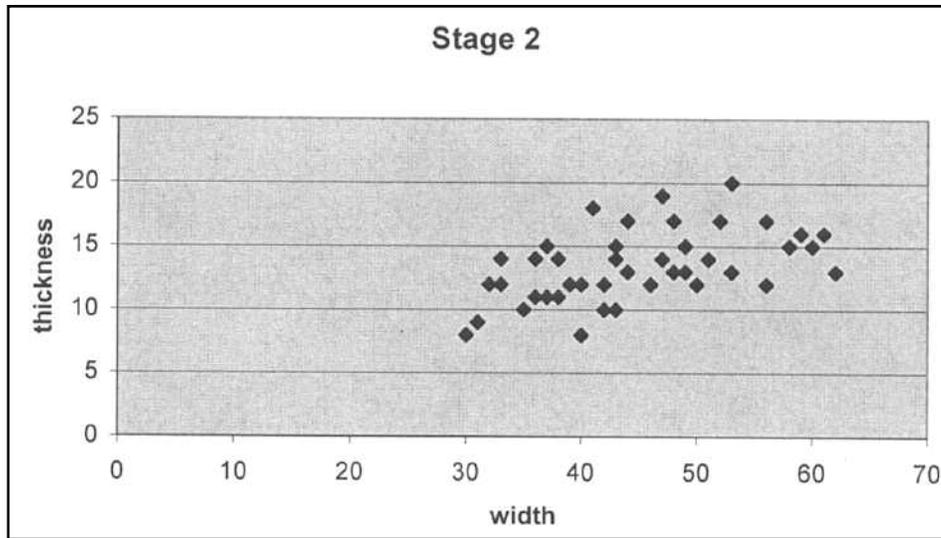


Figure 22. Scattergram of width vs. thickness for Stage 2 bifaces from Areas A and B.

an attempt to distinguish them statistically, two primary subdivisions have been made.

The first subcategory involves 24 bifaces which, on the basis of size (Table 3), geometric outline, and the frequent presence of channel flake thinning scars on one or both faces, are considered to be preforms for fluted points (Figure 29, nos. 9–28). The whole specimens vary in outline from ovate to lanceolate. The most obvious examples of fluted points in process are illustrated in Figure 29, nos. 11–16, 23–38. In most cases the base is straight, or as in nos. 11 and 26, slightly concave. All have had channel (end-thinning) flakes struck from the base on one or both faces. Three examples (nos. 13–15) display traces of grinding on the base, probably to prepare the striking platform. The specimen shown as no. 13 has had two adjacent flutes removed from one face, and a ground nubbin for the third or central flake is clearly visible. The two examples in

nos. 14, 15 broke during removal of the channel flake, which hinged through the blade.

An odd specimen, shown as no. 8, is included with the group because it strongly suggests an unsuccessful attempt by a novice to produce a fluted point. Two channel flakes were removed from one face, and three from the obverse. The flutes run the full length of the point. One edge is bifacially chipped, the other unifacially worked. Part of the formerly straight base is missing; the remaining portion displays delicate bifacial nibbling. The opposite end, or “tip,” is narrow and straight, with delicate unifacial nibbling. This object has slight wear on the edges, apparently from use as a knife. The weights of five whole preforms are 11.5, 23, 28, 44.5, and 63.5 g.

The mean width/thickness ratio for fluted point preforms is 3.67. Figures 24 and 25 demonstrate the relatively high clustering by the metrical attributes for Stage 3 bifaces. The

Table 3. Summary statistics for fluted point preforms from Areas A and B.

Attribute	N	Mean	Range	Standard deviation
Length (mm)	10	71.1	37–108	23.53
Width (mm)	22	36.6	25–53	7.54
Thickness (mm)	22	10.0	6–14	2.28

key factor is the reduced thickness, and smaller range in thickness, of the preforms compared to Stage 1 and Stage 2 bifaces.

The second subcategory of Stage 3 bifaces comprises broad, ovate bifaces, some of which are very likely knives. Others, as previously indicated, are probably preforms for either knives or projectile points. Unfortunately, all of these specimens are fragmentary, only two small ones being nearly complete (Table 4). Channel (end-thinning) flakes are almost entirely lacking on these items. Thirty-five objects are included in this subcategory, most of which are illustrated in Figure 23. Probable finished knives are represented by three broad, thin tip fragments, all evincing considerable rounding and gloss on the edges (nos. 2–4). Although suggesting finished objects assignable to Stage 4, they are lumped with Stage 3 bifaces due to their fragmentary condition. Fifteen of the remaining bifaces in the group display from slight to considerable rounding/gloss on the lateral edges. The two small ovate examples (nos. 14, 15), a broad, lobate-stemmed specimen (no. 22), and the basal fragment of a large, lanceolate biface with a large channel flake scar on one face (no. 20) are also worthy of special note.

The mean width/thickness ratio of Stage 3 bifaces is 4.03. The stage 3 sample tends to be slightly thicker and wider than fluted point preforms (cf. Figure 24 and 26).

It seems necessary to make a distinction between functional and technological classes of artifacts. In the case of bifaces, Stage 1, 2, or even 3, it is often impossible to know precisely just what end product the maker had in mind—what mental template he (or she) was

using (Deetz 1967:45–49). There are two possible formal goals here: fluted points and biface knives. Only three bifaces have been definitely classified as deliberately fashioned knives, of probable broad ovate or lanceolate form. It is evident that preforms at almost any stage of manufacture could have served as cutting tools, if one or more edges were sharp enough. In point of fact, a significant proportion of bifaces in each stage actually were used as knives, no matter what their ultimate form was to have been.

Stage 4 Bifaces: Fluted Points

There is considerable variation in the size and some other attributes of Stage 4 bifaces, or fluted points, as can be seen in Figure 27. Thirteen definite examples have been recovered at the West Athens Hill, 10 from the Area B excavations and three from the surface in Area A.⁵ There are both whole and fragmentary points, all of which are finished except for the large one in Figure 26, no. 13, which is well advanced but has an unsharpened tip. The point shown as no. 2 was the first recovered at the site by R. Arthur Johnson, and is a particularly fine specimen.

Measurements, materials, and other attributes of the fluted points are given in Table 5. Summary statistics are provided in Table 6. Among general comments, the lack of edge or basal grinding on three apparently finished points (Figure 27, nos. 3, 10, 11) should be noted. The presence or absence of this trait cannot be determined for two broken points missing the base (nos. 5, 6) and there are no signs of rubbing on the not-quite-finished specimen, (no. 13). The midsection in no. 6 has

Table 4. Summary statistics for Stage 3 bifaces other than fluted point preforms from Areas A and B.

Attribute	N	Mean	Range	Standard deviation
Length (mm)	—	—	—	—
Width (mm)	24	47.9	32–63	8.58
Thickness (mm)	30	11.9	9–15	1.64

⁵ Twelve more fluted points or fluted point preforms were found in the 1969 and 1970 excavations at Area C.

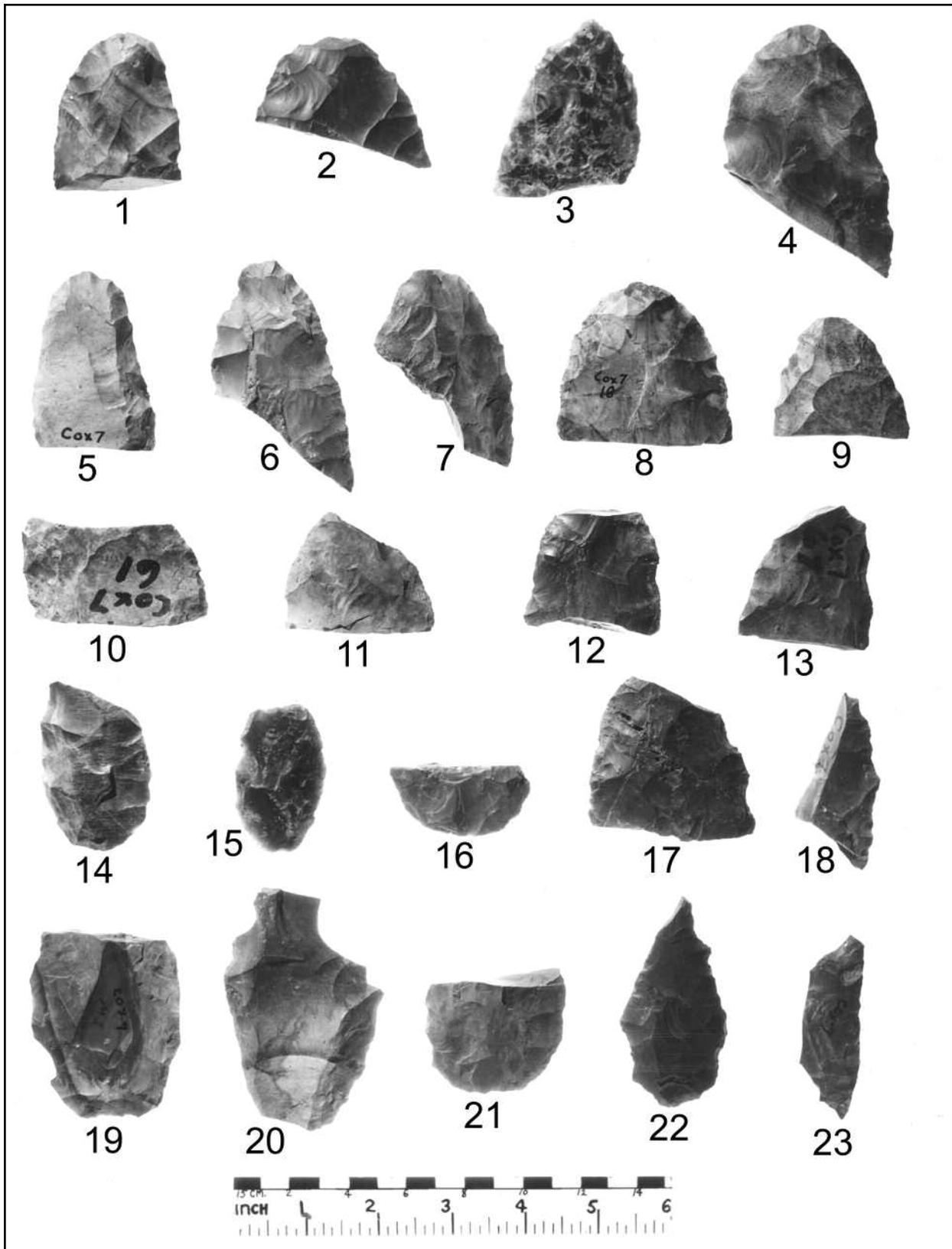


Figure 23. Stage 3 bifaces from Areas A and B. Nos. 2–4, large finished knives; all others probable pre-forms for knives. Material: all Normanskill chert.

Table 5. Metric and non-metric data for finished Stage 4 fluted points from Areas A and B .

Catalog No.	Provenience	Length (mm)	Width (mm)	Thickness (mm)	Grinding?	Material	Remarks	Figure 26 reference
44042-4, 13	Sec. E10N0, str. 1	68	26	8	None	Norman-skill chert	Slightly eared, base indented 4 mm; 2 flutes removed each face, 1 lateral, one central; weight 17 g.	Figure 26, no. 11
44066-18	Sec. E0N20, str. 1	—	36	7	None	"	One slight ear, base indented 3 mm; 1 wide, single flute each face.	No. 10
44007-1	Sec. E0N0, str. 1	—	30	8	Lower edges	"	Mid-section, upper end of one channel flake scar present.	No. 12
44041-11	Sec. E10N0	—	24	6	Base and lower edges	"	Reworked, used as knife; Central flute one face, overlies trace of preliminary flute; other face has 2 flutes; base indented 4 mm.	No. 8
RAJ collection	Area A surface	41	20	6	Base and lower edges	"	One short flute one face; other face shows 2 overlapping flutes. Base indented 3 mm; Weight 5.7 g.	No. 2
JHM collection	Sec. E0S10, str. 1	37	17	6	Lower edges	"	One face shows one lateral, one central flute; other face shows 2 overlapping flutes. Slightly eared base; base indented 3 mm	No. 4
44042-14	Sec. E10N0, str. 1	45	22	7	None	Smoky chert	Triple fluted one face, single flute other faced. One ear; base indented 3 mm.	No. 3
44067-17	Sec. E0N20, str. 1	40	23	5	Base and lower edges	Norman-skill chert	Tip re-sharpened; fully fluted, 2 flutes one face, 1 on other. Base indented 3 mm. Weight 6 g.	No. 9
44034-18	Sec. E10S10, str. 2	—	27	8	Lower edges	"	Midsection frag.; upper parts single flutes visible on each face.	No. 7
44014-15	Sec. W180-S50, Surface	—	22	5	?	"	Midsection frag.; Upper portions single flutes visible each face.	No. 5
44080-7	Sec. W10N-40, str. 1	—	34	7	?	"	Mid-section frag.; upper end of a flute visible one face.	No. 6
44069-9	Sec. E10N20, str. 1	—	40	10	?	"	Unfinished tip frag.; upper part attempted flute hinged through blade.	No. 13
JHM collection	Area A surface	51	27	8	Lower edges	Western Onondaga chert	Slightly convex base. Both faces fluted. Point was broken at base, and reworked.	No. 1

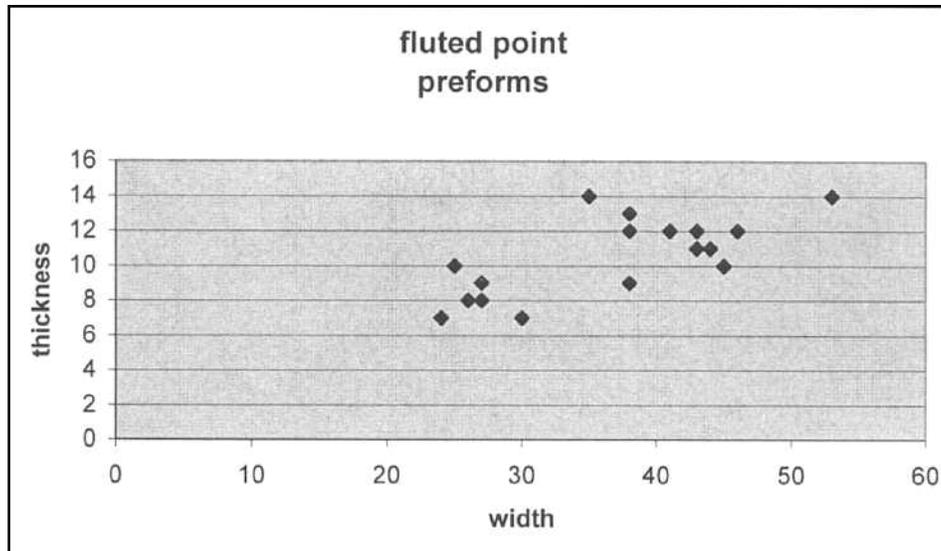


Figure 24. Scattergram of width vs. thickness for Stage 3 fluted point preforms from Areas A and B.

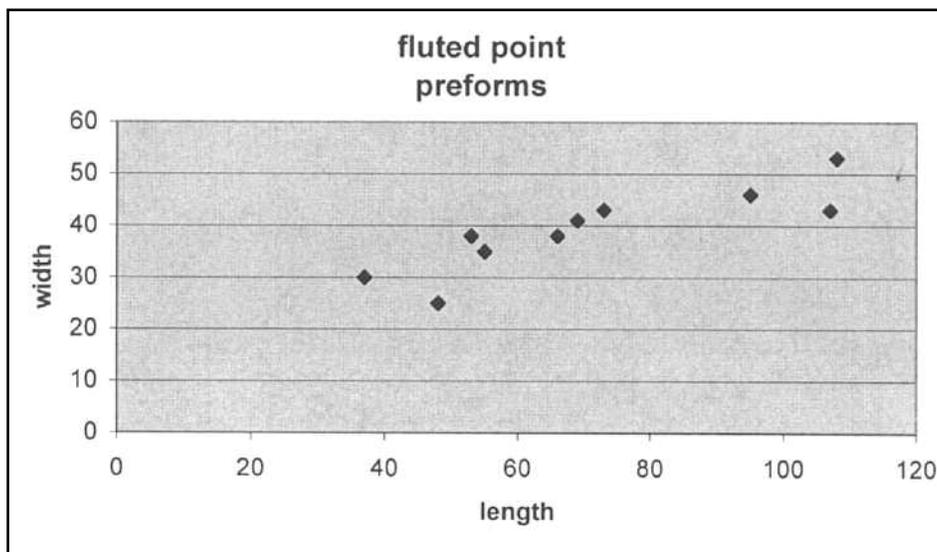


Figure 25. Scattergram of length vs. width for Stage 3 fluted point preforms from Areas A and B.

the blade form and flaking characteristics of fluted points and the upper end of a channel flake scar is visible on the illustrated face. The point in no. 8 seems to have been slightly reworked after the tip was broken off, and used as a knife. The point in no. 1 was originally somewhat longer, but after some mishap the base was reworked for further use.

Multiple fluting is evident on only four points, three of which have traces of two channel flakes on one face and one flake on the

other face (Figure 27, nos. 3, 4, 11), and one of which had two channel flakes removed from one face, and three from the other (no. 8). These are the sole examples of possible "Enterline" fluting (Witthoft 1952), but it is of course possible that the technique was practiced on other points where the final fluting has obliterated all traces of the preliminary flutes.

All of the points except three (Figure 27, nos. 6, 12, 13) are fluted on both faces. The

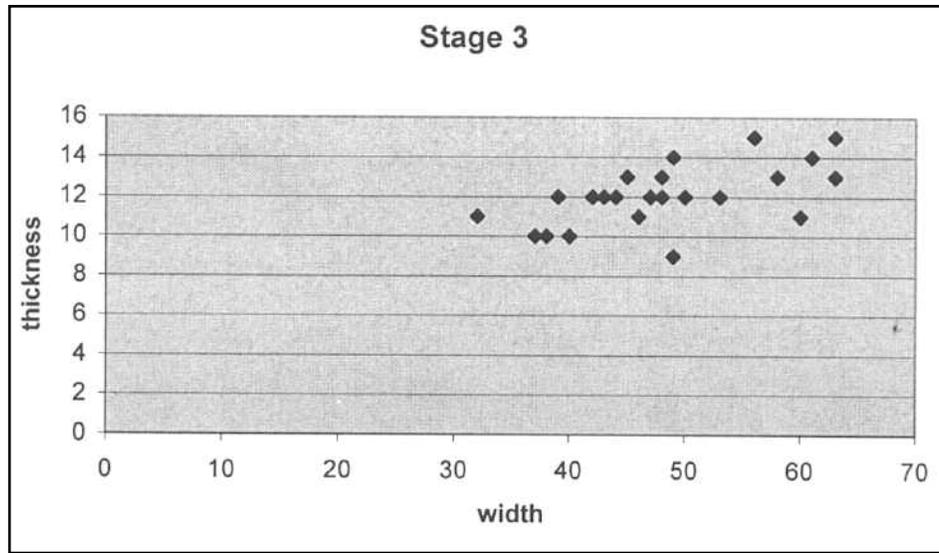


Figure 26. Scattergram of width vs. thickness for Stage 3 non-fluted preforms from Areas A and B.

three exceptions are broken, lacking the base, and it is possible that there were short channel scars on the missing portions of the apparently blank faces.

Nearly all of the points conform generally to the Eastern Fluted, or Gainey style, considered to represent the oldest period of occupancy by Paleoindians (Gramly and Funk 1990). All are lanceolate, and with one exception the greatest breadth is at or just above midpoint. The exception (no. 3) is widest at the base, narrowing gradually toward the tip. The point in no. 4 is the best example of the relatively late Cumberland-Barnes type. A majority of the points had straight to very slightly constricted sides between base and midpoint. The base, where intact, is indented.

In every case but two the raw material is local Normanskill chert. The point with a reworked base (Figure 27, no. 1) is western

New York Onondaga chert. The fine specimen, no. 3, is of translucent smoky chert.

The mean width/thickness ratio of Stage 4 fluted points is 3.87, and the range is 2.83 to 5.14. Compared to graphs of previous stages in biface production, Figure 28 shows that finished fluted points are both narrower and thinner, and the range of thickness is more restricted than on the other bifaces. The weights of four whole points are 17, 5.7, 6, and 5.5 g.

Projectile Point Tips and Midsections

Twenty-one fragmentary points are in this group (Figure 29, nos. 1–7) and are classified as Stage 4 bifaces. All seem to fall within the size and shape range of Eastern Fluted points, but without exception the basal section is missing. Three pieces (nos. 3, 6, 7) display what may be the extreme upper ends of chan-

Table 6. Summary statistics for Stage 4 fluted points from Areas A and B.

Attribute	N	Mean	Range	Standard deviation
Length (mm)	6	47.0	37–68	10.37
Width (mm)	12	27.1	17–40	6.50
Thickness (mm)	13	7.0	5–10	1.35

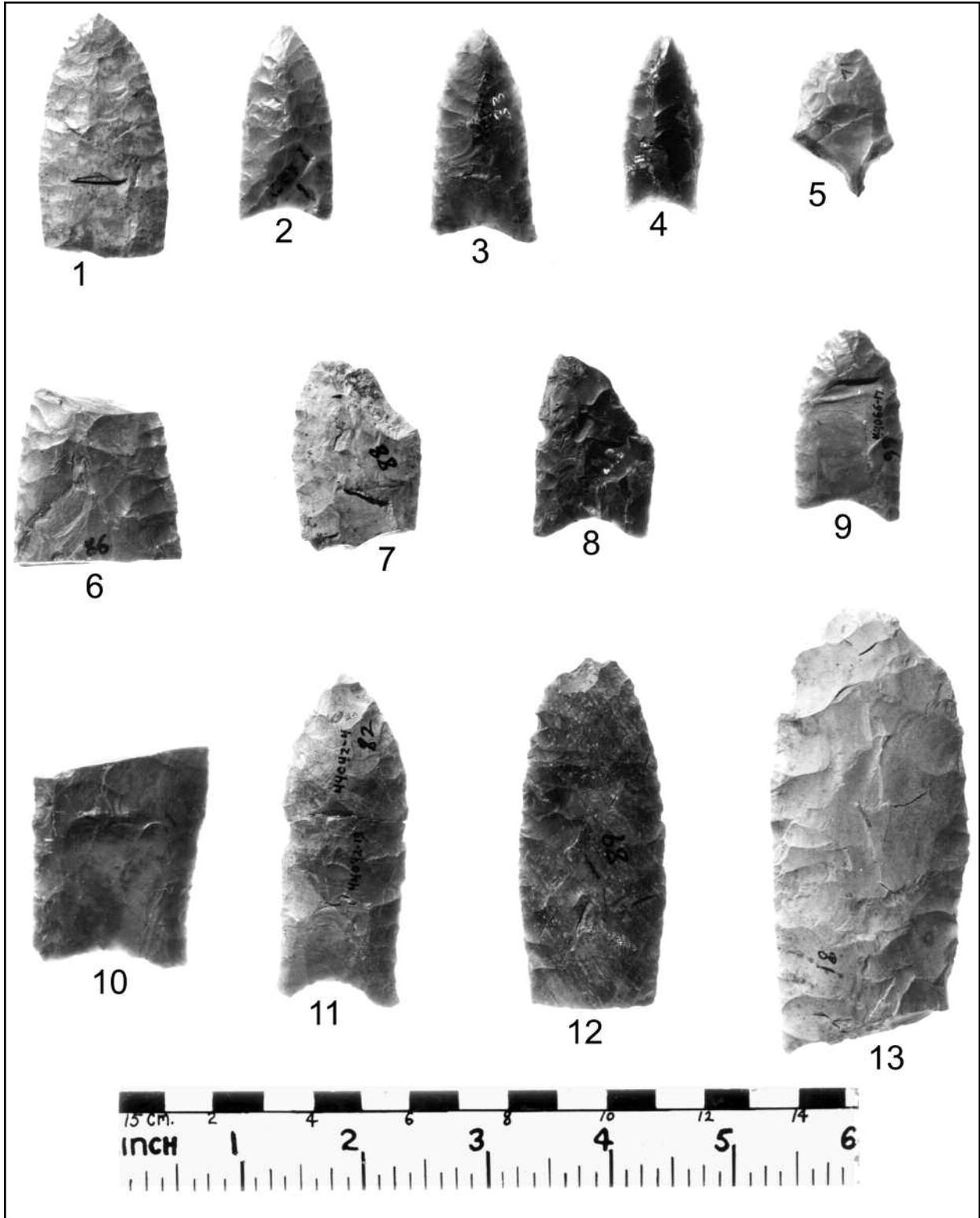


Figure 27. Fluted points from Areas A and B. Materials: no. 1, western Onondaga chert; 3, smoky gray chert; all others Normanskill chert (no. 4 is plastic replica of specimen in private collection).

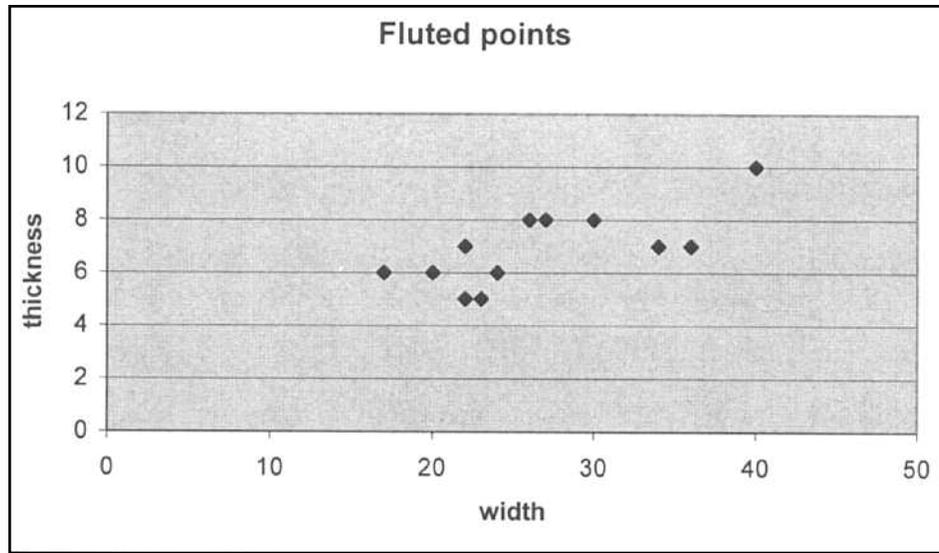


Figure 28. Scattergram of width vs. thickness for Stage 4 fluted points from Areas A and B.

nel flake scars immediately adjacent to the line of fracture. As shown in Table 7, the group seems to resemble the fluted point sample in thickness.

The scattergram for width vs. thickness (Figure 29) conforms to expectations from the fluted point data (i.e., these bifaces are relatively narrow and thin and the range in thickness is ca. 2-3 mm).

Most of the fluted point fragments are of Normanskill chert; one tip is clear crystal quartz, another is yellow Pennsylvania jasper, and a third is black chert containing tan specks, possibly a Normanskill variety.

Miscellaneous Bifaces

This category is a catch-all for artifacts which cannot be placed satisfactorily in the other groupings. Fifteen examples can be described as core tools, based on spalls, nodules, or slabs of chert, which have been modified in such a way as to produce a single bifacially sharpened cutting and/or scraping edge

(Figure 31, nos. 10–17). In nearly every case, the thickest part of the tool is opposite the working edge, frequently displaying the weathered original surface of the nodule, and provides a convenient surface for the hand to grip. These tools uniformly possess edge wear, generally edge-crushing and nibbling, and might be considered a form of backed knife. Despite the presence of retouched or steeply beveled working edges, these items are clearly not unifaces and deserve a separate classification. In length they range from 48 to 94 mm, in width from 35 to 74 mm, and in thickness from 10 to 29 mm.

Another group of 10 small, ovoid thick bifaces (Figure 31, nos. 1–3, 5–9) are more difficult to assign as to function. In six cases (nos. 5, 7–9) at least one, sometimes two, steeply bevelled edges appear to have been used for scraping. Battering along the edges of four of these may evince unsuccessful attempts at thinning. Another small ovoid (no. 6) appears not to have been used, and may be a spent core. The example in no. 1 may be an ovate

Table 7. Summary statistics for probable fluted point fragments from Areas A and B.

Attribute	N	Mean	Range	Standard deviation
Width (mm)	16	33.9	25–40	5.64
Thickness (mm)	21	8.2	4–12	1.8

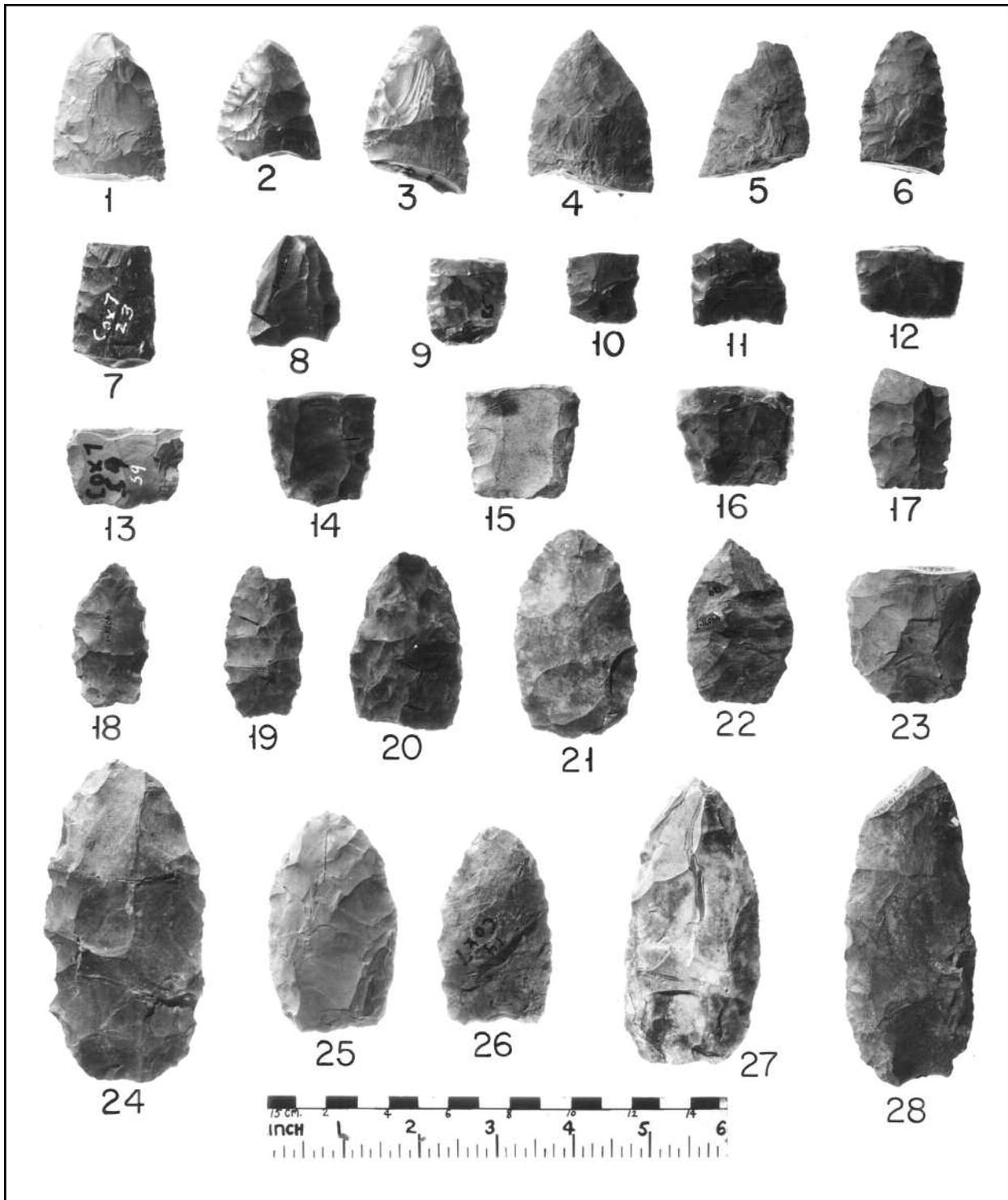


Figure 29. Fluted point fragments and preforms from Areas A and B. Nos. 1–7, fragmentary fluted points; 8, unique bifacial object with multiple fluting on both faces; 9–28, fluted point preforms. Material: No. 1, brown Pennsylvania jasper; all others Normanskill chert.

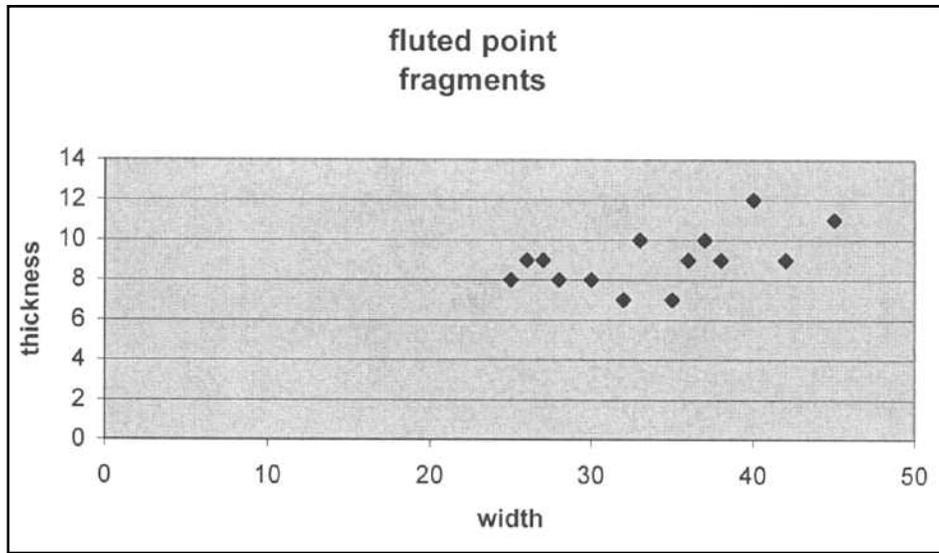


Figure 30. Scattergram of width vs. thickness for probable fluted point fragments from Areas A and B.

knife, but the edges are sharp and unworn. The broken biface in no. 2 and the oval piece in no. 3 seem to have been knives. This group of artifacts range from 51 to 71 mm long, 30 to 45 mm wide, and 13 to 19 mm thick. A small, broad, tapering-stemmed object lacking signs of use (no. 4) may not be of Paleoindian origin. It bears some resemblance to Susquehanna knives. Seven other “nondescript” pieces are also in this miscellaneous biface group. My reexamination of these objects indicated that some, at least, could more properly be classified with Stage 1 or 2 preforms, and this impression is reinforced by the graph of width vs. length (Figure 31) when compared to the Stage 1 bifaces (Figure 19).

A total of 33 items are included in this category. All of them are of Normanskill chert. Statistics for the weight in grams of 12 whole specimens are as follows:

Mean	52.2
Median	37.8
Standard dev.	50.5
Range	18.5–209
Count	12

Unifaces

Objects in this large class were intentionally produced by the simple unifacial modifica-

tion of chert slabs, cores, and flakes. This modification consisted of retouching, generally by percussion flaking, along one or more discrete edges. In the majority of cases, the chipping tool was directed against the bulbar face, detaching flakes from the other (dorsal) face of the tool. A minority of smaller tools display delicate flaking or nibbling, which appears to be the result of pressure flaking.

End Scrapers

The great majority of these artifacts are of classic trianguloid or trapezoidal form, with the bulbar face unmodified. All end scrapers are based on medium-sized flakes struck from cores, steeply beveled by retouching the broad end and in many cases trimmed to form along the sides. The flakes used were sometimes flat, but more often hump-backed or ridged. Over 30 percent of the end scrapers still retain the striking platform at the narrow end.

Many of the 92 end scrapers from Areas A and B show wear on the bit ends, and often along the sides as well, whether the sides were retouched or not. The wear is usually in the form of edge-crushing. A small number display wear or battering on the butts. Commonly, the working edge on the broad end has been rechipped to an extremely steep angle.

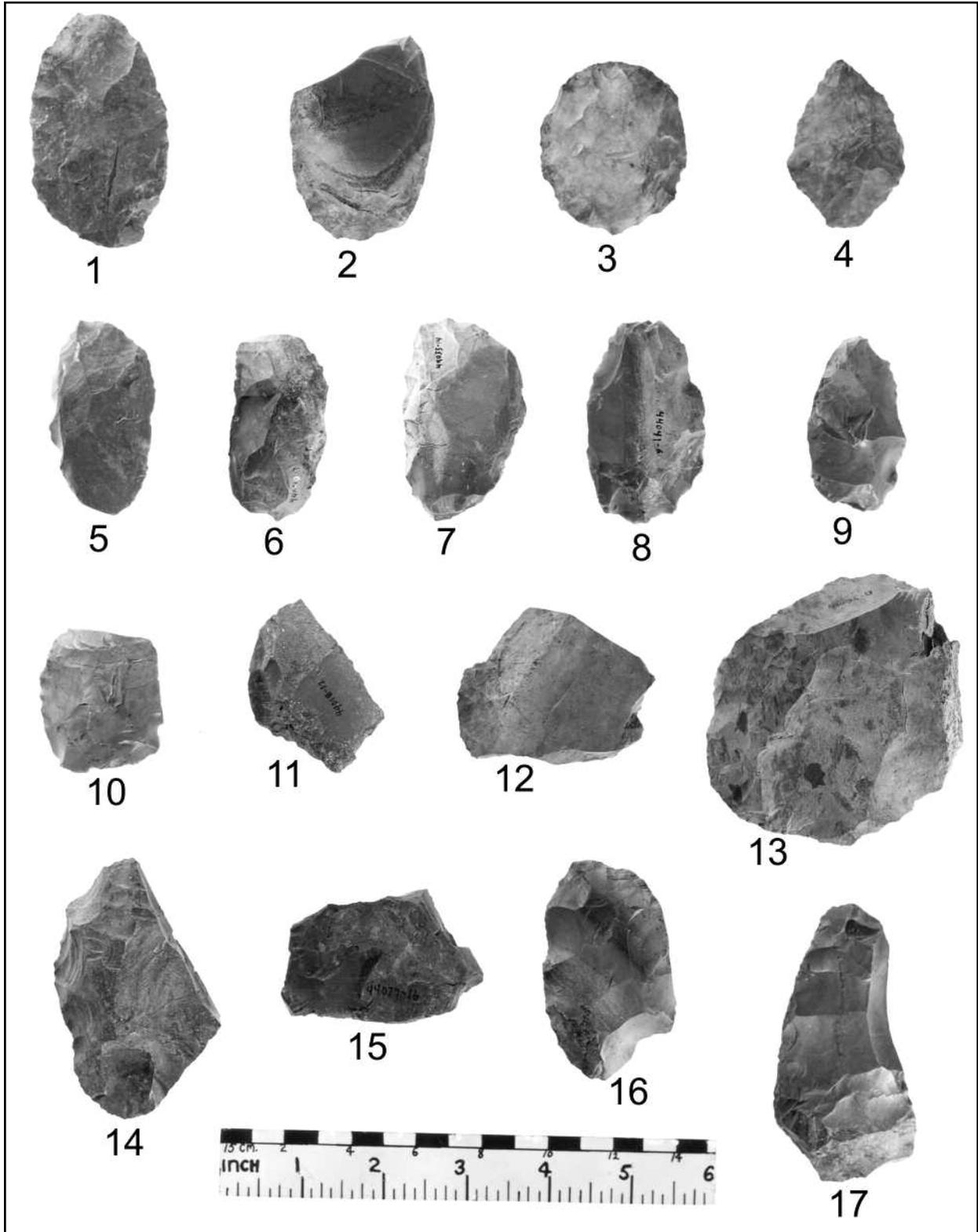


Figure 31. Miscellaneous bifaces from Areas A and B. Nos. 1-3, 5-9, small ovoid bifaces; 4, tapered-stem bifaces; 10-17, biface-edged cores and flakes. Material: all Normanskill chert.

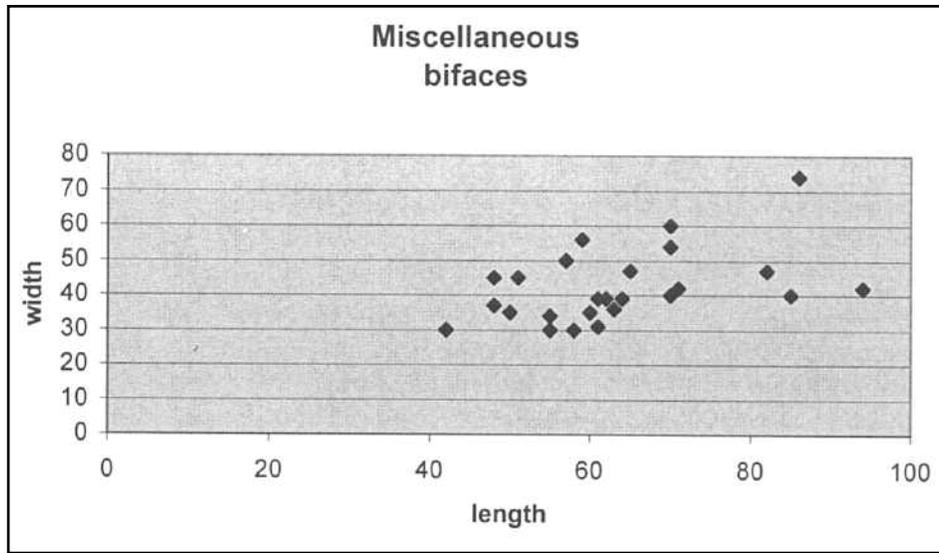


Figure 32. Scattergram width vs. length for miscellaneous bifaces from Areas A and B.

The end scrapers have been sorted, more or less arbitrarily, into several morphological varieties. Of the total number, 85 are of triangular or trapezoidal form; simple examples of the type are shown in Figure 33, nos. 2, 8–42, 44, 45. Within this group, 15 display weak to prominent graving spurs (nos. 8, 9, 12, 22, 28, 33, 40, 43), which are characteristic of Paleoindian implements. The spurs are usually to be found on one or both of the front corners, but in a few instances they are located along the sides. Twenty-nine other tools among the 85 triangular specimens have straight to slightly rounded main working edges with sharp or right-angled corners. These corners, like spurs, could have been used for graving bone or wood. The remainder in the class have rounded or irregular ends. One scraper (no. 40) is notched just behind the

working edge; two (no. 1) are double-ended. An additional seven end scrapers can be described as irregular, with one main scraping edge perpendicular to the longest axis.

Measurements were taken of edge angles on the bit portions (“working ends”) of end scrapers (a sample of 26). The results indicate a range of 35–75 degrees, with the majority (17) falling between 40 and 60 degrees, only 3 between 35 and 40 degrees, and 6 between 60 and 75 degrees.

Most end scrapers were made from local Normanskill chert. Seven are of red or yellow Pennsylvania jasper (Figure 33, nos. 31–35, 39–41), 1 is of an unidentified cream-colored, tan-speckled exotic jasper (no. 42), and 4 are of Western New York Onondaga chert (nos. 36–38). Summary statistics for end scrapers are presented in Table 8.

Table 8. Summary statistics for end scrapers from Areas A and B.

Attribute	N	Mean	Range	Standard deviation
Length (mm)	91	32.16	21–75	9.47
Width (mm)	92	26.97	13–43	9.95
Thickness (mm)	92	8.78	4–19	3.13
Weight (g)	39	7.03	2.5–14.4	3.1

Side Scrapers

The 185 items in this class, like end scrapers, can be broken down into rough subgroups. Metrical data are presented in Table 9. These are the most numerous of the intentionally modified tools on the site, and they were made from almost any convenient flake, block, or core, whatever its size or shape. The bulk of these tools conform in a general way to Byers' (1954) "ear-shaped" category for scrapers at the Bull Brook site (Figure 34, nos. 9–12, 14, 15, 17, 21, 24; Figure 35, nos. 4, 6, 7, 10, 13, 14). Approximately 16 specimens, mostly based on the terminal portions of nodules, which in some cases had initially served as cores, are placed in a "turtleback" group (Figure 35, nos. 3–6, 9–16). Twelve specimens can be referred to as convergent scrapers, featuring two retouched long edges converging to a tip. The tip has in some cases been broken in use (Figure 34, nos. 4–6). One of the convergent scrapers, plus several others of varying form (Figure 35, nos. 3, 5), possess spurs probably used in graving. Very few of the scrapers can be considered to have true spokeshave edges, however. Other specimens of particular interest are a massive fist-sized "pulping plane" (Figure 35, no. 15) and a heavy tool with roughly retouched semicircular working edge (no. 16). The rest of the side scrapers run the full gamut of forms through "ear-shaped," oval, trianguloid, and simply irregular.

Over 75 percent of the side scrapers evince heavy wear, usually in the form of edge-crushing, on the retouched edges. In the majority of cases, unmodified edges also show signs of use. On one example the striking platform has been heavily battered; on two other scrapers it is much worn.

Twenty-one, or 11 percent, of the side scrapers are directly based on natural chert blocks. The remaining pieces were nearly all made from cores or flakes struck from cores. Of this group of 164, only 48, or 29 percent, still retain the striking platform, which for one reason or another was removed from the other 116. On four side scrapers, the striking platforms can be described as faceted butts.

The weight of the "pulping plane" is 564 g; this weight is not included in the calculations above.

Local Normanskill chert used for over 96 percent of the side scrapers. Exotic stones comprised 2 pieces of Upper Mercer, Ohio chert (Figure 34, nos. 6, 10), 1 of yellow Pennsylvania jasper, 2 of Western Onondaga chert, 1 of Oriskany chert (no. 5), and 2 of locally available Kalkberg chert (nos. 4, 17).

Flake Knives

The separation of uniface knives from side scrapers is essentially arbitrary and intuitive. The two tool types are alike in almost every way, except that the retouched edges of knives are shallow rather than steep and that knives tend to be thinner than scrapers. Thirty-nine items have been classified as knives (Figure 36). All but one appear to be based on flakes, about half of which still possess striking platforms. In almost every case there are signs of wear (chiefly edge-crushing) along the retouched edges, and on unmodified edges as well. Metrical data are presented in Table 10.

The great majority of flake knives are of Normanskill chert, but a small number were fashioned from non-local stones. Two examples are of Fort Ann chert (Figure 36, nos. 18, 21), 1

Table 9. Summary statistics for side scrapers from Areas A and B.

Attribute	N	Mean	Range	Standard deviation
Length (mm)	168	58.9	20–120	17.62
Width (mm)	172	39.41	15–81	9.43
Thickness (mm)	174	15.93	4–59	7.53
Weight (g)	125	47.5	4.5–377	43.1

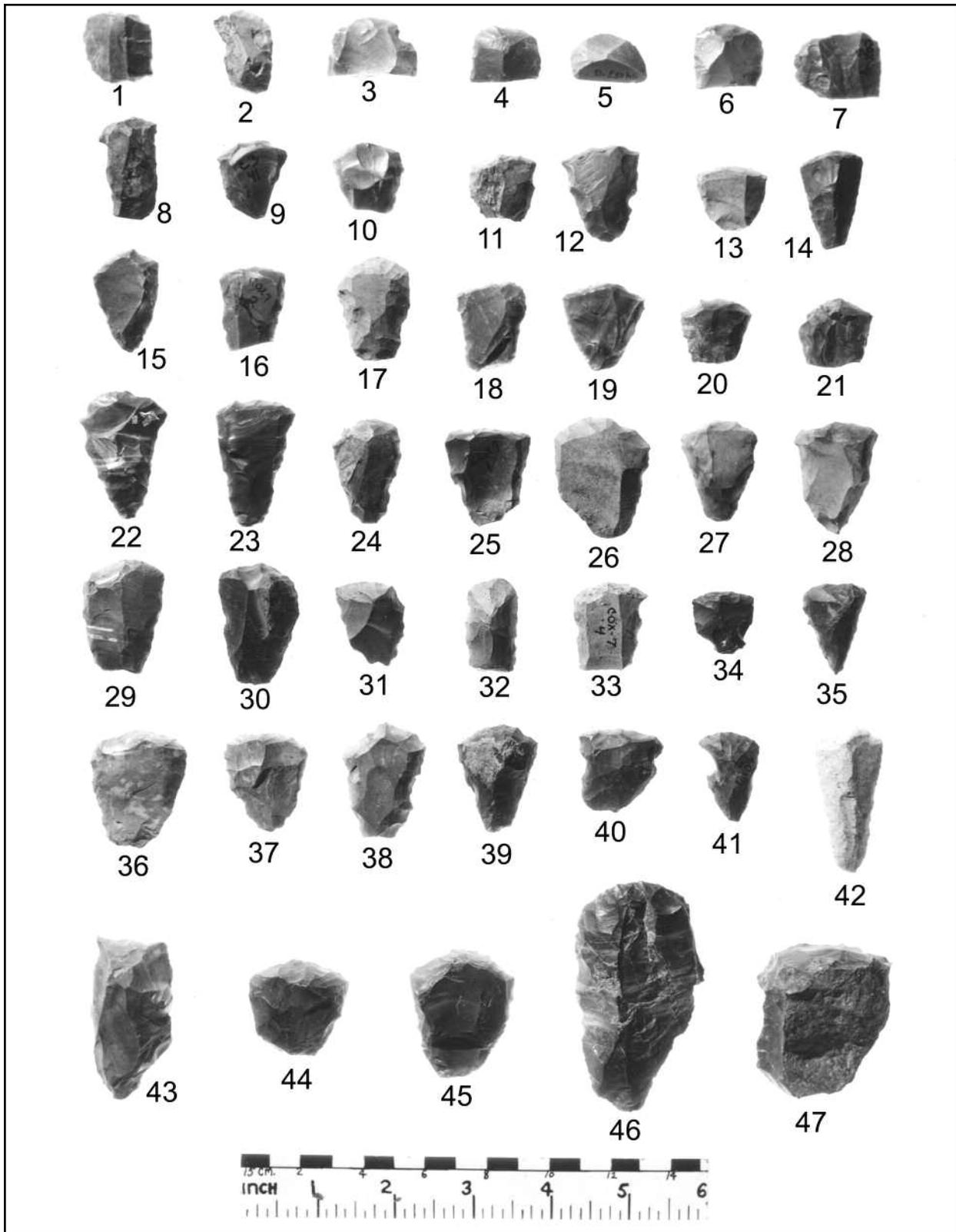


Figure 33. End scrapers from Areas A and B. Nos. 8, 9, 12, 22, 28, 33, 40, 43, spurred variety. Material: all Normanskill chert except nos. 31–35, 39–41, Pennsylvania jasper; 36–38, western Onondaga chert; 42, creamy speckled chert of unknown origin

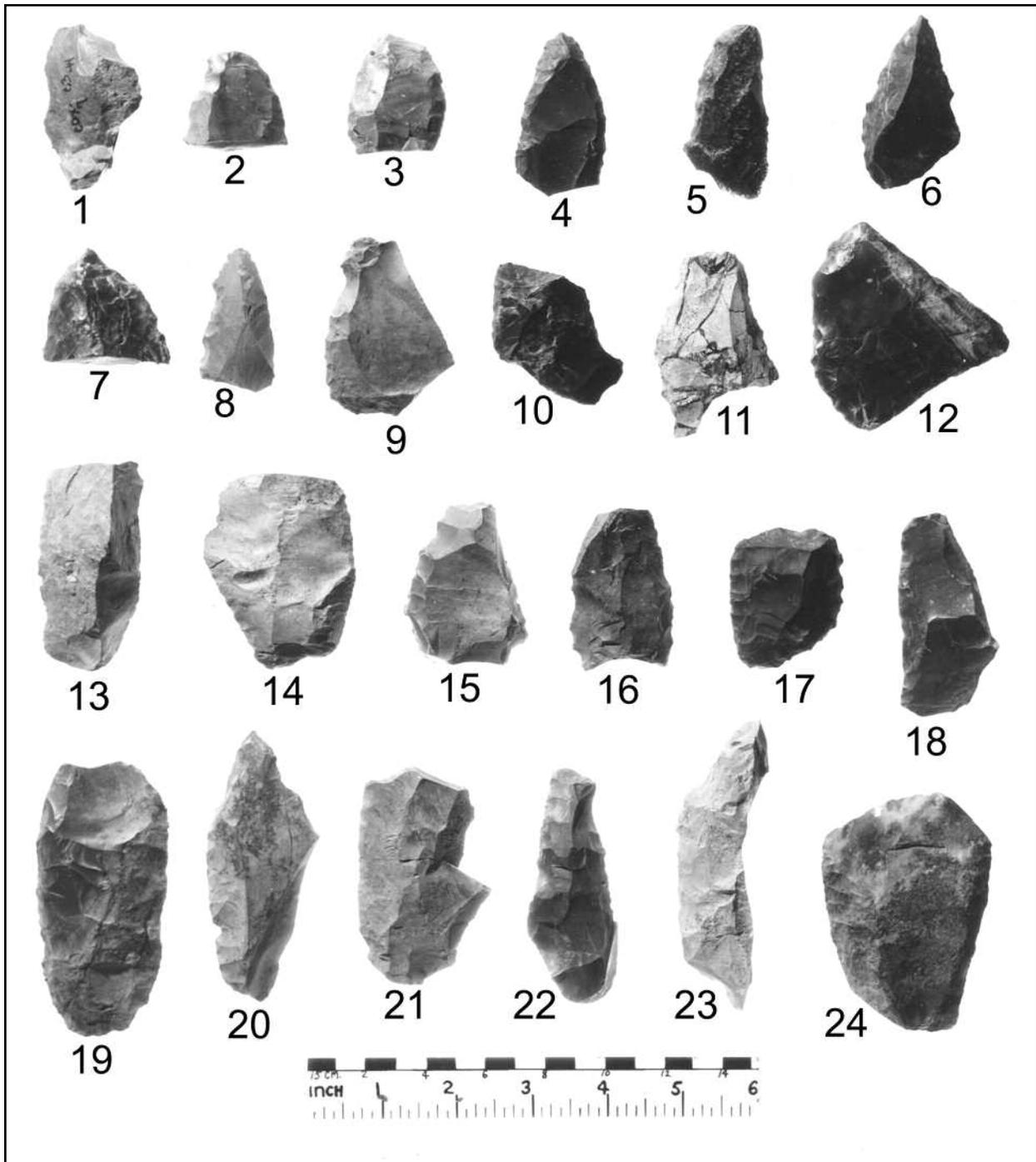


Figure 34. Side scrapers from Areas A and B. Material: all Normanskill chert except nos. 4, 17, of Kalkberg chert; 6, 10, Upper Mercer, Ohio chert; 5, grainy black (Oriskany?) chert.

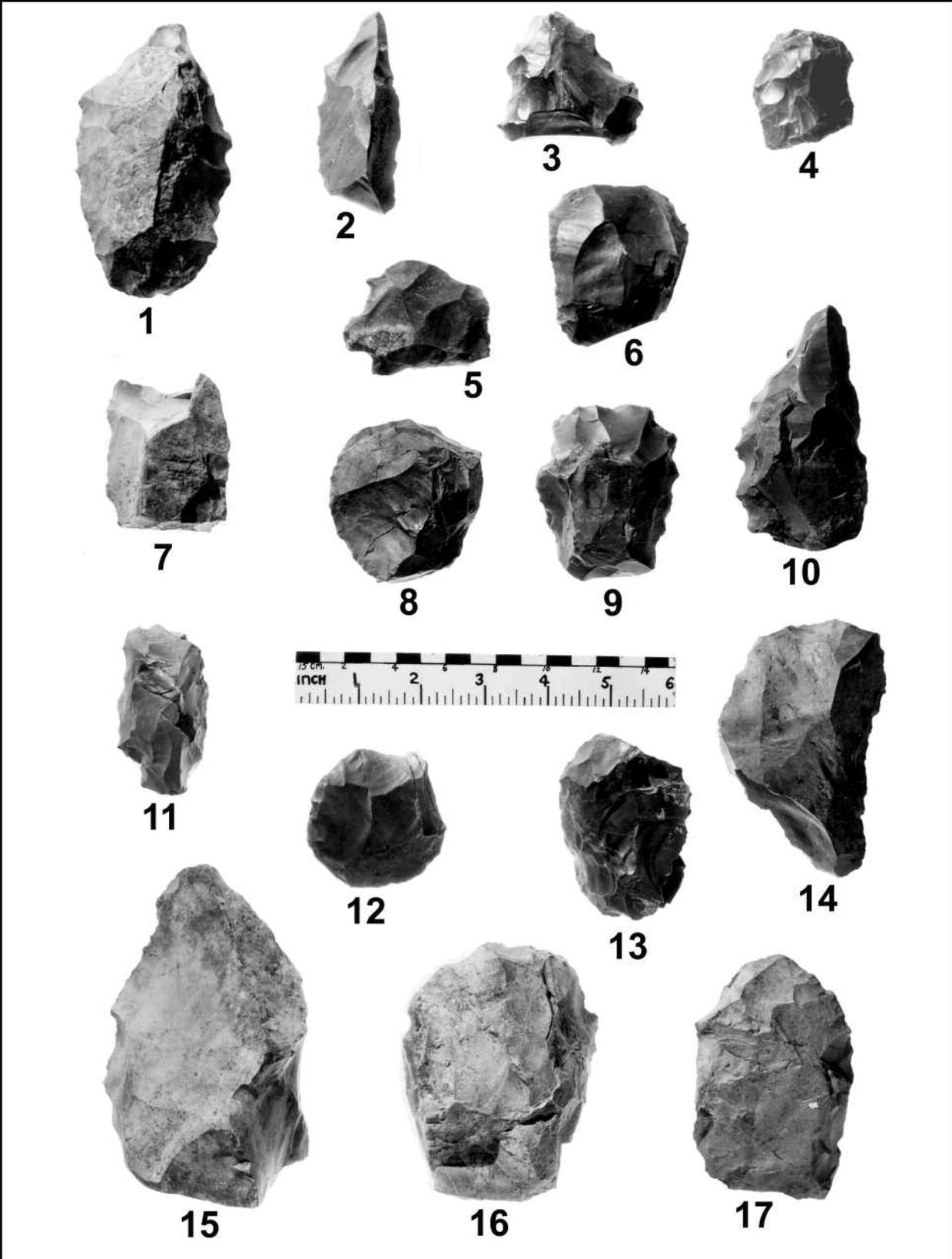


Figure 35. Large side scrapers from Areas A and B. Nos. 3 and 5 have graving spurs. Material: all Normanskill chert

Table 10. Summary statistics for flake knives from Areas A and B.

Attribute	N	Mean	Range	Standard deviation
Length (mm)	34	49.86	23–95	17.29
Width (mm)	34	33.15	17–51	10.80
Thickness (mm)	34	9.0	4–18	3.25
Weight (g)	33	20.5	2.5–58	16.6

is of crystal quartz (no. 8), and 1 is of quartzite (no. 15).

Retouched Flakes

This designation applies to 30 tools that cannot be conveniently assigned to the other uniface categories. Generally, they are based on oval or irregular flakes that have either slightly or irregularly retouched edges. Wear (step-flaking or crushing) is present in a majority of cases. Four specimens were made from naturally occurring chert chunks. Seven of the artificial flakes still have striking platforms. The retouched flakes range in length from 20 to 88 mm, in width from 20 to 55 mm, and in thickness from 6 to 24 mm. All but one are of Normanskill chert, the exception being of Western Onondaga chert.

Graver

This specimen of Normanskill chert is a spall bearing a single narrow projection, produced by deliberate retouch on two edges. Utilization is evident on the tip and on the unretouched edges of the spall.

Utilized Flakes

A total of 660 cores, spalls, and flakes lacking deliberate, systematic retouching display evidence of use on edges, ends, or corners. This evidence was produced mainly by edg nibbling, or removal of tiny flakes by pressure against another solid object. In some cases the edge is so rough and jagged as to suggest battering or chopping. On a few pieces utilization has pressed off an even row of tiny chips, creating a steeply angled working edge suggest-

ing but not identical to intentional retouch. The modifications are almost entirely on the thinnest, sharpest edges of the flakes or cores. All of these specimens are Normanskill chert.

Pieces Esquillees

Despite careful inspection of over 12,000 waste flakes from Areas A and B, only five examples of this class of tool were found in the collection. All are Normanskill chert. Three are flakes that display battering on opposite, paired edges. Bifacial chipping, sometimes resulting in the removal of long, ribbon-like flakes, is a result of such battering (Figure 37, no. 2). Two objects assigned to this class have the appearance of small biface preforms (no. 3).

Pieces esquillees were numerous at the Debert site, Nova Scotia, where they were first recognized by MacDonald (1968: 85–90). This tool type, common in the Old World Upper Paleolithic, seems to have been used for grooving and splitting bone or antler (Semenov 1964:149–150).

Though the years since discovering the site, R. Arthur Johnson had collected artifacts from various loci, principally Areas A and B. The following (Table 11) is a summary listing of 42 chipped stone items donated to the New York State Museum in 1979 and also following Johnson's death. These artifacts had not been previously studied, nor have they been subjected to metrical and wear pattern analysis, except for the three fluted point preforms. They are all Normanskill chert. The listing is not exhaustive, since some items in Johnson's donation have not been examined in detail.

Table 11. Trait list for chipped stone tools in the R. Arthur Johnson collection.

Bifaces, stage 1: 8
Bifaces, stage 2:
Fluted point preforms: 3.

One whole biface measures 56 mm long, 36 mm wide, and 13 mm thick. It does not possess end thinning flake scars. A second specimen is a basal fragment, measuring 43 mm wide, 12 mm thick, broken during end thinning of one face. The third item is also a basal fragment, measuring 35 mm in width, and 10 mm in thickness, and is fluted on one face. None of these objects show basal or edge rubbing.

- Other biface fragment: 1.
- Side scrapers: 7
- Retouched flake tools: 3
- Utilized flakes: 20

These artifacts are included in the trait list below (Table 13), and has been integrated into Tables 35 and 36 in final sections of this report.

Rough Stone

Cobble Hammerstones

Glacially derived cobbles were used by the occupants of Areas A and B at West Athens Hill to work the chert veins and nodules exposed in the sandstone outcrops, and probably to make lithic tools (Figure 37, nos. 1, 4–6, 8, 9). Hammerstones (n = 167) occurred in many sizes, but only a few are so large as to have required the use of two hands rather than one to hold them. Most of the cobbles are of ovate shape, the rest being spheroidal or discoidal, and almost invariably display battering on one or both ends of the long axis. A few examples are battered around the entire periphery.

Of 66 hammerstones examined from Areas A and B, 24 are quartzite, 38 are sandstone, 1 is gneiss, 1 is granite, and 2 are conglomerate. The weights of the hammerstones are presented in Table 12.

Table 12. Weights of a sample of hammerstones from Areas A and B (in g).

Mean	500.6
Median	3,84.5
Mode	148
Standard dev.	475.13
Range	2,864
Minimum	55
Maximum	2,919
Count	66

Anvil-hammerstones

Six objects are similar to simple cobble hammerstones, but in addition to battered ends or edges they display the unmistakable scarification that results from use as anvils on one or two facets or flat surfaces.

Abradingstones

This section represents a modification of the typology used in Ritchie and Funk (1973), in which anvilstones and abradingstones were listed separately. Reanalysis indicates that the items in the site sample are not easily subdivided in this fashion.

This interesting group of 11 artifacts were apparently primarily abraders, also often called whetstones. Eight can be typed as grooved abraders (Figure 38, nos. 1–3). But three tools, not assigned to the group of grooved stones, have one broad, shallow, smoothed depression each bearing fine striations or scratches, generally on the naturally most even and flat surface that faced upward when the tool lay on the ground. In each case, the smoothing and concavity may have been produced by rubbing another flat, solid object of stone back and forth across the stationary slab. One of these tools was also used as a heavy hammerstone because both ends show removal of large fragments from forceful battering. Perhaps it could be described as a hammer-milling stone, or alternatively, as a hammer-abrader. The other two closely resemble

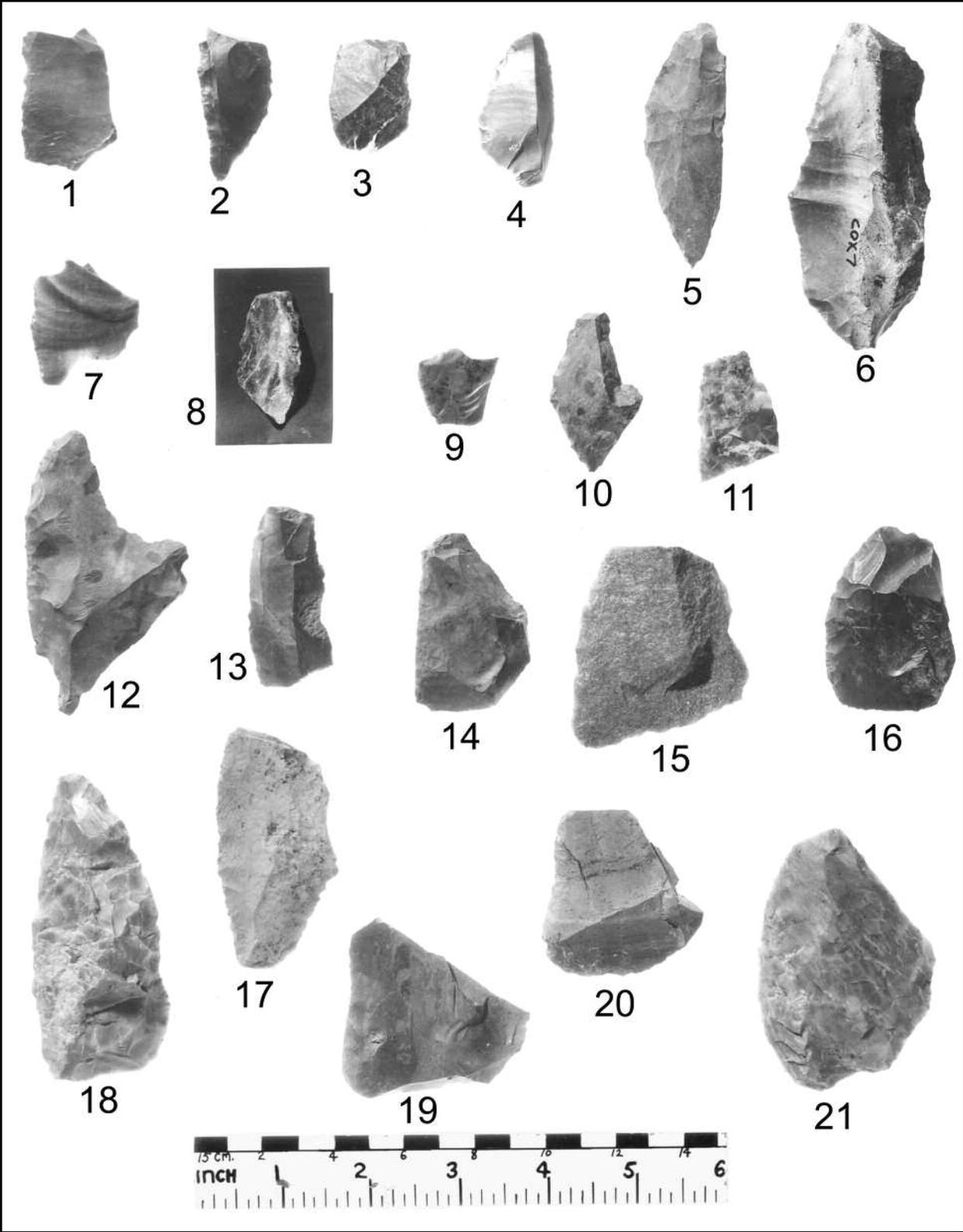


Figure 36. Flake knives from Areas A and B. Material: all Normanskill chert except no. 8, quartz; 15, quartzite; 18, 21, Fort Ann chert.

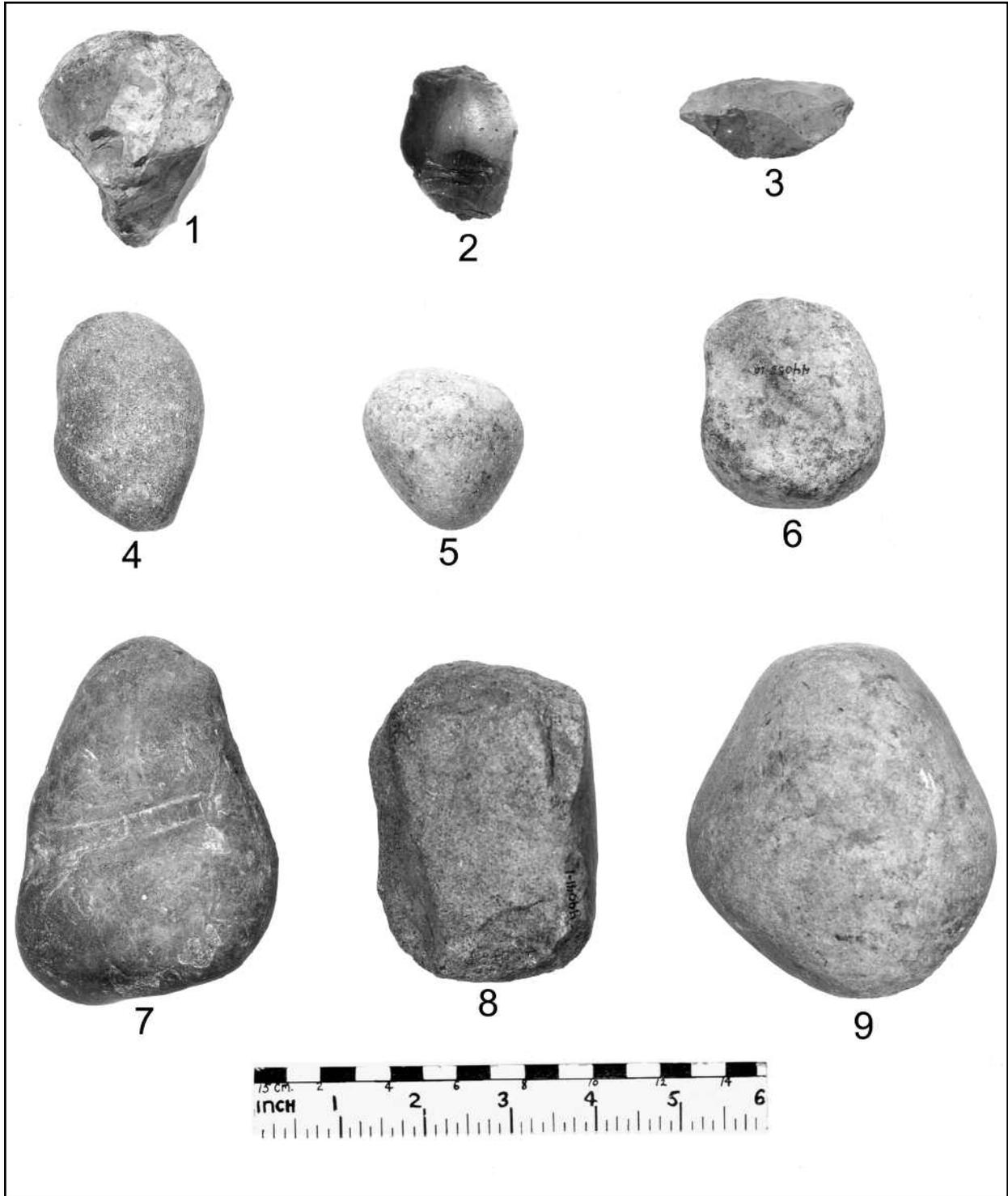


Figure 37. Chipped and rough stone tools from Areas A and B. No. 1, chert pebble hammerstone; 2, 3, battered objects identified as pieces esquillees; 4–6, 8, 9, cobble hammerstones; 7, possible petroglyph. Material: 1–3, Normanskill chert; 4–9, quartzite.

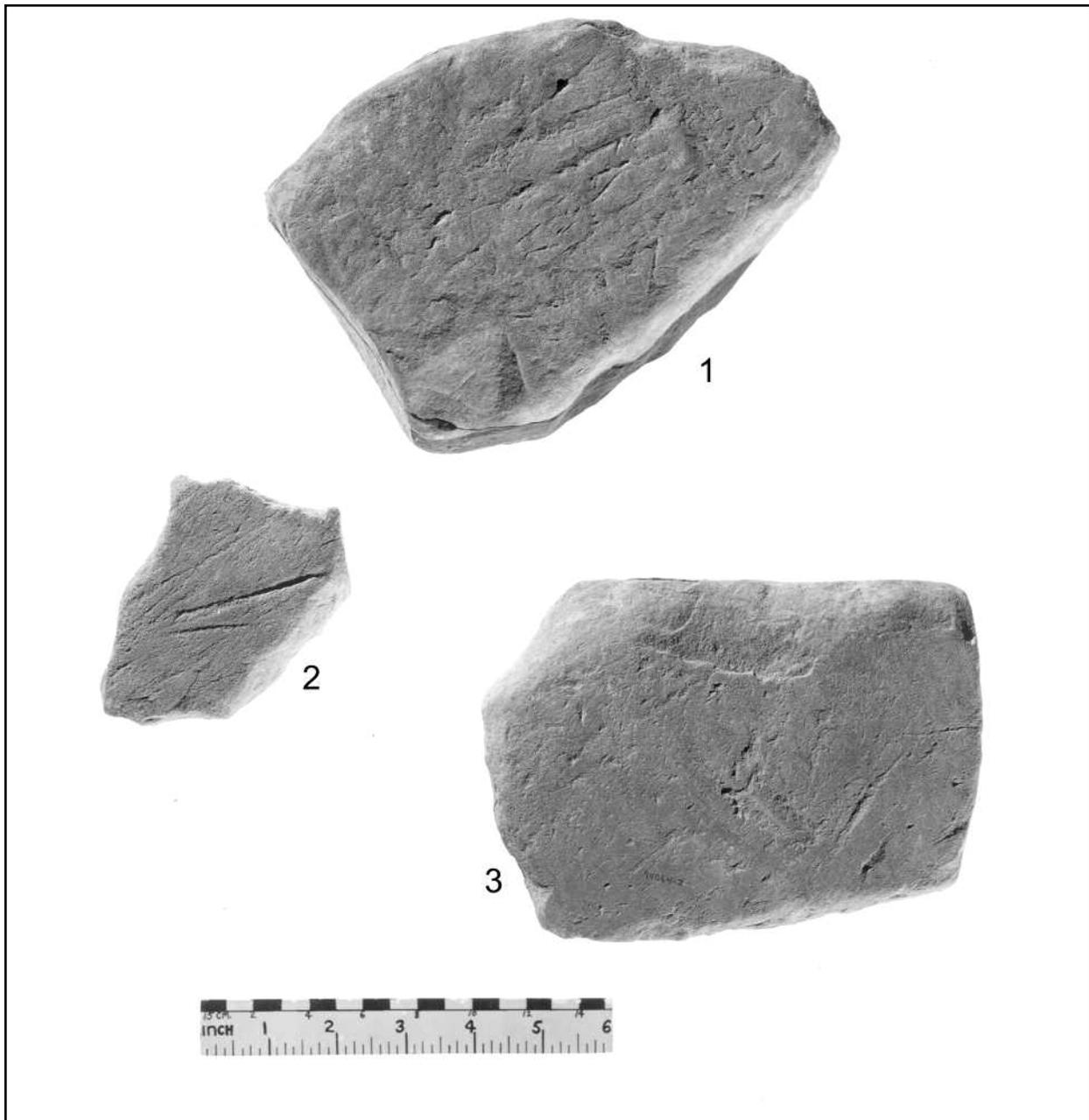


Figure 38. Rough stone tools from Areas A and B. Nos. 1-3 grooved abradingstones. Material: all sandstone

the millings commonly found on later sites of the Archaic and Woodland periods. It is conceivable, although difficult to prove, that the smoothed surfaces on these objects were produced by milling or mealing of nuts and other plant foods. No tools resembling mullers or handstones were found to support this hypothesis, and this was confirmed by reexamining the rough stone tools from all loci at West Athens Hill.

It should be noted that some of the tools display small scarred areas indicative of use as anvilstones as well as abraders. These 11 tools, whether anvilstones, millings, abraders, or combinations of these functional types, range in weight from 230 to 5,422 g. They range in length from 95 to 215 mm, in width from 71 to 155 mm, and in thickness from 23 to 55 mm. Sandstone slabs were used for all of these tools. The questions raised by the wear patterns on the “abraders” are considered in later pages.

Possible Petroglyph

One small quartzite cobble (Figure 37, no. 7) bears what appear to be crudely scratched lines arranged in a rather enigmatic pattern. The main design is in the form of a ladder, the sides of which diverge at one end. Fainter lines can be seen on both sides of it.

It is difficult to suggest what the scratches may represent—they are definitely not random. There is some resemblance to a butterfly or other arthropod; the ladder motif could stand for a segmented body, and two small projections at one end could be antennae. The faint crescentic scratches on both sides of the main motif, with some stretch of the imagination, can be visualized as wings. Other interpretations are possible. For example, it has been suggested that the central figure is an elephant’s head and trunk, the crescentic lines being tusks.

I examined this specimen with a stereomicroscope under 5 to 25 magnification. It seemed to me that the main part of the design exhibited grooves that had been incised or engraved into the stone using a hard, sharp

Table 13. Trait list for Areas A and B.

Chipped Stone	
<i>Bifaces</i>	
Projectile Points, Fluted	
Finished	13
In process	27
Possible	21
Projectile Points, Archaic 10	
Other Bifaces	
Stage 1	104
Stage 2	64
Stage 3	35
Miscellaneous	34
Total Bifaces	308
<i>Unifaces</i>	
Scrapers, end	92
Scrapers, side	192
Knives, flake	39
Flakes, retouched	33
Graver	1
Pieces esquillee	5
Flakes, utilized	680
Total Unifaces	1,042
Rough Stone	
Hammerstones	167
Anvil-hammerstones	6
Abradingstones/ anvilstones	11
Petroglyph (?)	1
Total Rough Stone	185
Total Assemblage	1,535

object such as a stone flake. The quartz grains appeared to have been broken by the application of strong force.

During the reexamination of the collection in 1999, I experienced some doubt about the original interpretation of the object as an artifact and wondered whether it was a fossil (it had been examined by a geologist circa 1966 but he was unable to verify the lines repre-

sented a fossil). I submitted it to Dr. Ed Landing, New York State Paleontologist, New York State Museum, for his examination. He was unable to conclusively determine whether it was an invertebrate fossil or an artifact. Therefore, for this report I have modified my description to designate it a *possible* petroglyph. Whatever one sees in this object, it may well be of Paleoindian origin, coming as it did from Stratum 2A. Its weight is 479 g. It measures 101 mm long, 74 mm wide, and 43 mm thick.

Summary of Lithic Materials Used in Chipped Stone Tools

The data in Table 14 are self-explanatory. Only 33 artifacts from Areas A and B, 2.5 percent of the total, are made of stones other than Normanskill chert. Of this group, only a few items are of other locally obtainable materials (viz., quartz and quartzite from glacial cobbles or rock outcrops) and Kalkberg chert (from the Kalkberg or Helderberg escarpment). The remainder are exotic to the area, and in 13 cases the sources are outside New York State,

in Ohio and Pennsylvania. Western Onondaga chert and brown or red Pennsylvania jasper were the two most important materials besides Normanskill chert.

It is of further interest to note that more non-local stones were used for end scrapers than for any other artifact class. Over 60 percent of such materials present in Areas A and B are to be found in end scrapers, and nearly 90 percent are accounted for by uniface artifacts. A further breakdown shows that 7 of the 9 Pennsylvania jasper tools and 4 of the 9 items of Western Onondaga chert are end scrapers.

Lithic Debitage Analysis

Over 12,000 pieces of chert debitage were recovered in the State Museum explorations of West Athens Hill in 1966. The total does not include utilized flakes, utilized cores, or pieces esquillees, all of which are classed as artifacts (total number 665). With one exception, a flake of red Pennsylvania jasper, the source was the Normanskill chert veins on or near the site. There was not a single identified

Table 14. Frequencies of lithic materials used for artifacts other than Normanskill chert, from Areas A and B (1973 analysis).

Type	No.	Percent of Deliberately Made Artifacts (623)	Percent of All Chipped Stone Artifacts (1,308)
Western Onondaga Chert	9	1.4	.7
Fort Ann Chert	4	.6	.3
Upper Mercer Chert	3	.5	.2
Kalkberg Chert	1	.2	.08
Oriskany Chert	1	.2	.08
Pennsylvania Jasper	9	1.4	.7
Smoky Quartz	1	.2	.08
Clear Quartz	3	.5	.2
Quartzite	1	.2	.08
Speckled Creamy Chert	1	.2	.08
Totals	33	5.4	2.5

flake of Western Onondaga chert or any of the other exotic stones used for some lithic tools. Occasional chips of quartzite were probably derived from the manufacture of a small number of uniface tools from local cobbles of that material.

In Area B of the excavations, varying quantities of debitage were saved from all squares except those disturbed by collector digging. However, every chip and core was collected from only six squares. As might be expected, the highest counts were from these squares (total 10,408). In this group, the proportion of debitage to artifacts was 11 to 1.

The major task of analyzing the numerous pieces of debitage was carried out by Beth Wellman, then Laboratory Technician, in the Anthropological Survey, New York State Museum. The lithic refuse was broken down into eight morphologic categories.

1. *Blocks*. These are angular fragments of chert from the hilltop veins, apparently picked up on the surface, or pried and hammered from their matrix, by the Indians. Some are weathered on all facets to a yellowish-brown or white color. There are also some pieces bearing a rind from the plane of contact with sandstone. Other pieces showing one or more fairly fresh-appearing chert surfaces were apparently separated from parent exposures by rough hammer blows, or were loose blocks

intentionally split to inspect the qualities of the material. These might be called block fragments. Some of the unworked pieces are of tabular form, and can be referred to as vein plates.

A small sample of five blocks showing no modification range from 94 to 150 mm in length, 75 to 110 mm in width, and 51 to 100 mm in thickness. They range in weight from 431 to 1,029 gm. This sample provides a general idea of the size and weight of these objects, but a few visually inspected blocks in the total sample from the locus are even larger than those measured. Summary statistics for a limited sample of *block fragments*, not qualifying as cores, are presented in Table 15.

2. *Cores*. In this category are blocks, block fragments, or vein plates bearing at least one flake scar denoting the intentional removal of flakes, for some purpose. Some of these items display flake scars over most of their surface. They vary from rectilinear blocks or block fragments to roughly spheroidal shape. Summary statistics for a small sample of cores are presented in Table 16. These data give some idea of the size and weight attributes of these objects in Area B and permit comparison with the data from Area C.

3. *Core Fragments*. These are spalls that are usually thick and semi-pyramidal, or keeled, in form, too small to have been useful as cores

Table 15. Summary statistics for block fragments from Area B.

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	55.3	41.9	27.7	91.3
Median	52	39	26	59.5
Mode	78	32	26	20
Standard deviation	20.0	12.0	13.6	88.7
Range	74	41	49	298
Minimum	32	26	11	14
Maximum	106	67	60	312
Count	20	20	19	20

Table 16. Summary statistics for a sample of cores from Area B.

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	86.8	65	41.5	281.3
Median	86	62	41	221
Mode	90	62	42	456
Standard deviation	21.4	13.4	9.6	155.6
Range	105	49	43	578
Minimum	55	46	24	105
Maximum	160	95	67	683
Count	39	39	39	39

Table 17. Summary statistics for core fragments from Area B.

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	66.0	42.8	28.5	89.1
Median	61.5	43	28.5	81.5
Mode	59	45	40	100
Standard deviation	15.0	7.7	6.8	38.0
Range	63	29	26	139
Minimum	46	27	14	27
Maximum	109	56	40	166
Count	24	23	24	24

in themselves. They appear to have been struck from cores as an attempt to prepare new striking platforms. Technically, they equate with both primary and secondary flakes. It is frequently difficult to identify either the striking platform or the bulbar face. In fact, it is easy to confuse some of these items with block fragments. Summary statistics for a small sample of core fragments from Area B are presented in Table 17. Again, these figures provide some notion of the range in such items from the locus, and permit comparison with similar materials from Area C.

4. *Primary Flakes*. These are first flakes to be struck from vein plates or blocks that have weathered surfaces. Such flakes preserve the

cortex or patinated surface on their dorsal side and show fresh chert on their ventral face. They are sometimes removed by hard hammer percussion. They are sometimes difficult to distinguish from block fragments.

5. *Secondary Flakes*. These are flakes struck from cores by the percussion method. The scars of flakes previously removed from the cores are visible on the dorsal surfaces. The striking platforms are clearly evident on these flakes, which are generally of expanding ovate or trianguloid form. Some are irregular in outline.

6. *Retouch Flakes*. This category of debitage is considerably smaller than the mean dimensions for secondary flakes. Striking platforms

and bulbs of percussion are weakly developed. Soft hammer percussion is indicated. Some of these flakes may be from the retouch of end and side scraper working edges.

7. *Biface Thinning Flakes*. These are similar to retouch flakes, except that they are produced by thinning a biface; the striking platforms are at an acute angle to the surface of the face from which the flake was removed and retain part of the face from which the blow was struck.

8. *Broken Flakes*. No striking platform or bulbs of percussion can be discerned on these flakes. The portions with striking platforms may have been deliberately or accidentally

broken off. In size and shape these flakes otherwise correspond to the classes of secondary flakes and retouch flakes.

No polyhedral or prepared cores occurred in the debitage. True blades are extremely rare among secondary flakes, although a small number of elongate, blade-like flakes are present. Some cores bear the scars of narrow, ribbon-like flakes that were detached from them. The same cores also display the scars of the more typical expanding ovate or trianguloid flakes, removed by means of striking platforms on various edges or corners.

The counts and percentage frequencies of the eight debitage categories from six squares in Area B are presented in Table 18.

Table 18. Frequencies of debitage classes in complete samples saved from six excavated squares in Area B.

Class	No.	Percent
Blocks & Block Fragments	1,723	16.6
Cores	302	2.9
Core Fragments	3,209	30.8
Primary Flakes	466	4.5
Secondary Flakes	3,030	29.1
Retouch Flakes	842	8.1
Bifacial Thinning Flakes	12	0.1
Broken Flakes	824	7.9
Totals	10,408	100.0

ARTIFACTS FROM AREA C

The artifacts from this locus (Figure 39) are generally similar in typology, morphological range, size, and lithology to those from Areas A and B at West Athens Hill but with some interesting differences. The distribution of artifacts in Area C is plotted in Figure 40.

CHIPPED STONE

Bifaces

Bifaces in Process Stage 1 (n = 103)

It should be recognized that the attempt to create fine subdivisions of Stage 1, 2, or 3 bifaces is a subjective process. Although I initially divided the sample into Stage 1A, Stage 1B, and generalized Stage 1, all of these have been combined as simply Stage 1 for this analysis. Metrical data are presented in Table 19 (24 items assigned to this stage were found in the debitage during the analysis, and were chiefly very small fragments, therefore metrical data

will not be presented for them). These objects conform to the description of Stage A bifaces in the original report (Ritchie and Funk 1973:16), and as presented above. They are relatively crude, thick, roughly ovate, showing evidence of the initial steps in reduction from a core or spall. Both faces and both edges show at least partial flaking. Percussion flaking resulted in deep, broad, flake scars, and unmodified areas of cortex are frequently observed.

The mean ratio of width over thickness for Stage 1 Bifaces is 2.79. The range is 1.06 to 4.87. Nearly all of these items are of Normanskill chert, the single exception being of a black chert reminiscent of Kalkberg chert. Scattergrams for width vs. thickness and length vs. width for State 1 bifaces are presented as Figures 41 and 42, respectively.

This clustering for State 1 bifaces in Area C compares well to the graph of width vs. thickness for Stage 1 bifaces from Areas A and B (see Figure 17).

Table 19. Summary statistics for Stage 1 bifaces from Area C.

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	74.1	50.8	18.2	79.5
Median	72	49	17	59.5
Mode	73	56	17	N/A
Standard deviation	16.5	12	5.3	49.7
Range	76	62	26	170.4
Minimum	51	28	8	35.6
Maximum	127	90	34	206
Count	20	55	77	12

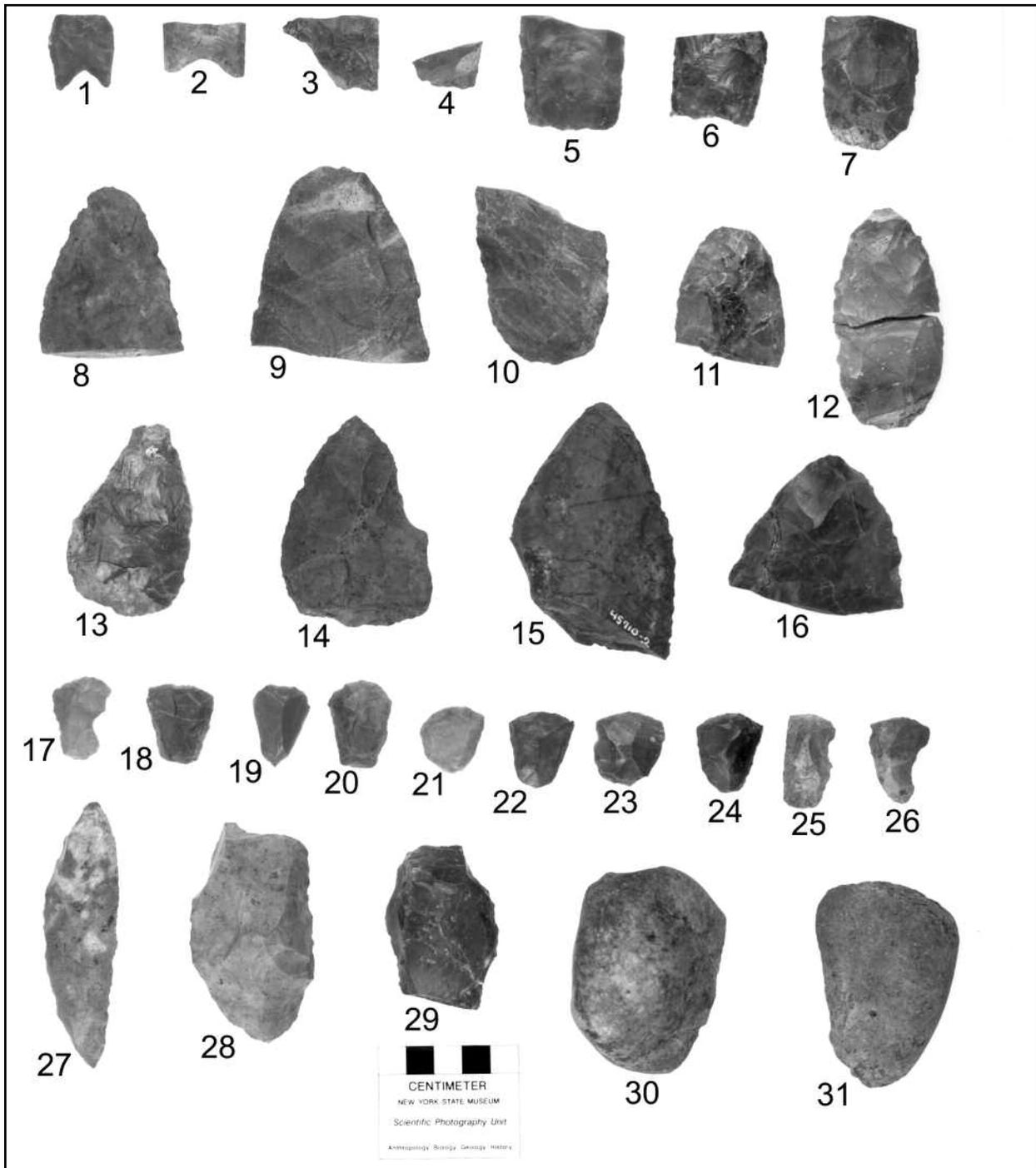


Figure 39. Chipped and rough stone tools from Area C at West Athens Hill. Nos. 1–2, 4 basal fragments of finished (Stage 4) fluted points; 3, 5, 6, fluted points in process, broken during end-thinning; 7–16, fragmentary bifaces (7, 11, 12 are probably Stage 3 fluted points, while the others are larger and probably functioned as knives); 17–26, trianguloid or trapezoidal end scrapers (note probable graving spurs on 17, 18, 20, 22, 23, 24, 26); 27, elongate limace or side scraper with parallel steeply retouched edges and pointed ends; 28, steeply retouched side scraper on “turtleback” core; 29, side scraper on thick, flat flake with one long retouched working edge; 30, 31, cobble hammerstones. Material: Chipped stone items are of Normanskill chert except nos. 25, 29, of Western New York Onondaga chert, and no. 27, of Pennsylvania jasper. The hammerstones are of quartzite.

West Athens Hill Site Area C

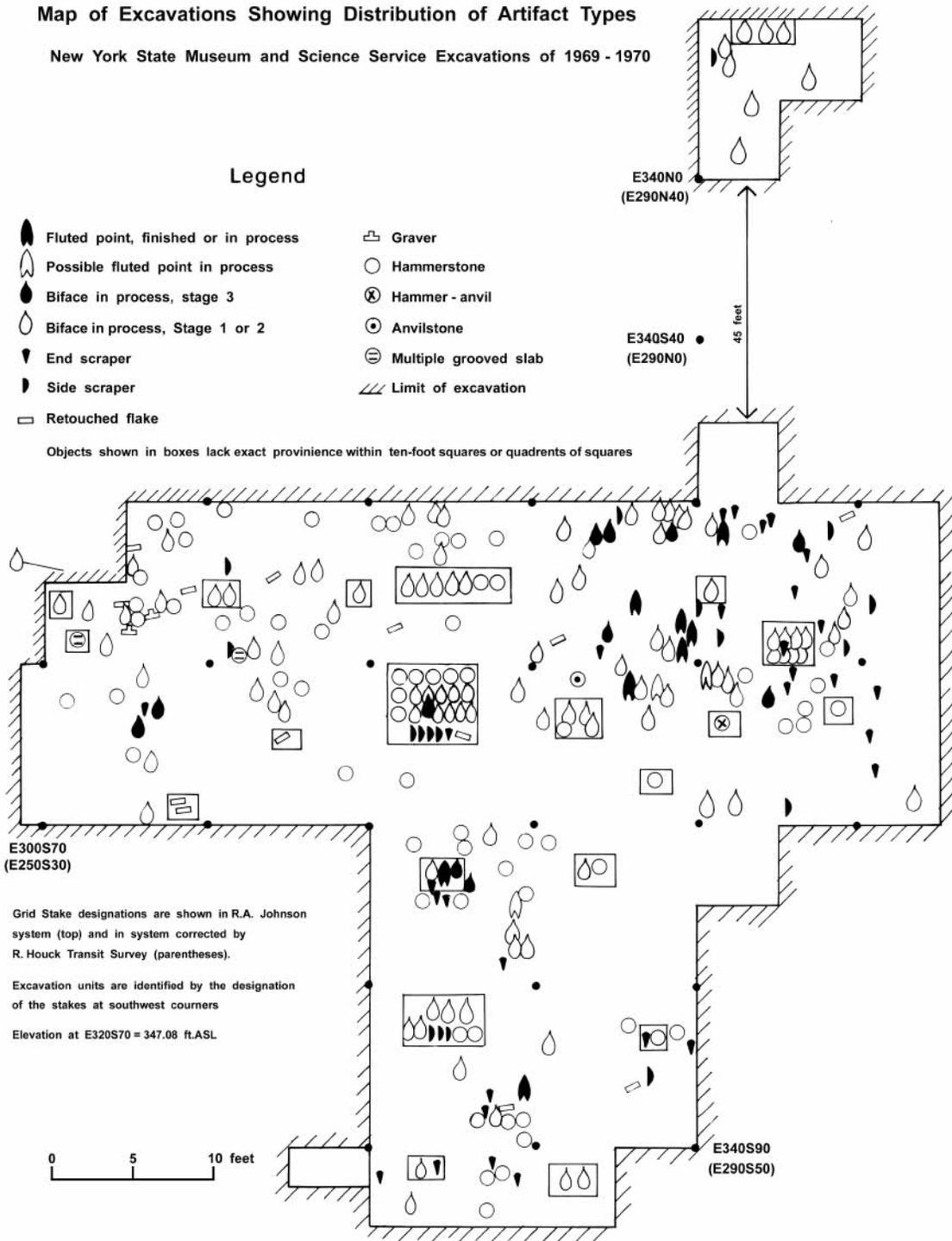
Map of Excavations Showing Distribution of Artifact Types

New York State Museum and Science Service Excavations of 1969 - 1970

Legend

- | | | | |
|---|--------------------------------------|---|-----------------------|
|  | Fluted point, finished or in process |  | Graver |
|  | Possible fluted point in process |  | Hammerstone |
|  | Biface in process, stage 3 |  | Hammer - anvil |
|  | Biface in process, Stage 1 or 2 |  | Anvilstone |
|  | End scraper |  | Multiple grooved slab |
|  | Side scraper |  | Limit of excavation |
|  | Retouched flake | | |

Objects shown in boxes lack exact provenience within ten-foot squares or quadrants of squares



E300S70
(E250S30)

Grid Stake designations are shown in R.A. Johnson system (top) and in system corrected by R. Houck Transit Survey (parentheses).

Excavation units are identified by the designation of the stakes at southwest corners

Elevation at E320S70 = 347.08 ft.ASL

0 5 10 feet

E340S90
(E290S50)

DATUM


Figure 40. Map showing distribution of artifacts in Area C.

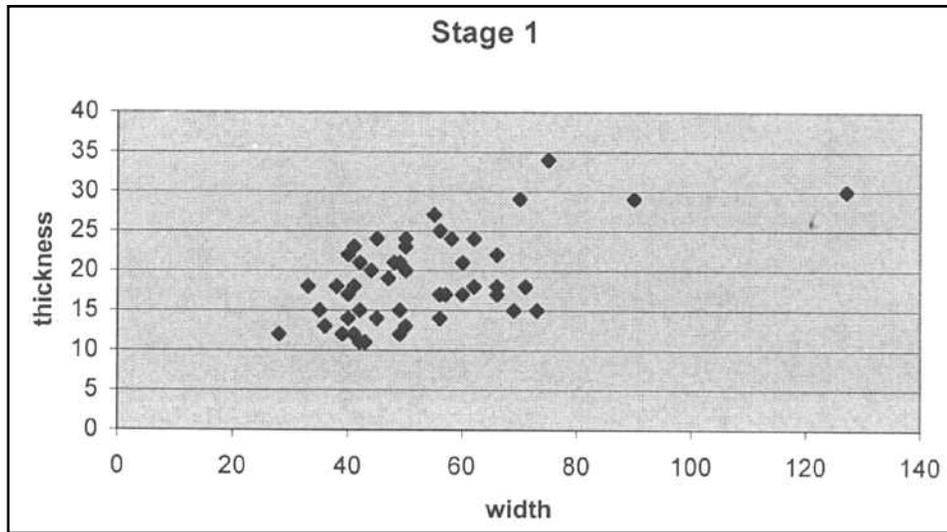


Figure 41. Scattergram of width vs. thickness for Stage 1 bifaces from Area C.

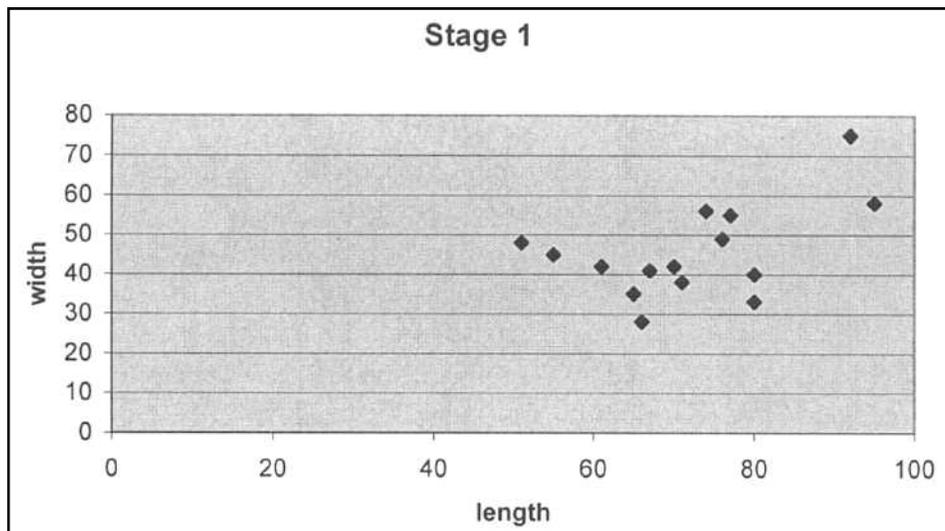


Figure 42. Scattergram of length vs. width for Stage 1 bifaces from Area C.

Stage 2 Bifaces (n = 40)

Bifaces in this group from Area C were further reduced toward the final product. Percussion flaking was more evenly applied, and the resulting form is again smaller and thinner than Stage 1 bifaces and more symmetrical. Descriptive statistics are shown in Table 20 (as with Stage 1 bifaces, study of the debitage turned up additional specimens, chiefly small fragments, so metrical data are

not presented for them). Again, the classification into Stages 2A, 2B, and generalized Stage 2 was abandoned and all of these bifaces are combined as Stage 2. All of these specimens are fragmentary, therefore length measurements are not given. It is also worth noting that one of the Stage 2 bifaces is clearly in the form of a Susquehanna knife, not pertaining to the Paleoindian occupation. It is not included in Table 20.

Table 20. Summary statistics for Stage 2 bifaces from Area C.

Statistic	Length (mm)	Width (mm)	Thickness (mm)
Mean	N/A	50.2	12.1
Median	N/A	49	12
Mode	N/A	60	10
Standard deviation	N/A	12.1	2.3
Range	N/A	55	8
Minimum	N/A	35	9
Maximum	N/A	90	17
Count	N/A	27	31

The mean ratio of width over thickness for Stage 2 bifaces from Area C is 4.15. The range is 2.57 to 5.22. All of these objects are Normanskill chert. A scattergram for width vs. thickness of State 2 bifaces is presented as Figure 43. This graph compares well with the graph for Stage 1 bifaces from Area C (Figure 41) as well as that for Stage 2 from Areas A and B (Figure 21).

Stage 3 Bifaces (n = 8)

These eight objects are the only items in this advanced biface category from Area C, apart from the possible fluted point preforms.

The material is Normanskill chert. All are fragmentary. They range in width from 19 to 64 mm, and in thickness from 7 to 14 mm.

There are some interesting morphological differences within this small group, represented by three tip-to-midsection fragments of what may have been narrow stemmed or side-notched projectile points. They range from 19 to 25 mm in width of blade and 7 to 8 mm thick. The other five bifaces may be knives, tending to be wider and thicker, ranging from 39 to 64 mm wide and 8 to 14 mm thick, commensurate with the majority of other bifaces in the assemblage.

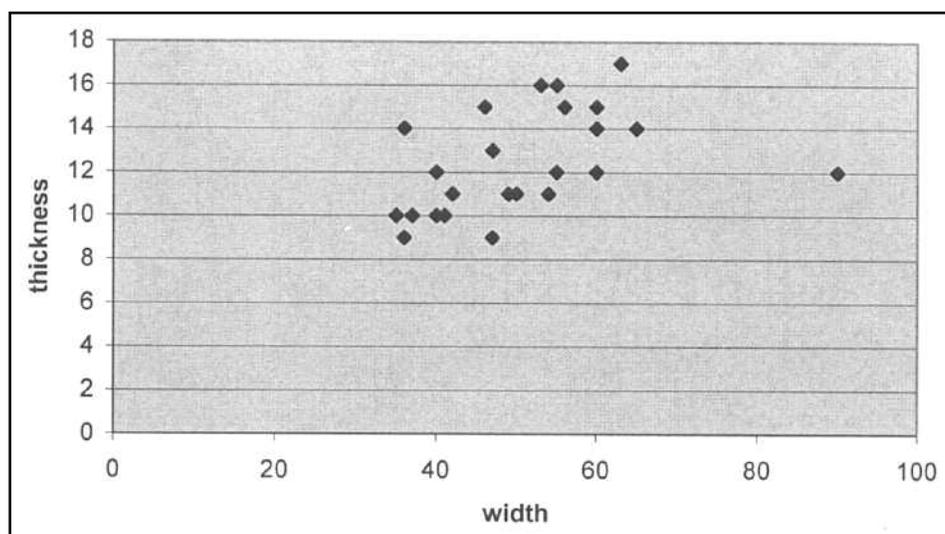


Figure 43. Scattergram of width vs. thickness for Stage 2 bifaces from Area C.

The narrow-bladed bifaces may well have pertained to a Late Archaic component at West Athens Hill, but the absence of the diagnostic basal portions precludes confident identification. Their presence is not surprising, considering the discovery of two broad-bladed contracting-stemmed Susquehanna knives in Area C, a Susquehanna knife and small stemmed point in Area E, and the relatively late point types in Area B.

Fragmentary Bifaces, Not Classified (n = 2)

Both are of Normanskill chert.

Fluted Points (n = 12)

Twelve specimens from Area C were confidently identified as fluted points. Because so many bifaces in process are represented in the assemblage, it is difficult to decide which ones are fluted point preforms. Apart from size and shape, a chief criterion is the presence of end-thinning flake scars on the base of a preform assigned to Stage 1 or 2. Items at Stage 3 are easier to classify because they have been further thinned, have a symmetrical outline, and display one or two scars from removal of end-thinning flakes or even final channel flake scars.

Table 21 presents summary data for the 12 bifaces from Area C classified as fluted points. Only three, however, are considered to be finished specimens. Only one is nearly whole. Summary statistics for fluted points are presented in Table 22.

The first finished point (see Figure 39, no. 1) is nearly whole, lacking just the tip. It is ground on the base and also on the sides (19 mm and 15 mm, respectively). There is one channel flake scar on one face, two on the other face. The point was reworked and now the blade has a pentagonoid outline. The base is indented 6 mm. The material is Normanskill chert. The second finished specimen is Normanskill chert (see Figure 39, no. 2) and consists of the basal half. Both lateral and basal grinding are present. Two channel flake scars are evident on the face, and one channel flake scar on the other face. The base is deeply

indented to 6 mm. Slight fire-spalling is present. The third finished point (see Figure 39, no. 4) is a basal fragment, 26 mm wide and 6 mm thick, with a straight base. Both faces are fluted. There is no basal or edge grinding. It too is Normanskill chert.

All of the other bifaces included in Table 21 are assigned to Stage 3. They are Normanskill chert in gray and grayish-green varieties. There are seven basal fragments. Two of these bear single flutes or end-thinning flake scars on one face, and the other face is basally thinned. Two others show fluting on one face, but the attempt at fluting the opposite face hinged through the blade. One fragment bears a single flute in one face, and two overlapping channel flake scars on the other face. The base is straight, and only slightly rubbed. This point was very nearly finished before it was broken.

The basal section of a reconstructed biface (see Figure 39, no. 12) was broken during end-thinning of one face; no channel flake scars are on the other face. The slightly excurvate base as well as the edge lack grinding. It is Normanskill chert. Two distal sections probably from fluted points (Figure 39, nos. 11–12) are Normanskill chert. Four other Stage 3 biface fragments, 2 basal, 1 tip, and 1 midsection are possibly from fluted points. Three are Normanskill chert, 1 is a dark gray chert with small white specks.

The mean ratio of width to thickness is 5.01 mm, and the range is 4.22 to 6.0 mm. A scattergram of width vs. thickness for these artifacts is presented as Figure 44.

This scattergram compares well with the graph for fluted points from Areas A and B (Figure 27). It shows a similar range of width and thickness.

There are four possible fluted points in process, none of which is whole (Table 23).

The mean width of possible fluted points in process is 33.5 mm, the mean thickness 8.3 mm. The ratio of width over thickness ranges from 2.8 to 5.29.

Table 21. Summary of data for finished (stage 4) fluted points and Stage 3 preforms from Area C.

Catalog Number	Description	Length (mm)	Width (mm)	Thickness (mm)	Grinding?	Material	Remarks	Figure 39 reference
45693-1	Basal frag. (Stage 3A)	—	34	7	None	Normans-kill	Fluted one face, thinned other face. One tang missing.	No. 3
45007-1	Basal frag., finished (Stage 4)	—	29	6	Lateral and basal	Normans-kill Slight fire-spalling.	2 flute scars one face, 1 on other face. Base deeply indented (6 mm).	No. 2
45679-2	Basal frag. (Stage 3A)	—	33	6	None	Normans-kill	One face fluted to break, other face basally thinned. Base slightly concave (2 mm).	No. 6
45006-1	Nearly whole, minus tip, finished (Stage 4)	—	36	6	Basal and latera (19 mm and 15 mm up from base)	Normans-kill	One flute scar one face, 2 scars other face. Point reworked to pentagonoid outline. Base indented 6 mm.	No. 1
45679-1	Basal frag. (Stage 3A)	—	38	7	None	Normans-kill	Flute scar on one face extended past break, was 21–24 mm wide, fluting attempt other face hinged through blade. Base straight.	No. 5
45679-3	Upper half (Stage 3A)	—	39	8	None	Normans-kill		
45693-2.5	Whole Stage 3A Preform	78	38	9	None	Normans-kill	Broken in half by attempted end-thinning. No flute scar on other face. Rounded base.	No. 12
45679-4	Basal frag. (Stage 3A)	—	38	7.5	Slight basal rubbing	Normans-kill	Broken in half by attempted thinning. No flute scars. Rounded base.	
45677-1	Upper half (Stage 3A)	—	40	8	None	Normans-kill		No. 11
45680-7	Basal frag. (Stage 3A)	—	26	5	Slight basal rubbing	Normans-kill	One flute one face, 2 flutes other face. Straight base.	
45006-8	Basal frag. (Stage 3A)	—	49	9.5	None	Normans-kill	Broken during end-thinning on one face, hinged through at 40 mm length. No flute other face.	
45680-1	Basal frag., finished (Stage 4)	—	26	6	None	Normans-kill	Both faces fluted, straight base	No. 4

Table 22. Summary statistics for Stage 4 fluted points and Stage 3 preforms from Area C.

Statistic	Length (mm)	Width (mm)
Mean	35.5	7.08
Median	37	7
Mode	38	6
Standard deviation	6.5	1.36
Range	23	4.5
Minimum	26	5
Maximum	49	9.5
Count	12	12

Unifaces

End Scrapers (n = 37)

These tools are broken down as follows; 24 trianguloid, 3 trapezoidal, 1 massive, 3 oblong, 5 fragmentary, and 1 in process. Size and weight measurements are presented in Table 24. Most of these tools were made of Normanskill chert, but 4 are of Western Onondaga chert and 1 of Eastern Onondaga chert.

Edge angles were measured on the bits of end scrapers from Area C. All (n = 14) the measured scrapers from Area C showed angles of 40–60 degrees, and half (7) fell within 40–50 degrees. This result indicates a nar-

Table 23. Metrical data for possible fluted points in process from Area C.

Catalog No.	Description	Length (mm)	Width (mm)	Thickness (mm)	Material	Figure 39 reference
45678-1	Basal frag. (Stage 3)	—	37	7	Normanskill	No. 7
45676-2	Basal frag. (Stage 3)	—	47	11	Normanskill	No. 10
45695-1	Tip frag. (Stage 3B)	—	22	5	Dark gray speckled chert	
45695-2	Midsection (Stage 3)	—	28	10	Normanskill	

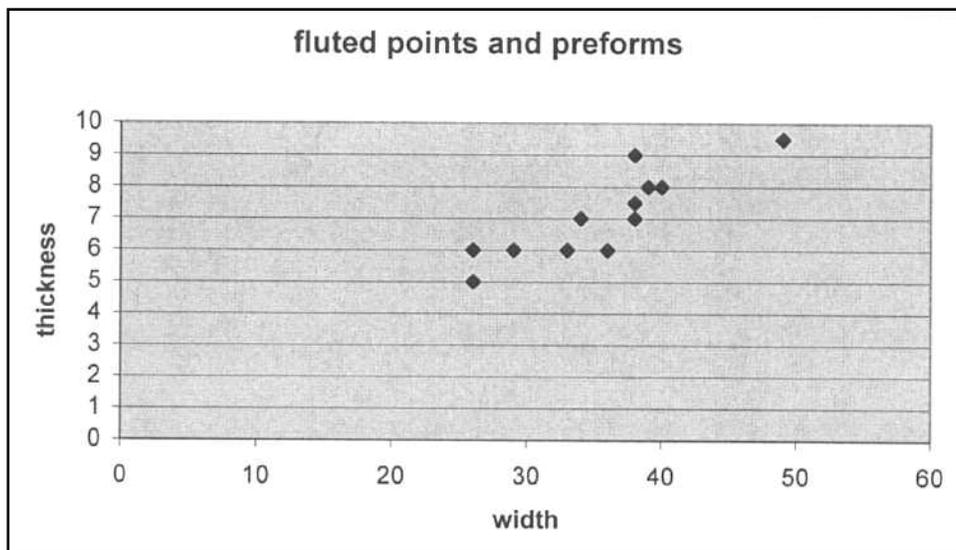


Figure 44. Scattergram of width vs. thickness for State 4 fluted points and Stage 3 preforms from Area C.

Table 24. Summary statistics for end scrapers from Area C.

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	35.1	23.7	8.6	8.8
Median	34	23.8	8	7
Mode	35	25	7	7
Standard deviation	12.3	6.0	2.6	11.4
Range	65.5	35	11	63.5
Minimum	19.5	15	6	2
Maximum	85	50	17	65.5
Count	29	30	32	28

rower range of edge angles than represented in Areas A and B, but it should be noted that less than half of the scrapers from Area C were measured for that attribute.

At first glance the mean weight of end scrapers from Areas A and B is significantly less than that from Area C, despite the similarity in size. But if one unusually massive end scraper from Area C is removed from the calculation, the mean weight of end scrapers from both loci is approximately 7.0 g.

Side Scrapers (n = 19)

The objects classified as side scrapers have been subdivided as follows: massive, with two retouched working edges, 2; hump-backed, on core, with two retouched edges, 1;

on small flake, with two retouched converging edges from same face, 1; on large flake, with one retouched edge, other edge utilized, 1; on small flakes, with one retouched edge, 9; with two converging edges, from retouch on dorsal and ventral faces, 2; on a rectangular flake, retouched on entire periphery, 1; on a flake with single retouched semicircular edge, showing small “spurs” or possible graving points between retouch flake scars, 1; and a fine limace or slug-shaped side scraper, 1. Summary statistics for these tools are presented in Table 25.

All but 5 of the side scrapers from Area C were fashioned from Normanskill chert. One (the “limace”) is brown Pennsylvania jasper, 1 is Western Onondaga chert, 1 is a dark bluish

Table 25. Summary statistics for side scrapers from Area C.

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	62.6	43.5	14.4	39.8
Median	63	40	14	33.5
Mode	58	35	11	14
Standard deviation	15.9	14.9	5.1	31.5
Range	66	50	18	120
Minimum	28	20	6	4
Maximum	94	70	24	124
Count	17	17	17	14

gray chert with quartz streaks, and 2 are gray chert, possibly an Eastern Onondaga variety.

Retouched Flakes (n = 19)

These tools from Area C are not to be confused with “biface thinning flakes,” also often called “biface retouch flakes,” or with “retouch flakes.” Some of the specimens in this class could have readily been placed in the “side scraper” category. They generally consist of secondary flakes bearing some retouch on a single edge, but one is on a nodule, another with retouch on one ventral, one dorsal edge. Some of these tools show only rude flaking (that is, uneven retouch flaking or very short retouch), and one is a biface with a steeply retouched scraping edge. Thirteen of these objects range in length from 32 to 72 mm, in width from 17 to 52 mm, and in thickness from 5 to 17 mm. The range in weight is 6 to 53 g. All of these tools are Normanskill chert.

Other Unifaces (n = 4), all of Normanskill chert, as follows:

Scraper or Core, Humpbacked (n = 1).

This specimen, measuring 79 mm in length, 42 mm in width, and 23 mm thick, weighs 77 g and shows crushing and rounding on the rudely retouched parts of the edges.

Chopper-Scraper? (n = 1)

This large spall or core has a retouched edge, and a prominent beak or graving point adjacent to the retouch. It is 106 mm long, 87 mm wide, and 26 mm thick. Its weight is 267 g. It has no visible wear.

Gravers? (n = 2)

One of these is on a secondary flake, with a stubby point or tip created by removal of single flakes from each edge adjoining the tip. It measures 42 mm long, 30 mm wide, and 10 mm thick and weighs 10 g. There is no visible wear. The other tool is a biface retouch flake modified to a graver. One long edge shows crushing and light rounding/gloss, and the tip is beveled with moderately heavy rounding/gloss and nibbling. This tool measures 34

mm long, 32 mm wide, and 5 mm thick.

Other Chipped Stone: Pieces Esquillees (n = 2)

One object from Area C is an elongated blade core of Normanskill chert, both ends of which show heavy step-flaking or battering. It is 73.5 mm long, 38 mm wide, and 21 mm thick and weighs 70 g. Possibly it actually served as an unusual chipping hammer, but it is strongly reminiscent of pieces esquillees from other site contexts.

The second object is a secondary flake pieces esquillees showing bipolar battering, and weighs 13 g.

Utilized Flakes (n = 903)

This category includes 31 *possible* utilized flakes and consists largely of primary and secondary flakes, but also includes biface thinning flakes (7), as well as snapped flakes. By far the predominant material was the local chert, but there was 1 utilized flake of Western Onondaga chert and 5 of a mysterious, lustrous blue-black chert that may be a Normanskill variety.

One large utilized secondary flake also apparently served as a burin, because a longitudinal flake was removed along one edge from the end opposite the striking platform. The sturdy graving corner thus created shows moderate rounding and abrasion. It measures 79 mm in length, 38 mm in width, and 15 mm in thickness, and weighs 47 g.

The counts for utilized flakes here differ from those in the Area C catalogue. I ultimately rejected as unmodified many pieces identified as “utilized” in the catalogue.

Debitage

Due to time constraints and lack of technical assistance, the writer selectively examined the large collection of chert debitage from Area C, concentrating on identifying, measuring, and weighing quarried blocks, block fragments, cores and core fragments. All other categories of debitage were examined piece by piece, but no attempt was made to count,

measure, and weigh the numerous primary, secondary, uniface retouch, and broken flakes.

Blocks, unmodified, chert visible on surface. These represent the original quarried chert as it occurred in the rock strata. In general, they have not been further reduced and no flakes were removed. A sample of 11 was examined and measured. A different but overlapping sample of 18 of the largest blocks in the collection was weighed in order to provide a rough comparison to the size of block fragments and cores. The block weighing 4,000 g was the largest in the collection, measuring over 200 mm long, but was not part of the first sample. Summary statistics for these artifacts are presented in Table 26.

Block fragments. These are simply pieces of the original quarried blocks, presumably

produced by the splitting of blocks in order to ascertain the amount and quality of chert underneath the weathered or encrusted surface. They are distinct from cores in that they do not show any scars of deliberately removed flakes. Summary statistics for a sample of these artifacts are presented in Table 27.

Cores. I counted, measured, and weighed a sample of 158 cores identified in the samples from Area C. Cores are relatively large objects of chert bearing one or more flake scars. Some are blocks or block fragments that are partially flaked, while others are blocky but display evidence that numerous flakes have been taken off, and still others are roughly spherical in shape. The cores were repeatedly turned by knappers to find satisfactory striking plat-

Table 26. Summary statistics for samples of quarried chert blocks from Area C.

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	93.8	68.1	56	935.5
Median	87	69	59	534.5
Mode	84	73	N/A	N/A
Standard deviation	18.5	11.5	10.2	918.2
Range	61	47	37	3,771
Minimum	65	45	32	229
Maximum	126	92	69	4,000
Count	11	11	11	18

Table 27. Summary statistics for a sample of block fragments from Area C.

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	64.5	46.1	28.5	40.3
Median	64.5	47	29.5	21
Mode	77	50	17	1
Standard deviation	17.8	10.1	12.2	56.5
Range	77	36	43	275
Minimum	37	27	7	1
Maximum	114	63	50	276
Count	28	28	28	66

forms and flakes, usually of expanded shape, were knocked off by hard hammer percussion. No polyhedral or prismatic cores were seen in the collections from either Areas A and B or from Area C, but a rare few appeared to have been used for the production of blades. Summary statistics are given in Table 28.

Core fragments. The 114 core fragments examined from Area C by no means represent the whole sample from the locus. All of these artifacts are Normanskill chert, except for one of blue-gray chert with numerous lighter-colored veins. This material vaguely resembles both Fort Ann and Eastern Onondaga chert, but could not be conclusively identified. Summary statistics for core fragments are presented in Table 29. One hundred thirteen were

weighed, but a sample of only 30 core fragments were measured to provide some indication of their sizes in comparison to cores.

Primary flakes. These were examined individually but not counted, weighed, or measured.

Secondary flakes. These were also examined individually but not counted, weighed, or measured. This is certainly the numerically predominant category from Area C, numbering in the thousands, and mostly Normanskill chert. Other materials include Western Onondaga chert (n = 8), gray quartzite (n = 1), milky quartz (n = 1), reddish-brown chert (n = 4), and a lustrous blue-black chert (n = 32).

In one excavation unit, the debitage included over 100 secondary flakes of fire-

Table 28. Summary statistics for a sample of cores from Area C..

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	94.9	69.2	45	332.9
Median	93	67	45	273
Mode	95	60	49	214
Standard deviation	18.9	14.6	11.4	195.9
Range	100	71	51	1071
Maximum	150	112	72	1167
Minimum	50	41	21	96
Count	156	154	154	152

Table 29. Summary statistics for a sample of core fragments from Area C.

Statistic	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Mean	68.0	45.3	22.2	33
Median	64	44	20	22
Mode	62	50	17	5
Standard deviation	15.0	11.1	8.1	33.3
Range	59	48	30	148
Minimum	50	25	10	1
Maximum	109	73	40	149
Count	30	30	30	113

spalled Normanskill chert. Given the absence of identified features on site, it is possible that these flakes were affected by a forest fire or historic burning of tree stumps rather than exposed to fire in a prehistoric hearth.

Retouch flakes, small, non-bifacial. Few of these were seen in the collection, but their low numbers may reflect the fact that the excavated sediments were not screened. Despite careful trowelling by the crews, it is likely that some small flakes were not observed and therefore were not collected.

Biface thinning flakes (n = 414). All of these flakes are Normanskill chert, with the exception of 1 possibly of Knauderack chert, and 1 of a reddish-brown chert.

Channel flakes (n = 3). These relatively long, narrow, straight-sided flakes represent the best candidates for this by-product of end-thinning fluted points. Several other flakes may pertain to this group, but using caution they were instead lumped with the secondary flakes.

Rough Stone Tools (n = 75)

Hammerstones (n = 69)

As in the assemblages from Areas A and B, hammerstones from Area C were based chiefly on glacial cobbles, but a small number were based on slabs from the local bedrock. Of 67 hammerstones examined, 38 are quartzite, 23 are sandstone, 5 are granite, and 1 is gneiss;

a choice of raw materials quite similar to that at Areas A and B. Summary statistics for hammerstone weights are presented in Table 30.

Anvil-Hammerstone (n = 1)

This tool is of sandstone and weighs 858 g.

Anvilstone (n = 1).

This specimen is quartzite and weighs 259 g.

Milling-anvilstone (n = 1).

This is a massive combination tool of sandstone, weighing 3,769 g. It measures 245 mm long, 200 mm wide, and 64 mm thick.

Abraders or Grooved Stones (n = 2)

These are massive tools, on sandstone slabs, weighing 3,051 and 5,424 g. Respectively, they measure 225 mm and 230 mm long, 150 mm and 175 mm wide, 61 mm and 83 mm thick. The questions raised before concerning the functions of similar objects from Areas A and B, apply to these tools also.

Teshoa (n = 1)

This item is a split quartzite cobble and may have served as some sort of chipping tool.

A trait list for Area C is presented in Table 31.

Table 30. Weights of hammerstones from Area C.

Statistic	Weight (g)
Mean	437
Median	301
Mode	553
Standard deviation	574.5
Range	3,892
Minimum	46
Maximum	3,938
Count	67

Table 31. Trait List for Area C.

Chipped Stone	
<i>Bifaces</i>	
Fluted Points	
Finished	3
In Process	9
Possible	4
Other Bifaces	
Stage 1	103
Stage 2	40
(includes 2 Sus- quehanna knives)	
Stage 3	
(includes 3 possible narrow side-notched or stemmed points)	8
Fragments	2
Total Bifaces	169
<i>Unifaces</i>	
End Scrapers	37
Side Scrapers	19
Retouched Flakes	19
Other	6
Utilized Flakes	903
Total Unifaces	984
Rough Stone	
Hammerstones, cobble	69
Anvilstones, cobble	1
Anvil-hammerstones, cobble	1
Grooved abraders	2
Milling-anvilstones	1
Teshoa	1
Total Rough Stone	75
Total Assemblage	1,228

USE-WEAR PATTERNS ON ARTIFACTS

Use-wear patterns on select tools from different areas of West Athens Hill were analyzed as part of the overall research. A number of researchers have systematically studied patterns of edge-wear on chipped stone artifacts, with a view to determining how and on what materials the tools were used. Experimental studies have been of considerable help in narrowing down the functional possibilities. A pioneering study by Semenov (1964) was followed by the work of Keeley (1980), Tringham (Tringham, et al. 1974), Wilmsen (1968), and many others. Some of these studies have employed high-powered microscopes at varying magnifications (generally from 100 to 500 power) in order to observe edge damage not ordinarily visible to the naked eye. Others have relied on stereomicroscopes at lower power (5 to 50 magnification), which some workers (including me) feel are adequate for identifying the principal types of wear, although some micro-wear may be missed.

In the 1970s, the writer undertook a series of experiments in which unmodified chert flakes of varying thickness and shape were employed in scraping bone and wood. Leg parts of freshly butchered deer, consisting of the metapodial and foot with skin and fur still on, were obtained. After removal of the skin and feet, the tendons and adhering membranous tissue were cut and scraped from the metapodials. The resulting wear on flakes consisted of small chips pressed off the working edge. The longer the flakes were used, and the more force used in pressing them against the bones, the more extensive the wear became. This pattern of wear is identical with the edge crushing and edge nibbling observed

on many utilized flakes and on tools such as end scrapers and side scrapers.

My experiments with wood were less conclusive. Chert flakes were used to scrape the bark off white pine branches, and to shave the underlying wood as in shaping weapon shafts. Both thick and thin flakes accomplished the job beautifully, but without visible signs of wear. A thin flake with a concave edge was used like a knife to slice deeply into the wood, and as a saw to cut through it. Those tasks were easily managed, but despite the application of considerable force, the thin, sharp working edge remained without modification. Doubtless hard wood should also be tried, but it seems likely that most trees available to the Paleoindians were relatively soft, including spruce, fir, willow, and alder. There is, however, evidence that some oak trees were present in the Spruce-Fir forests around 11,000 B.P. (Moeller 1980).

Edge rounding, gloss/polish, and occasionally striations, like the attributes observed on unifaces from Area C, were not produced in my brief experiments. These types of wear are often assumed to result from the scraping of hides, caused not by the material of the hides but by soil and grit that adheres to the surface of the hides and eventually produces some attrition of the tool's edge. But the often-reported presence of phytolith smears on the edges of end scrapers and other tools suggests some use on plants. Experiments by Keeley (1980) and others also showed that the working of bone produced rounding and gloss on unifaces.

Chipped stone tools from Areas A and B were initially examined for possible use-wear patterns using a stereomicroscope at 5 to 25

magnification. Little or no edge-wear was observed on fluted points or bifaces in process, and what was present on the latter could be attributed to deliberate edge-abrasion to prepare striking platforms for removal of flakes in the thinning of edges. Use-wear in the form of rounding and gloss was observed on the edges of some Stage 3 bifaces that had been tentatively identified as biface knives. This type of wear suggests they were used as meat cutters. End scrapers, side scrapers, and retouched flakes showed definite indications of wear, generally in the form of edge-crushing, and various degrees of rounding/gloss (but ordinarily only one kind of wear appeared on any particular tool). These tools were apparently employed in various tasks, not necessarily always the kind that would produce discernible modifications of the edges or adjoining surfaces. But contact with bone, hardwoods, and hides may be indicated for the tools that showed evidence of use-wear.

A reexamination of the wear patterns on 51 of the 92 end scrapers from Areas A and B was undertaken in October 2000 because the pattern noted for the original report (i.e., a predominance of crushing) seemed inconsistent with the wear patterns observed on scrapers from Area C. The summary follows:

Light crushing on one front corner:	1
Light crushing on left spur:	1
Light crushing on right side bit:	1
Light crushing on left side bit:	2
Light crushing on central bit:	3
Light crushing on: whole bit and corners:	2
Heavy crushing left and right sides bit:	1
Moderate crushing on front corners:	1
Heavy crushing on left edge, some on corners:	1
Mild crushing/nibbling on corners:	1
Mild crushing on bit, nibbling on left corner:	1

Nibbling on right side of bit, near corner:	1
Slight crushing and gloss on bit:	1
Moderate rounding/gloss whole bit:	1
Heavy rounding/gloss on side spur:	1
Resharpening or crushing on bit:	11
No visible wear:	21

This study confirmed the impression gained from the original analysis, although a much higher percentage of end scrapers lacked any other signs of wear than stated in Ritchie and Funk (1973). As in previous analyses, I used a Wild Stereomicroscope at 5 to 25 power. This discrepancy is difficult to explain.

The summary for 32 Area C end scrapers is as follows:

Crushing on bit only:	6
Crushing on bit, front corners, and/or spurs:	3
Crushing on bit, rounding/gloss on bit, lateral edges, and rounding on dorsal surface:	1
Rounding/gloss on bit, front corners or spurs:	4
Rounding/gloss on bit, crushing on spurs:	1
Rounding/gloss on bit:	5
Rounding/gloss on lateral edge only:	2
Rounding/gloss on edge and bit:	1
No wear observed:	9

The summary for 19 Area C side scrapers is as follows:

Crushing on a retouched edge:	4
Crushing and rounding/gloss on retouched or non-retouched edge:	2
Rounding/gloss on one or more retouched edges, plus some dorsal smoothing:	2
Rounding/gloss on main retouched edge, heavily ground spur:	1
Rounding/gloss on retouched edges:	3

Rounding/gloss on retouched edge, opposite edge battered (step-flaked):	1
Rounding/gloss on striking platform:	1
No wear observed:	5

The summary for 13 retouched flakes is as follows:

Crushing on non-retouched edges:	5
Rounding/gloss on retouched edges, crushing on non-retouched edge:	1
Rounding/gloss on retouched and non-retouched edge, crushing on non-retouched edge:	1
No wear observed:	6

Thus, more rounding/gloss was evident on the unifaces from Area C than those from Areas A and B, suggesting a contrast between the tasks performed and materials used in one locus vs. the others.

The frequently sharp or right angle front corners of end scrapers, and the somewhat less frequent presence of spurs on one or both corners, probably indicates an additional use for these tools, such as the piercing and cutting of hides for garment making or the fashioning of bone and antler tools and weapons. Similar functions are usually assumed for graters and denticulates.

It seems clear that some of the patterns of wear on uniface tools from northeastern Paleoindian sites could easily have been produced by using them to clean and work bone and antler. Heavy and continued use on wood, especially hardwood, might also eventually cause similar signs of wear. It seems rather unlikely that the narrow, rounded bits of end scrapers would be useful in working wooden shafts for weapons, given the difficulty of maintaining contact between two small, concave surfaces. On the other hand, concave scrapers and side scrapers may have been well suited for the task. As stated above, another function of end scrapers was probably for processing hides.

Samples of utilized flakes from the main loci at West Athens Hill were examined to

ascertain the types of use-wear, including 14 items from Areas A and B and 40 from Area C. A majority of these ad hoc tools showed nibbling (rarely crushing) along the longest and thinnest edges. It is usually assumed that utilized flakes were used to cut meat. Small flakes were pressed off when the edges struck underlying tendons and bone. But a curious aspect of the wear identified as edge-nibbling is the predominance of flakes removed from just one side (face) of an edge, as if pressure was applied with a sideways scraping or dragging motion, the flake held perpendicular to and angled away from the direction of action, rather than a cutting motion with the flake held more or less vertically and moved back and forth in a direction parallel to the cutting edge. It is difficult to determine how these wear patterns were made on the West Athens Hill tools; one can only guess the kind of material that created the form of edge-nibbling observed. What was scraped with these tools? Bone is a possibility, though the associated polish seen in experimental studies is lacking on most of these tools (Keeley 1980).

But the thinnest, sharpest edges on 10 of the 40 flakes inspected from Area C displayed both nibbling and rounding/gloss suggesting use in working bone, hides, or other soft materials. Wear was usually not evident on thick portions of the flakes, except occasionally on the striking platforms or, where the platforms were absent, on the broad ends of the flakes.

As previously noted, grooved or striated stone slabs from Areas A, B, and C pose another enigma. The grooved abraders are tabular rock slabs upon which multiple parallel or radial grooves and also fine linear scratches have been worn. On two specimens the overall surface containing the grooves has been smoothed (see Figure 38, no. 3). The grooves and striations vary in depth and width. One exceptionally fine implement (see Figure 38, no. 2) bears relatively deep grooves on both primary faces. The crucial question is how the grooves were produced. They had to be produced with materials as hard as the surface of the slabs, in other words as hard as the silica composing them. This amounts to a hardness

of 7 in the Mohs scale. Only objects of stone that were available to the prehistoric Indians could have created the grooves and scratches. The writer's experiments using unproven "junk" bifaces from surface collections on sandstone slabs had suggested that the grooves could *not* have been produced by the chert knapper either: (1) hammering on cores, bifaces, or flakes placed edge perpendicular to the flat surface, or (2) grinding the edges of bifaces using a prolonged back-and-forth motion (Funk 1976:217).

The first action would have produced irregular, short linear scars at odd angles to each other that, with continued use, tended to spread horizontally, creating a larger, oval scarred area. This is not the case. The second action would have produced long, straight grooves with polished bottoms and sides and U-shaped cross-sections. These types of grooves were produced by the writer on the unmodified bottom surface of a slab from Area B. The grooves were quite unlike those of prehistoric origin on the upper surface, however. The observed grooves tend to be of varied length, width and depth, ranging from a few millimeters to 10 cm long. Many are V-shaped in cross-section, and some of the grooves have subsidiary lineaments or grooves at the bottom. Contrary to the writer's earlier published opinion (Funk 1976), however, some of the grooves do have relatively broad, U-shaped cross-sections. None of those grooves show smoothed or polished edges and bottoms, perhaps because 10,000 years of weathering has affected the surfaces within the grooves, although this seems unlikely. After all, grinding and use-wear polish have survived on bifaces for the same length of time. The abraders bearing grooves with U-shaped cross-sections could have been used for grinding the lateral edges of fluted points, but could not have produced the grinding on the indented bases of the points. Small stone hones would presumably have better served this task, but none has been identified in the collection. But what was the function of the abraders that display a pre-

dominance of small, shallow scratches and grooves with *V-shaped* cross-sections?

The writer previously suggested that the principal function of the grooved abraders was to sharpen bone awls or needles (Ritchie and Funk 1973:27), but on reanalysis it seems obvious that at best it was a secondary function. On several specimens the relatively large, deep grooves occur on the same tool with shallower grooves and fine scratches or striations. This suggests that the larger grooves represent prolonged repetition of the same action that produced the small, shallow grooves and striations. If the tools with deep grooves were used primarily to sharpen the tips of bone tools, why are there so many small, shallow scratches on the same tools that would have been useless for such a task? It seems certain that the grooves could only have been produced by the back-and-forth motion of stone objects such as chert flakes or perhaps bifacial and unifacial tools. My experiments with bone tools made from leg bones of freshly killed deer failed to produce any visible effect on the much harder surfaces of the stone slabs. It remains possible that the larger, deeper grooves, once made using sharp stone tools, were useful for sharpening the tips of bone tools such as awls or needles.

Recent experiments (in May 2002) yielded more definitive results. Using an unmodified sandstone slab from a roadside outcrop, upon which I placed chert blocks collected from the talus at the base of the Helderberg escarpment, I first "quartered" or broke up the blocks with repeated blows from a granite cobble. After vigorously striking the blocks and pieces of blocks several dozen times and scattering fragments over a radius of three meters, I had produced at least 15 short, irregular indentations or scars on the surface of the slab. These scars were unlike those on the abraders that had not also been used as anvilstones, but identical to those occurring along with scratches and grooves on a few abraders and on anvilstones per se. Next, however, I applied the thinnest, sharpest edges of block fragments and flakes to the slab with a vigor-

ous forward-and-backward motion, pressing down at the same time. As few as two or three such actions produced permanent, shallow scratches in the surface of the slab. The more this action was repeated, the broader and deeper the grooves. These indentations were initially V-shaped in cross-section, but with heavy, continued effort became more U-shaped as thicker portions of the chert fragments adjacent to the edges intruded slightly into the slab. The edges of the chert fragments showed abrasion damage.

The same results were obtained with the thin, sharp edges of a milky quartz bifacial projectile point from a disturbed surface context. Just one vigorous, unidirectional application to the sandstone surface created a narrow, linear scratch. Repeated efforts resulted in slightly broader, deeper grooves. Needless to say, the edges of the quartz point became rounded and smoothed, losing their former sharpness.

My working hypothesis from these experiments is that the scratches and grooves on the abraders from West Athens Hill were, in large part, produced by deliberate abrasion of the edges, including bases, on biface preforms to produce striking platforms with a better "bite" for flaking tools, such as soft hammerstones and antler billets. But the problem with this interpretation is that I observed only rare instances of possible platform preparation after examining a majority of the bifaces, at all reduction stages, from the site. At 5 to 25 magnification, only seven specimens displayed slight to moderate rounding at high points on the edges.

Another possibility was that the abraders were employed to produce better striking platforms on the bases of fluted points in

process, including "nubbins," preparatory to the removal of channel flakes. But my examination of all the fluted points in process from the site showed only two possible examples of grinding on the central projecting nubbin or striking platform. In other cases there was some rounding and gloss on parts of the base near the lower corners of the preform, but not in the central portion of the base.

To some extent, the deeper, broader scratches and grooves on abraders could have been created by lightly grinding the lower lateral edges of fluted points. But repeated and heavy application would have produced not only heavy grinding on the points—which we do not see— but also the deep, U-shaped grooves with polished sides and bottoms that resulted from my original experiments in the 1970s. Those types of grooves are rare on the slabs from West Athens Hill.

It is also important to note that among the hammerstones listed for Areas A and B are two objects with flat surfaces that bear striations and scratches identical to those on the grooved stones described above. One object is 114 mm long, 90 mm wide, and 46 mm thick and weighs 718 g. The broadest, flattest face shows multiple striations varying in depth, length, and width that are predominantly narrow, shallow, and relatively faint. The other tool is 78 mm long, 76 mm wide, and 46 mm thick, weighs 383 g, and has striations on both flat faces, also generally faint.

The grooved abraders and hammers appear to represent an important activity on the site, and it is difficult to escape the conclusion that it was associated with stone-working. But the specific tasks that produced the distinctive grooves remain a mystery.

ARTIFACTS FROM AREAS D, E, AND F

Area D produced 4 Stage 1 bifaces and 1 Stage 3 biface, the latter a possible fluted point in process, and 4 utilized flakes. Area E yielded 1 small, broad-bladed, narrow stemmed projectile point, 4 Stage 1 bifaces, 1 Stage 3 biface that is clearly a Susquehanna knife, 4 utilized flakes and 1 utilized core. Therefore,

these loci are multicomponent, and like Areas A and B, used during Archaic and Transitional period occupations. Debitage but no diagnostic pieces were recovered at Area F. All items are Normanskill chert. Paleoindian occupancy has not been established for these loci.

PALYNOLOGY

Pollen samples were collected from profiles in three different parts of the West Anthens Hill site: section W10N20, Stratum 1, Stratum 2 top, Stratum 2 bottom; section E20N0, Stratum 1, Stratum 2 top, Stratum 2 middle, and Stratum 2 base near bedrock; and section W180S30, Stratum 1, Stratum 2 top, Stratum 2 bottom. The samples were analyzed

by Donald M. Lewis, Scientist, Botany, New York State Museum and Science Service.

The results of the study were inconclusive. Most of the pollen grains in the samples were badly damaged through mechanical breakage. The small number of identifiable grains represented floral species that are found in the area today.

RADIOCARBON DATING

As previously mentioned, a concentration of debitage, artifacts, possible fire-cracked sandstone fragments, and flecks of charcoal occurred in the southwest quadrant of section E0N30. This concentration was tentatively designated Feature 2.

The charcoal appeared to be randomly dispersed within the concentration, but a linear mass on the periphery was the same size and shape as the charred roots of tree stumps encountered elsewhere on the site.

The dispersed bits of charcoal were collected as one combined sample. It was submitted to Isotopes, Inc. for radiocarbon assay in March 1968 in the hope that it represented the remains of a Paleoindian hearth. The resultant determination, received in April 1968, was disappointingly late; the uncalibrated date was A.D. 1650±115 years (I-3443). The charcoal probably originated in a recent forest fire.

STRATIGRAPHY, TYPOLOGY, AND INTRASITE SETTLEMENT PATTERNS

West Athens Hill is unique among New York Paleoindian sites in several respects: (1) it was not only a chert quarry, but a workshop and possibly also a short-term camp site; (2) it contained undisturbed, stratified artifact-bearing deposits; and (3) it produced evidence relating to possible family dwelling areas or chert-knapping stations, to be described below.

Considering the varying extent of bulldozer disturbance, some evaluation of the contextual situation is in order. Most of the culturally relevant deposits in Area B, and in the northern part of Area A, seemed to be intact and can probably be used for valid studies of artifact distribution. Area C was never disturbed except by naturally occurring tree falls.

Crucial to determining the composition and integrity of the Paleoindian assemblage is the stratigraphic position of Archaic and later artifact styles, as contrasted with Paleoindian items. There is little difficulty in assigning the great majority of the uniface tools to the Paleoindian component, since most of the non-fluted points belong to Susquehanna tradition complexes in which such traits as end scrapers are rare to absent. The presence of several Laurentian point types might have confounded such an interpretation, since uniface scrapers are common in Laurentian assemblages. However, there is the further consideration that the unifaces from West Athens Hill are much more typical of Paleoindian assemblages in the Northeast, being not only larger in general, but often different in form from characteristic Laurentian implements (that is, Paleoindian end scrapers

characteristically possess squarish or sharply right angled front corners and also often graving spurs, traits rarely found in Laurentian ones).

Some of the bifaces in process could have originated after the period of Susquehanna occupation at West Athens Hill. The difficulty is even greater with rough stone tools other than hammerstones because such traits as anvilstones and abradingstones are extremely rare in Paleoindian contexts, being rather characteristic of Archaic complexes. Anvilstones and hammer-anvils have, however, been reported for the Paleoindian manifestations at the Debert site, Nova Scotia (MacDonald 1968), Bull Brook, Massachusetts (Byers 1954, 1955, 1966), and the Vail site, Maine (Gramly 1982). But "millingstones" and "grooved stones" like those at West Athens Hill are lacking on those stations, except perhaps for a striated stone tool found at Vail. An abrader and cobble choppers were part of the Debert assemblage.

Despite the fact that Stratum 1 in Area B may be to a large degree a product of humus formation on a base originally similar in composition to Stratum 2, there is much justification in regarding the two deposits as physically discrete zones with temporal significance. Thus, the stratigraphic distribution of artifact traits within these layers in Area B should reflect a generalized depositional sequence, even though partly obscured by weathering and soil formation processes during the Holocene epoch.

The presence or absence of fluted and non-fluted points in undisturbed portions of Strata

1, 2, or 2A would seem to be a useful aid to interpretation. Indeed, one finished fluted point and six fluted points in process occurred in Strata 2 or 2A, whereas the non-fluted points were all found either in Stratum 1 or on the surface. Several abradingstones, anvilstones, and the possible petroglyph were recovered from Stratum 2 or its cognates, as was a full complement of end scrapers, side scrapers, and bifaces.

There seems to be little reason to doubt that except for a small percentage of the collection, artifacts from West Athens Hill pertain to the Paleoindian occupation. The exceptions include the late point styles of stemmed and notched form, the Susquehanna knives, the drill tip, and possibly the small tapering-stemmed biface (see Figure 31, no. 4).

The stratigraphic distribution of all artifacts recovered from Areas A and B, in terms of general categories, is presented in Table 32. Regarding the vertical spread of excavated artifacts, Stratum 1 was slightly more productive than Stratum 2. About 77 percent of artifacts with provenience occurred within Area B. Even if the 348 items marked "general surface," nearly all of which came from Area A, are considered in the calculations, at least 58 percent of the entire collection was found in the hollow.

Frequency distributions of individual traits in Area B are summarized by stratum in Table 33. Frequencies are given for artifact types from all excavated contexts, including

the clusters. Also given are totals for the surface and excavation units in Area A, as well as from Area C. The totals for each category or type on the entire site appear in the last column.

A high percentage of utilized flakes and cores occur in all three loci. This is to be expected on a quarry-workshop-camp station, where chert rejectage littered the ground, ready to hand whenever an Indian had sudden need of a cutting or scraping edge. The relatively high frequency of hammerstones is also explained by the nature of the site. These tools, based on cobbles imported from nearby stream beds or till exposures, must have served many functions, including the extraction of chert from its matrix, percussion chipping of artifacts, breaking of animal bones to obtain marrow or make bone tools, and so on.

The many utilized flakes, scrapers, knives, and other tools reflect considerable domestic and industrial activity at West Athens Hill. Chert, obviously, was quarried and made into various objects. Bifaces were roughed out, then made into points and knives. Fluted point preforms were often broken during end-thinning. Many of the finished (Stage 4) fluted points seem to have been broken in use, either as knives or as weapon tips. The bifacial industry on the site was directed mainly to the hunting and butchering of game.

Uniface scrapers have often been regarded as hide-working tools, but William A. Ritchie (personal communication 1971) once suggested

Table 32. Depth distribution of general artifact categories in Areas A and B (all provenience units combined).

Provenience	Chipped and Rough Stone Artifacts		Utilized Cores and Flakes		All Artifacts Combined	
	No.	Pct.	No.	Pct.	No.	Pct.
Surface	392	44.7	173	23.0	565	35.0
Stratum 1	265	33.8	304	45.7	569	38.0
Stratum 2	193	21.5	208	31.3	401	27.0
Totals	850	100.0	685	100.0	1,535	100.0

Table 33. Depth distribution and frequencies of artifact types with provenience data from Area B, plus artifact lists from Area C, Area A and the surface. The numbers are for all excavated units in Area B including the artifact clusters.

Types	Area B, Stratum 1		Area B, Stratum 2		Totals (in context), Area B		Area C	Surface and Area A	Site Totals
	No.	Percent	No.	Percent	No.	Percent			
Archaic points	5	100.0			5	100.0		5	10
Fluted Points	9	90.0	1	10.0	10	100.0	3	3	16
Fluted points in process	8	57.0	6	43.0	14	100.0	9	13	36
Fluted point fragments	6	75.0	2	25.0	8	100.0	4	13	25
Stage 1 bifaces	32	59.3	22	40.7	54	100.0	103	50	207
Stage 2 bifaces	14	53.8	12	46.2	26	100.0	40	38	104
Stage 3 bifaces	15	71.4	6	28.6	21	100.0	8	13	42
Misc. bifaces	11	52.4	10	47.6	21	100.0	2	13	36
End scrapers	18	54.6	15	45.4	33	100.0	37	59	129
Side scrapers	57	62.0	35	38.0	92	100.0	19	100	211
Flake knives	7	46.7	8	53.3	15	100.0		24	39
Retouched Flakes and Misc. Unifaces	14	82.5	3	17.6	17	100.0	23	16	56
Drills								1	1
Pieces esqillees	1	33.3	2	66.7	3	100.0	2	2	7
Gravers								1	1
Utilized Flakes	303	59.5	206	40.5	509	100.0	903	171	1583
Cobble Hammer-stones	60	46.8	68	53.2	128	100.0	69	39	236
Anvilstones	3	75.0	1	25.0	4	100.0	1		5
Anvil-hammer-stones	1	50.0	1	50.0	2	100.0	1	4	7
Milling-hammer-stone							1		1
Teshoa							1		1
Abrading-stones	5	71.4	2	28.6	7	100.0	2		9
Petroglyph (?)			1	100.0	1	100.0			1
Totals	569		401		970		1,228	565	2,763

that on sites in the Northeast, they were often used as wood-working implements, an important end product being dart or spear shafts. This notion would seem to have some support in the frequent pattern of wear on scrapers, consisting of edge-crushing or the detachment of small step flakes by pressure against some hard object. But some scrapers also display edge-rounding and polish or gloss, occasionally even manifested as heavy grinding. Tools used in working the softer, more pliant material of hides should logically be expected to display smoothed, polished edges (Keeley 1980; Semenov 1964: 85–93). Another problem is that it is hard to visualize the use of the small, convex bits of end scrapers on rounded wooden spear and dart shafts. It would be difficult to maintain firm contact between the scrapers and the shafts. As also noted, experiments by Keeley (1980) and others indicate that crushing and rounding/gloss may result from working bone and antler.

The Paleoindians at West Athens Hill must have possessed a varied inventory of tools in bone, antler, and perhaps even ivory, long since disintegrated by high soil acidity. Some of these implements would have served the chert-knapper's art. Bone awls and needles were doubtless important traits, essential to the skin and hide industry. They may have been sharpened on the grooved abradingstones. Other tools of bone and wood would have been well-suited for preparing hides in the form of beamers, scrapers, knives, and so on.

Our decision to record the precise locations of all artifacts recognized as such during excavation may have yielded data relevant to internal settlement patterns. The clustering of artifacts and debitage around stake W170S30 in Area A has been previously mentioned, but the extensive disturbance to the area precludes any effort to discern patterning in the plotted positions of artifacts. For Area B the horizontal distribution of artifacts from both Stratum 1 and Stratum 2 is shown in Figure 45. Study of this map shows that artifacts are not randomly dispersed through the hollow. Many items occurred in reasonably compact

concentrations that were separated by three to eight feet of open space. Some of the concentrations were of oval shape, others were rather amorphous, while the remainder were more or less well-defined arcs or semicircles.

In places undisturbed by bulldozing, it seems likely that the artifacts occurred in their original positions, since they were within a "silt till" that tends to be compact and resistant to slope wash, solifluction, and other processes that might transport items from one location to another within the hollow (G. Gordon Connally, personal communication, 1970).

An attempt was made to distinguish and designate by number the various clusters. They are presented as published in the original 1973 report, but reanalysis throws considerable doubt on my original interpretations.

Stratum 1

(Solid Symbols on Map, Figure 45)

Cluster 1. In sections W10N0, W10S10, E0N0. A rather neat arc about eight feet in diameter, which forms about one-half a circle. It intersects at one end with Cluster 2. It contains at least 17 items: 1 fluted point plus 3 in process, 1 Stage 1 biface, 3 Stage 3 bifaces, 6 side scrapers, and 3 end scrapers. No corresponding exists in Stratum 2, which produced 3 pieces positioned horizontally along the arc.

Cluster 2. In sections W10N0, W10N10. Another good arc about eight feet across, also forming one-half circle. It contains at least 10 items: 3 fluted points in process, 1 Stage 2 biface, 1 side scraper, 1 end scraper, 1 retouched flake, and 3 cobble hammerstones. It seems to match very well with Cluster 10 in Stratum 2.

Cluster 3. In section E0N10. A small, fairly tight group roughly in the form of an arc. At least 11 items: 1 possible fluted point tip, 1 Stage 2 biface, 5 side scrapers, 1 flake knife, 3 cobble hammerstones. If superimposed on Cluster 13 in Stratum 2, a convincing pattern emerges.

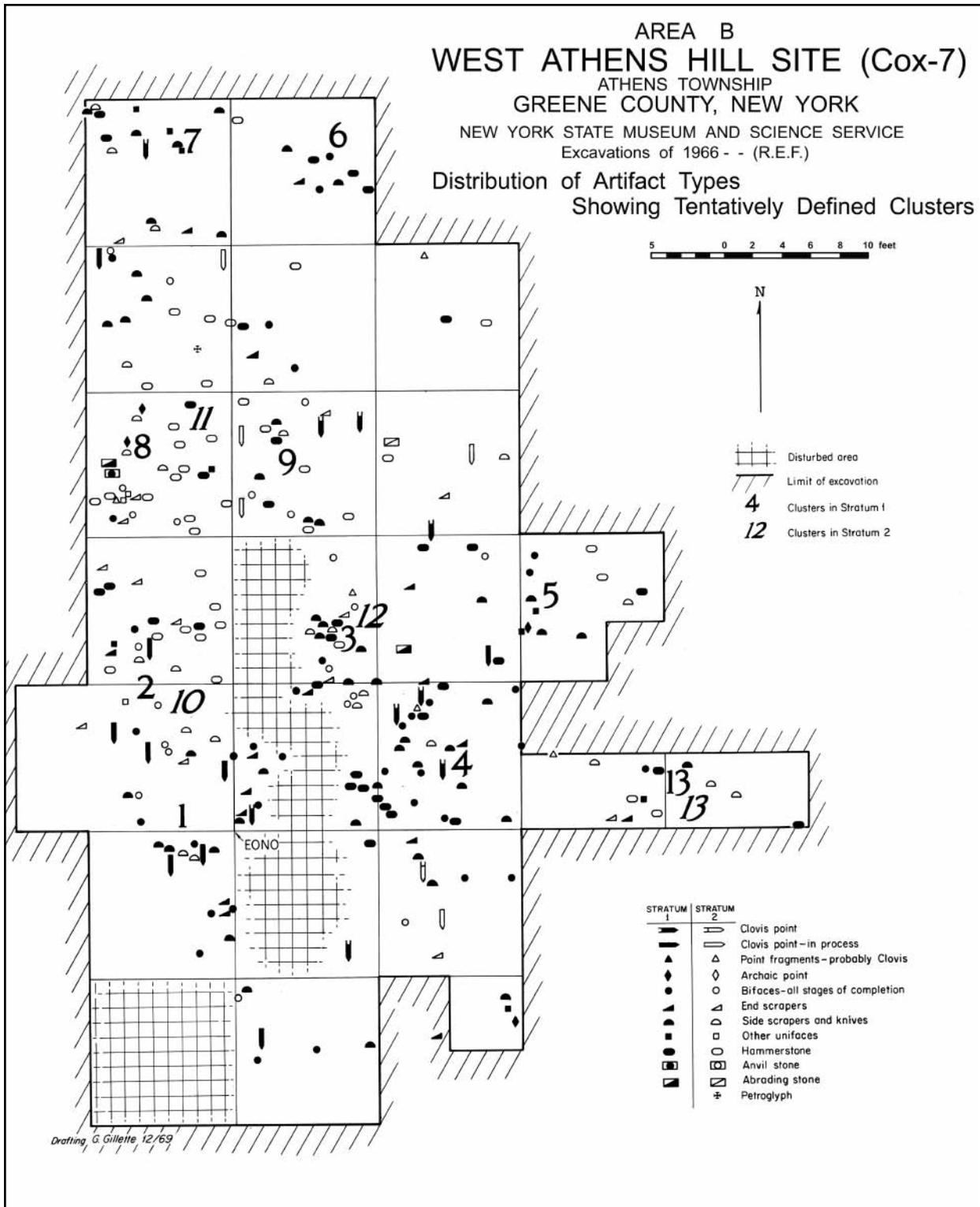


Figure 45. Artifact clusters possibly representing localized activity concentrations in Area B.

Cluster 4. In sections E0N0, E10N0, E10S10. A large concentration of 32 items: 3 fluted points, 1 fluted point tip (fits to the base of one point), 5 Stage 1 bifaces, 2 Stage 2 bifaces, 1 Stage 3 biface, 1 miscellaneous biface, 3 end scrapers, 5 side scrapers, 1 flake knife, and 10 cobble hammerstones.

Cluster 4 as a whole is roughly oval, about 12 feet by 10 feet. With the possible exceptions of 1 side scraper and 1 fluted point, this area produced no artifacts in Stratum 2 that might be attributed to the cluster.

Cluster 5. In sections E10N10, E20N10. A vaguely defined short arc which seems to comprise 1 bifurcated-base Archaic point, 1 fluted point in process, 2 Stage 1 bifaces, 2 side scrapers, 1 retouched flake, and 1 hammerstone. This area is nearly blank in Stratum 2. Aside from the fluted point preform, which is located on the periphery of the main group, none of the other artifacts is a particularly good example of a Paleoindian type, and could have been associated with the bifurcate point.

Cluster 6. In section E0N40. A small isolated oval group of artifacts measuring 3 feet by 6 feet. Includes 1 Stage 3 biface, 1 miscellaneous biface, 1 side scraper, 1 end scraper, 1 flake knife, and 3 cobble hammerstones. This spot is devoid of artifacts in Stratum 2.

Cluster 7. In section W10N40. Another isolated group of oval shape, about 7 feet by 3 feet. This time with 9 items: 1 fluted point, 2 side scrapers, 1 flake knife, 3 retouched flakes, and 2 cobble hammerstones. Stratum 2 here is empty except for 1 side scraper.

Cluster 8. In section W10N20. A poorly defined linear cluster comprising 2 Late Archaic points (1 Orient Fishtail, 1 untyped stemmed), 1 Stage 2 biface, 1 side scraper, 2 retouched flakes, 1 anvilstone, and 1 abradingstone. This cluster cannot convincingly be related to the more numerous and scattered objects from Stratum 2 in the same area. It is also important to note that none of the uniface tools in the cluster area, can by themselves be demonstrated to have Paleoindian affinities. They are smaller than most unifactes in the col-

lection, and are only slightly trimmed in each case along one short edge.

Cluster 9. Confined almost entirely to section E0N20. A semicircle about 7 feet across. May include 11 artifacts: 2 fluted points, 2 fluted points in process, 3 side scrapers, 1 abradingstone, and 3 hammerstones. May correspond to a small group of pieces in the same part of Stratum 2, attributed to amorphous Cluster 11.

Stratum 2. (Open Symbols on Map, Figure 45)

Cluster 10. In sections W10N0, W10N10. A well-defined arc about 8 feet in diameter, which is congruent with Cluster 2 in Stratum 1. It is made up of 17 apparently associated pieces: 1 Stage 1 biface, 2 Stage 2 bifaces, 1 miscellaneous biface, 3 side scrapers, 2 end scrapers, 1 flake knife, 1 retouched flake, and 6 cobble hammerstones.

Cluster 11. Almost entirely within sections W10N20 and E0N20. Tentatively designated since the artifacts are not tightly concentrated, but rather diffusely spread. Types: 1 possible fluted point tip, 2 fluted points in process, 1 Stage 1 biface, 2 Stage 2 bifaces, 3 Stage 3 bifaces, 4 side scrapers, 3 end scrapers, 1 flake knife, and 15 cobble hammerstones.

In contrast to Cluster 8, overlying Cluster 11 in Stratum 1, no Archaic points are present. Furthermore, the two end scrapers are of classic Paleoindian type, and one is of exotic chert. The side scrapers are good "Enterline" forms; one is of Upper Mercer, Ohio chert, and another is Oriskany chert.

Cluster 12. In sections E0N0, E0N10. A neat arc about 6 feet wide which seems to match nicely with Cluster 3 in Stratum 1. Artifacts are: 3 Stage 1 bifaces, 1 miscellaneous biface, 3 side scrapers, 2 end scrapers, 1 flake knife, and 1 cobble hammerstone.

Strata 1 and 2.

Cluster 13. In sections E20N0, E30N0. A roughly curvilinear arrangement of artifacts,

identified as 2 end scrapers, 3 side scrapers, 1 retouched flake, 1 Stage 1 biface, and 3 cobble hammerstones.

DISCUSSION

The great majority of artifacts from the Stratum 2 clusters conform well to ideal Paleoindian forms, in contrast to the items described for Clusters 5 and 8 in Stratum 1.

If these clusters are hypothesized to represent structural features resulting from patterned human behavior, it remains to be seen whether they have chrono-stratigraphic significance.

Clusters 1, 4, 5, 6, and 7 appear at first glance to be reasonably discrete entities, all of which pertain to Stratum 1. In each case only a few items, or none at all, were found in Stratum 2 in the same locality, and these could have been pressed, trampled, or otherwise intruded into that deposit from the higher level containing the cluster.

Certain clusters of objects in Stratum 1 seem to be closely matched in location and outline with other clusters in Stratum 2. These congruent pairs, therefore, may be actual features representing single archaeological episodes. These paired clusters are nos. 2 and 10, and 3 and 12. Clusters 8 and 11 do not form a congruent pair; separately Cluster 8, perhaps of Archaic origin, is better defined than is the combination of it with Cluster 11 and, as already mentioned, it lacks artifacts that are typologically convincing Paleoindian forms. It is noteworthy that no clearly patterned cluster occurred in Stratum 2 which was not a member of a paired cluster. Cluster 11, amorphous as it is, may entirely precede Stratum 1 in age.

It may therefore be suggested that Cluster 11 was possibly the first of the whole group to be deposited, and associated exclusively with Stratum 2. Next in age would be the paired clusters, nos. 2 and 10, and 3 and 12, which overlap from one stratigraphic zone into the other. Cluster 13, composed about equally of artifacts from both strata, may belong to this group. Last to be deposited, and youngest in age because limited to Stratum 1, would be

Clusters 1, 4, 5, 6, 7, 8, and 9. Clusters 5 and 8 may be partly or wholly of Archaic origin.

Comparisons of the frequencies of artifact types in the presumed stratigraphic sets of clusters (Table 34) reveal minor differences between sets. The relative proportions of such traits as fluted points (8.1–14 percent), Stage 1 bifaces (3.1–8.1 percent), Stage 2 bifaces (2.9–8.1 percent), end scrapers (9.4–10.2 percent), side scrapers (12.5–24.5 percent), and flake knives (2.9–6.1 percent) show relatively small fluctuations from set to set. Hammerstones are most common in Cluster 11 (Set A) and are more common in Set B than in Set C. These differences are fairly small, within 3 to 5 percent in most cases, varying by 12 percent in the case of side scrapers and 20 percent in the case of hammerstones, and probably not significant, considering the small samples involved.

One important qualitative difference emerges: three Archaic points are confined to Set C, believed to be the youngest of the clusters.

Further comparisons have been made of the type frequencies in the hollow in Area B, employing cluster sets A, B, and C, separately or combined, and the type frequencies for the site as a whole (Table 34). Whereas the frequency of projectile points remains fairly close from cluster to cluster, it is rather higher in Area B than for the site as a whole. The variation in percentages of other biface categories between the clusters and the total collection is about 3 to 4 percent. For unifaces, the correspondences are very close, generally within 2 percent. The greatest range in percentage applies to cobble hammerstones.

The total number of items other than utilized flakes in the clusters is 183, or slightly under one-fourth of the total collection from Areas A and B; yet Area B seems to be a microcosm of the whole site with respect to type frequencies. This implies that Area A had a pattern of type distribution similar to that of Area B, so that basically the same range of human activities is represented in each locus (but see the discussion of Area C below).

Presence-absence analysis of each individual cluster or pair, and comparisons between clusters, show that some traits occurred in all clusters, some in most, and others in only one or two. Thus, side scrapers appeared in every cluster; cobble hammerstones in all but two; end scrapers in all but five; and fluted points, blanks, or fragments thereof in 7 out of the 13 clusters. Other items were more evenly distributed, but with one exception, every cluster had at least one example of a biface belonging to one of the Stages 1, 2, or 3.

The similarity in range of artifact categories from one cluster to another, no matter what the variation in frequency, may indicate

that there was no significant division of activities within the horizontal space of the hollow. This holds true even when the cluster sets are studied as possible discrete episodes in time.

The clusters—no matter what their reality, or lack of it, as loci of tasks performed independently of other loci—were products of human behavior. Singly or in groups of small size, it would seem that people remained in each spot long enough to carry out certain activities: chert-knapping, weapon-making, possibly butchering and hide-working. Despite the absence of hearths or post molds, it is possible that each cluster represents a nuclear family domicile. The artifacts were

Table 34. Comparisons of frequencies of artifact classes in Area B between cluster groups and between the combined clusters, Area C, and the site as a whole. Set A cluster 11; Set B clusters 2, 3, 10, 12; Set C clusters 1, 4-9. Utilized flakes not included.

Artifact Traits	Set A		Set B		Set C		Clusters Combined		Area C		Total Site	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Fluted points, whole, fragmentary, in process	3	9.4	4	8.1	14	13.7	21	11.5	16	4.9	77	6.5
Archaic points					3	2.9	3	1.6			10	0.8
Stage 1 bifaces	1	3.1	4	8.1	9	8.8	14	7.6	103	31.7	207	17.5
Stage 2 bifaces	2	6.3	4	8.1	3	2.9	9	4.9	40	12.3	104	8.8
Stage 3 bifaces	3	9.4			5	4.9	8	4.4	8	2.5	42	3.6
Misc. bifaces			2	4.1	2	2.0	4	2.2	2	0.6	36	3.1
End scrapers	3	9.4	5	10.2	7	6.9	15	8.2	37	11.4	129	10.9
Side scrapers	4	12.5	12	24.5	24	23.5	40	21.9	19	5.9	211	17.9
Flake knives	1	3.1	3	6.1	3	2.9	7	3.8			39	3.3
Pieces esquillees									2	0.6	7	0.6
Retouched flakes and misc. unifaces			2	4.1	7	6.9	9	4.9	23	7.1	56	4.8
Cobble hammerstones	15	46.8	13	26.5	22	21.6	50	27.3	69	21.2	236	20.0
Other rough stone tools					3	2.9	3	1.6	6	1.9	24	2.0
Other chipped stone											2	0.2
Totals	32	100.0	49	100.0	102	100.0	183	100.0	325	100.1	1,180	100.0

perhaps discarded or lost within or around small huts or lean-tos that left no permanent imprint on the underlying soil. Thus, each cluster would represent at most occupation by one small family or work party within a single season. But the lack of hearths or other prehistoric features poses a serious problem for the notion that people actually camped on the site.

Furthermore, as a result of my reanalysis of the reality of clusters 1, 2, 3, 10, 12, and 14 is highly questionable. They adjoin the extensively disturbed area at the center of the excavations, and the few artifacts found in those units were no longer in their original positions. If the original distribution of those artifacts was known, plotting them on the map would have changed the configuration of some clusters and perhaps even rendered them more amorphous. The other clusters may still be valid as independent activity areas.

In Area C, artifacts did not occur in readily delineated clusters. Instead, an irregular distribution is evident within the grid excavation (see Figure 40). Most of the artifacts in Area C were hammerstones and bifaces in process, a fact that is consistent with the chert exposures and the large quantities of debitage. The locus was, however, more than just a chert quarry and workshop for production of early stage bifaces, since fluted points, a number of end and side scrapers showing edge wear, and utilized flakes were also present, suggesting such activities as hunting, hide-working, and wood-working. Once again, no convincing features such as hearths, pits, or house patterns were encountered in the excavations.

Analysis of artifact type frequencies in Area C suggests that there are some differences between Areas A and B. Side scrapers and end scrapers were relatively less common in Area C than in the other loci. No flake knives, as such, were identified there. Bifaces in process were slightly more common. Surprisingly, the Area C debitage produced 414 examples of biface thinning flakes, in contrast to only 12 identified in the debitage from

Areas A and B. I suspected that this may have resulted from the application of classificatory criteria that differed between the 1973 analysis and the present one, since 842 "retouch flakes" are listed for Area B in Table 18. I wondered whether some of those could actually be biface thinning flakes. However, my reexamination (in May 2002) of nearly all of the small flakes from Areas A and B failed to find any biface thinning flakes in addition to those previously identified. This is quite enigmatic because on loci where so many bifaces were produced, one would expect quite a large number of such flakes. Also, Beth Wellman and I failed to find a single example of a channel flake from Areas A and B, and found just three in Area C, although the manufacture of fluted points was an important activity there.

Three distal fragments of thick, narrow-bladed projectile points, probably of either the Bare Island or Normanskill type (Ritchie 1971) and therefore of Late Archaic age, were encountered at Area C, and at least two bifaces appear to be Susquehanna knives, indicating that Area C, like the other loci, was occasionally occupied by Archaic and Transitional (Terminal Archaic) people.

It would be difficult, if not impossible, to separate all the debitage of the Archaic and Transitional components from debitage of the Paleoindian component(s). But the production of broad-bladed Susquehanna tradition bifaces results in distinctive biface thinning flakes that might well be picked out of the larger sample.

The total span of Paleoindian occupancy cannot be determined without datable organic material. It is unlikely that only one short period of repeated occupations over, say, 50 years or, alternatively, centuries of continuous occupation are represented. Sporadic, brief visits by bands or work parties over a longer period are more likely, and West Athens Hill may have been abandoned for years at a time. But the total period of on-and-off occupancy by Paleoindians may have amounted to centuries. From time to time, work parties were almost certainly attracted to other equally fine

sources of chert within a few miles of the hill. The range in fluted point size and morphology may be a clue to the total period of Paleoindian visits to West Athens Hill, since large and small examples are present, with some variation in fluting technique, depth of basal indentation, and other attributes. But the relatively large, straight-sided Gainey-Debert style predominates. There only one or two examples of a later stage, such as that exemplified by relatively small, thin, often "fish-tail" shaped Cumberland-Barnes points (see Figure 27, no. 4; Ellis and Deller 1990; Gramly and Funk 1990).

How successful were we in attaining our research goals? Regarding the first goal, we established that the Paleoindian component was by far the most important in terms of the sheer number of diagnostic artifacts, and furthermore they were distributed over Areas A, B, and C, rather than concentrated in one

small locus. We also succeeded in locating and excavating stratified artifact-bearing sediments in Area B (the second goal). Concerning the third goal, we recovered 2,763 artifacts and over 20,000 pieces of quarry debris and debitage from the three principal loci. This is surely a representative sample since major portions of partially disturbed Area B and undisturbed Area C were excavated.

In terms of the fourth goal, we acquired some data, however incomplete, on quarry activity. We are able to delineate stages in biface production, the most important non-quarry activity on the site, and can state with conviction that other tasks such as wood-, hide-, and bone-working also occurred on the site. We failed, however, to meet the fifth goal by finding charcoal or other organic material that could date the Paleoindian occupation, and subsistence remains of any kind were absent.

COMPARISONS

Numerous Paleoindian sites have been found and excavated throughout North America and parts of Latin America. Therefore a great deal of information is now available on these oldest known inhabitants of the New World.⁶ More and more sites are being discovered, excavated, and reported in the Northeast, but much remains to be learned about all aspects of Paleoindian cultural traditions. Despite many similarities in artifact assemblages, there is increasing evidence of regional and temporal variation (Gramly and Funk 1990). It is inaccurate to speak of a Paleoindian "culture" in the sense of a narrowly defined set of traits and adaptive strategies, replicated over and over again wherever found. Nearly nothing is known about non-lithic artifacts that must have comprised major portions of material culture. In addition, there is an almost complete lack of data regarding skeletal biology, burial procedures, burial ceremonialism, social organization, and so on. Depending on the challenges of local and regional environments and the technological means of dealing with them, subsistence and settlement patterns, economic organization, ideology, ritual, trade and exchange, and other traits must have varied in time and space. This variability may, however, prove difficult to discern in the archaeological record.

A comparative analysis is needed in order to place West Athens Hill in the larger context of northeastern Paleoindian manifestations. Detailed comparisons will be primarily confined to the other 11 sites on record for eastern and central New York state, namely: Kings

Road, Swale, Twin Fields, Dutchess Quarry Caves 1 and 8, Zappavigna, "Hallock," Port Mobil, Davis, Potts, and Corditaie. *Sites* are defined in contrast to isolated finds of fluted points, and include plowed sites as well as undisturbed ones, where the projectile points are associated with other tools in *assemblages*. Nevertheless, isolated finds are important for a full picture of Paleoindian adaptations in the Northeast. Occasional reference will also be made, where appropriate, to sites located in other parts of northeastern North America. In western New York those include the Lamb site (Gramly 1999), the Hiscock site (Laub, et al. 1988), and the Arc site (Gramly 1999; Tankersley, et al. 1997).

This analysis considers aspects of cultural geography that guided and constrained the modes of aboriginal adaptation to the middle Hudson valley environment. Topography and drainage patterns would have tended to control Paleoindian movements across the landscape. People on foot would have followed routes of least effort in search of desirable campgrounds and special-purpose stations located within convenient distances of resources critical to their physical survival, such as fresh water, food, and raw materials for garments, shelters, tools, and weapons. Ancient peoples also needed to find sources of chert and other materials for stone artifacts. Local resources of food animals and plants had to be adequate to their needs. Another factor might have included territorial behavior, involving an awareness of the territorial boundaries of other bands. Although there

⁶ Admittedly, there is continuing controversy over the possibility of pre-fluted point occupations.

might have been competition between bands for important resources, occasional peaceful interaction would be crucial in the search for mates, social reinforcement, shared ritual behavior, trade partnerships, and so on. And while we lack sufficient information to define "catchments," some very preliminary and general models of subsistence-settlement patterns may be proposed.

Factors considered in the intersite comparisons include: elevation above sea level; relief; local topographic setting; structural attributes; relation to bodies of water; relation to sources of raw material such as chert; relation to food resources; chronology; place in regional developmental patterns; characteristics of artifact assemblages; within-site activities and organization; and position in regional settlement systems. The interrelationship of these variables can be summarized as follows:

Topography and associated resources on the landscape that satisfy basic human needs (food, water, raw materials, stable living surfaces, shelter) are *primary determinants of settlement patterns*. Most important, particular geographic regions must have sufficient food and water to support people bearing a hunting/fishing/gathering technology.

Site locations were chosen that were within convenient (time and energy saving) distances of resources. Multiple sites may have been occupied/used by a band if needed resources were not located within convenient distances of each other, seasonally or otherwise.

Living surfaces had to be level to only moderately sloping, as well as dry, in order for people to comfortably and efficiently carry out the various tasks and activities of daily life.

Raw materials, especially chert, and presumably also wood, bone, and antler were needed to make the weapons and tools that enabled such bands to obtain and process their food as well as obtain animal hides for clothing, build shelters, and so on.

The *kinds of chert-knapping debris* occurring on archaeological sites were determined by the types of artifacts manufactured, the reduction procedures followed by particular groups, the distances of campsites from

sources of the stone, and whether the group represented a pioneering population bringing exotic materials from other regions or were long-established residents who had located and were exploiting locally available sources.

The *amount and areal extent of chipping debris* was determined by the reasons that a site was occupied or utilized, the length of time it was occupied, the number of repeated occupations, the size of the occupying group(s), and the status of chert-knapping in relation to all other activities on site.

The *amount of exotic stone* in assemblages was determined by distance from the source, the size of Paleoindian territories (larger territories would have familiarized a group with resources occurring over a broad area), trade relations with other bands living at or near outcrops of the stone, and whether the occupants of the sites under study were pioneers carrying material from other regions or long-established residents who had found and come to rely on local raw materials.

The *ratio of the quantities of debitage to number of artifacts* was determined by the kind of site (the purposes for its occupation and the kinds of associated activities), the types of artifacts manufactured, the average size of artifacts, and the relation to chert outcrops (primary production vs. retouch or resharpening).

Wear patterns on artifacts were determined by the nature of tasks performed and the kinds of materials to which tools were applied in those tasks.

Productivity was determined by the kinds of activities on a site (e.g., chert-knapping, hunting, butchering, food preparation, cooking, wood- or hide-working) as well as the length of occupation, number of occupations, size of occupying groups, and other factors leading to increased accumulation of refuse. In the case of Paleoindians, we are considering only the quantities of stone tools and debitage since most other residues including features, organic remains, burials, and so forth are absent from the sites.

The *size and weight of particular artifact types* were determined by the kinds of tasks or activities in which they were employed (func-

tional demands), the strength of humans using them, and the size of chert blocks, vein plates, or nodules in available chert sources.

Artifact type frequencies were determined by the kinds and relative importance of tasks and activities that involved the items (e.g., hunting/butchering, fishing, plant food processing, hide-working, working of bone and wood, biface manufacture).

The *size of occupied areas* was determined by structure and local topography (caves/rockshelters vs. open-air sites, relief, slope, amount of living surface available), the nature of activities, the size of occupying groups, the number of repeated occupations, and the length of occupation. The larger the group, the longer or the more frequently repeated the occupation, the more refuse would be produced, the more widely dispersed it would be as a result of shifting loci of activity.

Specific intersite comparisons follow:

Elevation: West Athens Hill reaches a maximum elevation of just over 400 feet. The Dutchess Quarry Caves are at about 580 feet. The Corditaape site sits at about 500 feet, Potts at 410 feet, Port Mobil at 10 to 50 feet, Zappavigna at 400 feet, "Hallock" at about the same elevation, Kings Road and Swale at 140 feet, Davis at 200 feet, and Twin Fields at 300 feet. In Maine, the Vail site is situated at 1,870 feet and Michaud at 250 feet. But except when sites are close to tidewater, elevation by itself is not particularly meaningful; relief, however, informs us about the relationship of a site to its immediate surroundings in the continental interior.

Relief: West Athens Hill is the highest hill in Greene County east of the Helderbergs, rising over 250 feet above the adjoining terrain. The Dutchess Quarry Caves on Mount Lookout are also some 200 feet above the local terrain. All of the other sites are at lower relief, generally less than 30 feet above adjacent landforms. An exception is Davis, which occupies terrain that rises much higher to the west

and slopes down to the east on the edge of a clay terrace that lies some 150 feet above the waters of nearby Lake Champlain.

Local topographic setting: West Athens Hill is part of a system of rocky ridges, many chert-bearing, running north-south in Greene County. They are adjoined on east and west by low-lying flats and creek valleys that are also oriented generally north-south. Kings Road and Swale are on low-lying clay flats, adjoining a small creek east of the above-mentioned ridges and the Helderbergs. The Dutchess Quarry Caves, however, are in hilly terrain that interfingers with parts of the Black Dirt Area, a vast former marsh that was the bed of a proglacial lake within the present Wallkill River Valley watershed. Port Mobil is a series of loci situated on low terraces and knolls adjoining the Arthur Kill, presently a salt water channel but in late Pleistocene times a fresh water stream. Zappavigna and "Hallock" are on low rolling terrain outside the Black Dirt Area and within a fairly short distance of the Wallkill River. Twin Fields is on a late-glacial terrace along the Dwar Kill, a Wallkill tributary. Davis is on a similar terrace adjacent to Lake Champlain. The Corditaape site lies on an outwash terrace next to a Mohawk River tributary, and the Potts site sits atop a drumlin in generally flat terrain on the old bed of glacial Lake Iroquois. The Arc site occupies a flat, gently sloping field close to Oak Orchard Swamp and the Lamb site is on an outwash plain next to a kettle hole bog.

In contrast, the Templeton site in north-west Connecticut is on the floodplain of the Shepaug River (Moeller 1980), and so far is the only reported instance of this kind. It discovery suggests that many more Paleoindian sites remain to be found deeply buried on the floodplains of northeastern rivers.

Structure: All of the sites except the Dutchess Quarry Caves are open-air stations. Those stations vary in associated physical characteristics, including bedrock lithology, soils, slope of occupied surface, area of occu-

pation, nature of cultural deposits, presence or absence of features, the impact of modern cultivation, and other forms of disturbance. West Athens Hill is the only Paleoindian station in New York State that is a quarry-workshop, directly associated with chert-bearing outcrops (Flint Mine Hill, a much more heavily utilized quarry and workshop site, has produced two fluted points from the top of the ridge, but the site is multicomponent and artifacts of Archaic and Woodland periods are very abundant on and around the hill). West Athens Hill is also the only local Paleoindian site with sharply contrasting intrasite microtopography, namely, artifact-bearing loci on knolls and a hollow within the summit area as well as on a bench on the east side of the hill, well below the elevations of the other loci.

All of the other open-air sites are on flat glacial terraces, lake beds, or the crests of low ridges and knolls, and in one case on a flood plain terrace. Except for West Athens Hill and the caves, the New York sites have been plowed for many years, disturbing the formerly intact occupational remains, destroying features and middens, and dislodging artifacts from their original positions. Apart from the Dutchess Quarry Caves, there are no other confirmed instances of fluted points found in New York caves and rockshelters.

Precise information on the slope of occupied surfaces is lacking for some sites. For example, at Port Mobil, artifacts occurred on both low, level terraces and on knolls, but the data on slope have not been recorded. At Zappavigna, slope varied from level to about 2 percent. Although the "Hallock" site has not been mapped, it is on a ground surface sloping at about 2 percent toward the Wallkill River.

Occupied surfaces within the Dutchess Quarry Caves were nearly level despite the steep talus slope outside their mouths. The deglacial terrace at Twin Fields is level. Slope varies at West Athens Hill, but is nearly level on Area A, level to gently sloping at Area B, level to gently sloping at Area C, and steeper on the upper hillsides. The Kings Road and

Swale sites are on nearly level clay flats, the Davis site is on land sloping gently toward a bluff overlooking Lake Champlain, the Potts site lies atop a drumlin sloping down from the occupied area on two sides, and the Corditaie and Lamb sites are on outwash plains. Looking out of state, the Whipple site is on a high late-glacial terrace, the Vail site occupies a 5 percent slope down to the Magalloway River, the Michaud site is on an outwash plain with about a 2 percent slope, and the Templeton site is on a flood plain.

Soils on the open-air sites are generally gravel, sand, and silt loams based on glacial drift deposits. Exceptions include the "cave earths" that contained cultural material within the Dutchess Quarry Caves, the Lake Albany clay-silts at Kings Road and Swale, and the fine sand loam at the Templeton site. The agricultural potential of these soils is not relevant to interpreting Paleoindian subsistence and settlement, in the absence of cultigens. But differences in the fertility of soils on or near sites could have affected the abundance and distribution of wild plants that were some part of the Paleoindian diet.

There is variable information on the occupied areas of sites. Most of the open-air sites have been plowed for many years. Not only does this disperse artifacts horizontally from their original positions, thus artificially enlarging sites, but it provides ready access for surface collectors whose activities can reduce assemblage size and differentially remove certain artifact types. For example, one collector of my acquaintance collected only complete projectile points, disregarding the numerous fragmentary points in the plowed fields; yet his collection contained over 4,000 points. Another collector ignored scrapers, focusing his attention on projectile points. Some individuals are interested only in objects of historic period origin, such as coins, gun parts, bullets, and ceramics. This "thinning out" may diminish the visibility of a site in a cultivated field but also modify the original frequencies of artifact types in an assemblage. Sites may even be literally erased by intensive

collecting of waste flakes and cores as well as artifacts, as reported in the Unadilla and Susquehanna basins (Whitney 1974).

In other cases, severe disturbance precludes accurate estimation of site area. Also, occupation by multiple aboriginal groups over millennia may obscure the distribution of items from particular periods, complicating the task of determining the areal extent of Paleoindian components on a site. _

The smallest Paleoindian sites in the study area are: Dutchess Quarry Cave No. 1, area 45 square meters; Dutchess Quarry Cave No. 8, area 30 square meters; Twin Fields, area 230 square meters; Kings Road and Swale, each with an area of about 400 square meters; and Zappavigna, area 1,800 square meters. The Lamb site in western New York was small, at about 300 square meters. The Vail site in Maine was estimated at 5,600 square meters, and West Athens Hill at 8,100 square meters, making it the largest of these sites.

Two sites that might be considered "diffuse" also have large estimated areas: Potts occupied roughly 5,500 square meters, and Corditaipe roughly 6730 square meters. These sites consisted of some eight and four different loci, respectively, based on the presence of artifact and debitage clusters, separated by relatively barren areas within the large farm fields where they occur.

The Port Mobil site was undoubtedly relatively large, but accurate estimates of its occupied area were precluded by disturbance by modern industrial activity. Ritchie (1965: 21) estimated the area where Paleoindian diagnostic items were found at the Davis site to be one-third of an acre, or about 1,350 square meters, but the picture was confused by the multicomponent nature of the site. No information is presently on record concerning the size of occupied area at the "Hallock" site in Orange County, New York.

Relation to potable water. All of the sites, except West Athens Hill and the Dutchess Quarry Caves, are close to fresh water (i.e., within 330 feet [100 m] or less). No springs are

presently visible on the summit or slopes of West Athens Hill or Mount Lookout, although running water is within one-half mile (800 m) in each case. The Davis site is within 150 yards (135 m) of the shore of Lake Champlain and may possibly have been closer to water during the period of the brackish Champlain Sea. Ritchie (1965: 19–22) did not report the existence of creeks near the fluted point findspots, but aerial photos of the local topography indicate a small stream was close by the site. "Hallock" is on high ground gently sloping down to the Wallkill River and there is a spring nearby. The salt water branch of the Hudson River estuary that presently adjoins Port Mobil was a fresh water river in late-glacial times, but there is also a small creek and former wetland near the site.

Relation to sources of lithic raw material: Cherts of good quality for stone tool manufacture were available on, or very near, the West Athens Hill, Dutchess Quarry Caves 1 and 8, Kings Road, Swale, "Hallock," Zappavigna, Davis, and Twin Fields sites. A considerable variety of cherts was to be found in the outcrops of Cambrian and Ordovician rocks of the Wallkill Valley (La Porta 1996) and these predominated at the Zappavigna, Dutchess Quarry Caves 1 and 8, and "Hallock" sites, all in Orange County. Normanskill and Martinsburg cherts, as well as the Wallkill Valley cherts, were available to the occupants of Twin Fields. West Athens Hill itself is a Normanskill chert source, and both Kings Road and Swale are located within a half mile (800 m) of excellent sources of the same material. High-quality chert occurs only a few kilometers south of the Corditaipe site, in the Onondaga carbonate belt. The occupants of the Potts site had to go farther south (30 to 40 km) to obtain Onondaga chert for their chipped stone industry. Some local pebble jaspers were available to the residents of the Port Mobil site, but they also obtained Hardyston chert from eastern Pennsylvania at a much greater distance. Glacially imported cobbles of chert and other stones were also available prehistorically

in areas south of bedrock sources like the Onondaga carbonates.

Relation to sources of plant and animal food (subsistence): All of the sites are located within the deciduous forest environment that has been in place since the close of the Oak–Pine period some 7,500 years ago. But presumably the plant and animal species at the time of occupation, during the terminal Pleistocene, offered rather different subsistence resources to Paleoindians. Fossil remains of caribou, mastodont, moose-elk, dire wolf, ground sloth, cave bear, peccary, giant beaver, and other mammal species occur in Pleistocene deposits across the country and presumably the living animals were available to the Indians prior to the extinctions that occurred some time preceding 10,000 B.P. (Martin and Klein 1989). Elk, white-tailed deer, black bear, and other mammals characteristic of the Holocene occurred farther south but were probably gradually infiltrating the Hudson drainage as far back as 11,000 years ago. Numerous varieties of fish swam in the streams and lakes (Smith 1985), and both migratory and non-migratory birds were abundant. Some seeds and other edible plant parts must have been available, but the oaks predominated among nut trees and other mast-producing trees were few and far between in the dominant Spruce–Fir forest of the period. Undoubtedly, however, berries were varied and abundant in “edge” situations.

Skeletal remains of Pleistocene mammals have been found in sediments ranging from southeastern and eastern New York to the state’s western border. Relatively few sites are on record for the far northern parts of New York including the Adirondack Mountains. Most of the specimens are mastodont bones, at least 35 of which have been reported for Orange County alone (Ritchie 1965: Figure 3). Three mastodonts, a horse, and a deer were found in Greene County, two mastodonts, a deer, and a bison in Albany County, and a mastodont and a caribou in Schenectady

County. Few such finds were located between Albany and Syracuse, but are fairly numerous from the Finger Lakes to Buffalo. With the exception of the Byron Mastodont, now known as the Hiscock site (Laub, et al. 1988), no Paleoindian artifacts are yet reported in association with the bones of Pleistocene creatures anywhere in the state or in adjoining parts of North America. However, it is quite possible, even likely, that the inhabitants of West Athens Hill, Kings Road, and Swale preyed upon mastodont, caribou, and some other mammals whose bones are found in late-glacial sediments.

The Dutchess Quarry Caves, “Hallock,” and Zappavigna were all near the wetland that became the Black Dirt Area, and therefore their inhabitants probably took advantage of its bounty in plant and animal foods (Funk 1992; Funk and Steadman 1994). The caves contained varied faunal remains characteristic of the Holocene, but there were also bones of caribou, giant beaver, and flat-headed peccary that pertained to the Pleistocene. Unfortunately, direct dating of the bones of those three species by tandem accelerator mass spectrometer showed that they are much older than the known dates for Paleoindians, and it is now assumed they were introduced into the caves by animal predators and scavengers (Funk and Steadman 1994; Steadman, Stafford, and Funk 1997). Therefore, the caves failed to provide reliable evidence of the subsistence habits of their Paleoindian residents.

None of the other sites in the study area produced food remains. The Zappavigna site is located on the crest of a ridge adjoining a large, amphitheater-like depression on the headwaters of a creek. It is speculated that Paleoindians camped there one winter to prey upon caribou and other game, taking shelter against the foot of the ridge from cold wind, snow, and rain blowing from the north and west (Funk, et al. 2003).

Sites near wetlands, large creeks, rivers, or lakes, such as Port Mobil, Twin Fields, Corditaape, and Davis afforded their occupants access to fish, shellfish, aquatic mam-

mals and plants, and in some cases migratory ducks and geese. The Potts site is located near a small stream where some fish may have been available, but Gramly and Lothrop (1984) speculate that a caribou killing ground was close by. Kings Road and Swale, situated on low, very slight rises in the middle of the Athens Flat, are a half mile from the nearest source of Normanskill chert, "in the middle of nowhere," so I suggest that the sites were chosen for proximity to important food resources. Fish and mussels were probably rare in the small brook close by the sites, though larger creeks and the Hudson River were not far away. But the north-south oriented escarpment, ridges, flats, and streams in the general area would have restricted the lateral (east-west) movement of caribou and other game animals which presumably therefore tended to follow a north-south route passing near the sites. The choices available to the animals were limited, funneling them either along the Flat or along the Hans Vosen Kill valley. The occupants of Kings Road and Swale may have taken advantage of that configuration, lying in wait for game to appear in their vicinity. But there is no proof that people were actually taking advantage of those particular resources.

In western New York, caribou and mastodont bones occurred in the basal, Pleistocene zone of the Hiscock site, in apparent contemporaneity with fluted points, chert flakes, and scrapers of Paleoindian origin (Laub, et al. 1988). It is uncertain whether the Indians scavenged or killed the mastodont and caribou. The Templeton site in western Connecticut produced evidence that the Paleoindians living there were collecting acorns, reflecting the presence, though probably not abundance, of oak trees in the terminal Pleistocene environment (Moeller 1980). Fish bones and hackberry seeds were recovered from the Paleoindian zone at the Shawnee-Minisink site on the Delaware River in eastern Pennsylvania (McNett and McMillan 1974). Caribou bones were identified at the Whipple site on the Connecticut River in New

Hampshire (Curran 1984) and at the Bull Brook site, in Massachusetts (Spiess, Curran, and Grimes 1985). Calcined mammal bones were also found at the Sugarloaf site in western Massachusetts (Gramly 1998). The Michaud site in Maine (Spiess and Wilson 1987) produced some fragmentary, calcined mammal bones that could not be identified as to species. On comparative, topographic and ecological grounds, Gramly (1982, 1988) posited that caribou were intercepted and killed by people camped at the locations of the Vail and Adkins sites on the Magalloway River in Maine. Foods consumed by the groups who visited West Athens Hill and camped either on the summit or on the nearby lowlands remain unknown. Perhaps they hunted and feasted on the same migrating animals envisioned for the Kings Road and Swale sites.

The limited evidence suggests that Paleoindians subsisted on a moderately diverse range of animals and plants provided by the terminal Pleistocene landscape. Caribou and fish may have provided their "staple" foods in some parts of the Northeast. Migratory fowl may have contributed large amounts of protein to bands living along major flyways (Dincauze 2001). We might speculate that Paleoindians living along the seacoast were more oriented toward marine resources, at a time when sea level was much lower than at present. Therefore, if any of their sites survived wave erosion as the sea once again encroached on land, important information on their adaptations lies at considerable depth below modern sea level.

Chronology and place of sites in regional developmental stages: The only sites in the study area that have produced organic materials for potentially radiocarbon dating Paleoindian assemblages are West Athens Hill and the Dutchess Quarry Caves. But as stated above, the date for West Athens Hill is on charcoal of modern origin, the cave dates on charcoal pertain to Archaic components, and the bone dates to Pleistocene animals apparently dragged into the caves by scavengers or

predators before Paleoindians arrived. In western New York, excavations at the Arc site by Tankersley, et al. (1997) yielded a date of ca. 10,400 B.P. for the Paleoindian occupation zone (as noted above dates are presented here in radiocarbon years, ignoring standard deviations). The stratum at the Hiscock site containing mastodont and caribou bones and fluted points was dated at about 11,000 B.P. The Templeton site provided one date of 10,190 B.P. The Whipple site is dated between 11,400 and 9540 B.P., the Debert site, Nova Scotia at an average date of 10,600 B.P., the Vail site in Maine at 11,120 to 10,040 B.P., the Bull Brook site in Massachusetts at ca. 9380 to 6940 B.P., Shawnee-Minisink in Pennsylvania at 10,750 to 10,590 B.P., the Michaud site in Maine at 10,200 to 9010 B.P., and the Neponset site in Massachusetts at 10,120 B.P. Although many more dates are needed, it has been suggested that there are two populations of dates: an early one of about 11,000 to 10,500 B.P., associated with so-called "Gainey-Debert" style points (most similar to western Clovis points) and a later series of around 10,500 to 10,120 B.P. that applies to assemblages containing "Cumberland-Barnes" style points (Curran 1996). These age estimates leave aside the puzzling "late" dates of ca. 9,540 to 9010 B.P. for Whipple, Bull Brook, and Michaud.

The early Paleoindian sequence of Gainey-Debert points, Cumberland-Barnes points, and Crowfield points has been proposed by various writers (Curran 1996; Ellis and Deller 1990, 1997; Gramly and Funk 1990), and to date it has not faced any serious challenges. There is no doubt that the different styles overlapped in time. Any two of them not only intergraded in size and form, but were probably associated at times of change from Gainey-Debert to Cumberland-Barnes, and from Cumberland-Barnes to Crowfield in particular assemblages.

The assemblages within the study area are therefore assigned to these stages as follows:

Gainey-Debert: West Athens Hill. However, at least one point is of the Cumberland-Barnes type, indicating some

temporal overlap with "Parkhill" stage manifestations.

Cumberland-Barnes: Corditaipe, Potts, Port Mobil, Zappavigna, "Hallock" (?), Davis, Dutchess Quarry Caves 1 and 8, Twin Fields, Swale, Kings Road.

Crowfield: Some Crowfield points occurred with other later Paleoindian styles at the Reagen site, Vermont (Ritchie 1953, 1957).

Artifact assemblages: Northeastern Paleoindian assemblages consist almost entirely of artifacts made of lithic materials that, unlike objects of bone, hides, flesh, and wood have not perished from the agents of decay. Stone artifacts were especially important to the survival of those ancient people. They had to locate and exploit sources of the raw materials for artifacts, principally chert. The particular form of artifacts had to conform to their function, otherwise they would be useless. To some degree, function may determine style, but stylistic differences often consist of an idiosyncratic constellation of attributes permitted by the "slack" in purely functional attributes. And some writers have theorized that style has an important function apart from efficiency in hunting or other techno-economic activities, namely, it may be symbolic of group identity (Weissner 1983).

Almost without exception, the artifacts in the assemblages relate to the Paleoindians' livelihood in other words, they represent the technology that enabled them to extract food and other goods from the environment. Given the absence of subsistence remains on most New York sites, we are forced to rely on lithic items to interpret Paleoindian economic behavior, so that a great deal of time and effort is devoted to analyzing the assemblages. Non-economic aspects of their culture are less evidently observed in the weapons, tools and byproducts of manufacture and must be inferred largely on a comparative basis using data from ethnographically known cultures.

The assemblages are broken down into two major categories; weapons and tools. Weapons (projectile points) were used chiefly

for hunting, though at times they must have aided in defending bands against hostiles from other bands. Other tools were employed in the diverse tasks of domestic life. These functional types are postulated on the basis of data from ethnographic analogy and from experimental studies testing hypotheses generated to account for use-wear patterns (Keeley 1980; Semenov 1964).

Artifact assemblages reflect the tasks and activities performed on a site. Therefore elucidating the differences and similarities between sites may contribute to understanding the position of sites in regional settlement systems. Such comparisons can contribute to the definition of site types, each type illustrating one aspect of adaptation to the late-glacial landscape. For example, a heavy predominance of projectile points and biface knives in contrast to other artifact types means the site was primarily a hunting and butchering station; conversely, a predominance of netsinkers, bone harpoons, fishhooks, and related items on an Archaic site (those traits are not known for eastern Paleoindian sites) demonstrates the relative importance of fishing. Theoretically, the more diverse an assemblage (the greater the number of functional types) the more varied the activities and the more the site conforms to the definition of a central base-camp, rather than a limited-purpose station, defined from a much more limited array of functional types. Artifacts exhibiting the most complex morphology, such as projectile points, are more sensitive indicators of regional and temporal stylistic variation than unifaces. In this regard, projectile points are the Paleoindian equivalent of Woodland ceramics.

Another aspect of interassemblage variability consists of differences in the size and weight of bifaces and unifaces and the types of use-wear observed on them. Size and weight differences may provide clues to the types of activities performed (e.g., large scrapers used for processing the hides of large animals such as elk, small scrapers used for processing the hides of smaller animals such as foxes). They

may also reflect the distance of sites from bedrock sources of the lithic raw materials (i.e., at greater distances the groups may tend to conserve items made of their preferred materials, hence those items may be reworked and rehabilitated, reducing their dimensions), or the particular outcrops may offer blocks and nodules of either relatively small or relatively large size. Differences in use-wear patterns may reflect differences in the types of tasks performed on given sites; for instance, a predominance of edge-crushing on scrapers indicating use on bone and antler, a predominance of edge-rounding indicating use on hides.

The ratio of artifacts to chert-knapping debitage is one clue to on-site activities, including the relative importance of chert quarrying and knapping. As might be expected, only rarely do sites completely lack debitage. Aboriginal peoples had to rely on workable lithic material for tasks like hunting and killing game, cutting up meat, processing hides, and so on. Indices of site productivity (e.g., the quantities of artifacts and debitage per area excavated) probably reflect several things including the nature and relative importance of activities, the length of occupation, intensity of occupation, and size of occupying groups.

Finally, the types of lithic material used for an assemblage obviously provide clues to where the material outcrops, and materials exotic to a given region represent extra-local or extra-regional travel and trade relations of the people who occupied the site.

Sample Size

The recovered artifacts vary in number from 110 to 1,525 per site. These figures are not particularly informative because, short of total excavation, all of the assemblages are actually *samples*, incomplete portions of all the artifacts deposited prehistorically on the sites. More useful would be relating the size of assemblages and the size of areas investigated, to the total areas of particular sites. Sampling designs are important, since the problem is to evaluate the relationship of samples obtained

to the total area and internal structure on a site. Data are fortunately available concerning the relation of investigated area (excavated area, excavated area plus surface collected area, or simply surface collected area) to total site area for the Zappavigna, Kings Road, Swale, Twin Fields, Potts, Corditaiepe, and West Athens Hill sites.

Frequencies of Artifact Types

Although items such as pieces esquillees, drills, spokeshaves, and denticulates are found on some sites but not on others, giving an impression of greater diversity in some assemblages than in others, they are few in number where they do occur. They are far outweighed by the objects in the basic tool kit (i.e., fluted points, other bifaces, end scrapers, side scrapers and utilized flakes). Those objects were universal on the sites in Table 35, and bifaces in process occurred on all but one site. The ratios of the quantities of some types to others do, however, show contrasts from site to site. For example, the proportion of bifaces to unifaces varies, as do finished bifaces to those in process, biface knives to other bifaces, "made" artifacts to utilized flakes, and the amounts of exotic vs. local lithic materials. Rough stone tools, primarily cobble hammerstones, occurred on most sites. Some of the differences probably relate to differences in the relative importance of certain tasks and activities on the sites. Another consideration is the different types of wear patterns observed on artifacts in the assemblages.

Size and Weight of Certain Artifact Traits

Tendencies in the size and weight of artifact categories from the sites under study may reflect several determining factors, such as: the varying requirements ("heavy" vs. "light") of different tasks; the multi-function utility of certain types; the stage reached in the reduction process; the extent to which some items were reworked or resharpened; the size of raw material blocks and cores; and distance from sources of lithic material (the greater the

distance, the greater the tendency to conserve, resharpen, or rehabilitate artifacts).

Ten of the numerous fluted points found at the Lamb site, Genesee County, New York, ranged from 92 to 140 mm long and 30 to 39 mm wide; summary statistics were also published for a selected group of bifacial preforms (Gramly 1999).

Stage 1 and 2 bifaces represent early phases of the reduction trajectory from core to finished projectile point or knife. Therefore, objects in these categories from the various sites should be consistently larger and heavier than Stage 3 or finished (Stage 4) bifaces. This is borne out by comparing the data in Table 36 with the data in Table 37.

Although Table 38 shows some variation in end scraper size and weight, there is a high degree of uniformity among most of the assemblages. The major disparity is in the rather smaller and lighter scrapers from the Zappavigna and Corditaiepe sites, and the much larger and heavier scrapers from the Potts site. This Potts data are surprising, since its distance to Onondaga chert outcrops is the greatest of all the sites.

Although the end scrapers from Areas A and B at West Athens Hill appear significantly lighter than those from Area C despite a close similarity in size the mean weight for both groups is about 7 g, if one massive end scraper from Area C is removed from the calculation.

Comparisons with New England sites, despite the unevenness of published data, show much similarity in the sizes of end scrapers to the samples from central and eastern New York. For example, the six end scrapers of chert in the assemblage from the Adkins site, Maine, range from 27 to 32 mm in length; the 12 scrapers of crystal quartz tend to be smaller, averaging 22 mm long (Gramly 1988). End scrapers found at the Bull Brook II site in Massachusetts range in length from 13 to 50 mm, the mode tending from 25 to 35 mm (Grimes, et al. 1984).

A high degree of correspondence is also seen in the size and weight of items classed as side scrapers (Table 39). This is surprising in view of the considerable formal variability in

Table 35. Comparison of artifact types in assemblages from Paleoindian sites in central and eastern New York. The Dutchess Quarry Caves 1 and 8, the Davis site, and the “Hallock” site are not included because the collections from the caves and “Hallock” are confined to a few fluted points, out of context, and the handful of widely scattered artifacts from the Davis site was mixed with those of later cultures. Archaic projectile points are excluded.

Artifact Types	Zappavigna		Kings Road		Swale		Twin Fields		Potts		Corditaape		Port Mobil		West Athens Hill Areas A, B		West Athens Hill Area C	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Fluted points (finished)	3	2.7	3	.8	6	2.4	2	1.8	6	2.8	2	1.2	18	12.5	13	.9	3	.2
Fluted points in process			5	1.3	12	4.9					3	1.8	10	6.9	27	1.8	9	.7
Possible Fluted points	3	2.7	2	.5	1	.4							6	4.2	21	1.4	4	.3
Biface knives					7	2.8					1	0.6	3	2.1	35	2.3		
Bifaces in Process	17	15.5	65	16.7	23	9.3	2	1.8	12	1.7	17	10.2			168	11.0	151	12.3
Misc. bifaces			29	7.4	4	1.6	1	.9							34	2.2	2	.2
Drills/awls									5	.7			2	1.4				
End scrapers	47	42.7	55	14.1	89	36.0	42	36.8	66	9.3	93	55.7	47	37.6	92	6.0	37	3.0
End-side scrapers					3	1.2							3	2.1				
Side scrapers	3	2.7	67	17.2	36	14.6	37	32.5	46	6.5	14	9.4	22	15.3	192	12.6	19	1.6
Spokeshaves			3	.8			1	.9					15	10.4				
Flake knives			41	10.5	5	2.0	6	5.3	2	.3	2	1.2			39	2.6		
Retouched flakes	12	10.9	10	2.6	5	2.0									33	2.2	19	1.6
Gravers	3	2.7					5	4.4	33	4.6			4	2.8	1	.1	2	.2
Denticulates	3	2.7					2	1.8			1	0.6	1	.7				
Pieces esquillees			1	.3	4	1.6			22	3.1	2	1.2			5	.3	2	.2
Tool fragments					16	6.5			400	56.3								
Other unifaces	1	.9	1	.3	8	3.2			2	.3			1	.7			2	.2
Utilized flakes	11	10.0	102	26.2	28	11.3	16	14.0	114	16.0	26	15.6	12	8.3	680	44.6	903	73.5
Rough stone tools	7	6.4	6	1.6					3	.4	6	3.6			185	12.1	75	6.1
Totals for all Artifacts	110	100.0	390	100.0	247	100.0	114	100.0	711	100.0	167	100.0	144	100.0	1525	100.0	1228	100.0

Table 36. Comparisons of fluted point size and weight between sites, in terms of means and standard deviations. (N/A means not applicable).

Site	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Port Mobil	38±8.6 (N=15)	21±3.4 (N=15)	5.6±1.3 (N=15)	No data
Zappavigna	43±6.8 (N=3)	21.7±3.3 (N=7)	5.1±1.2 (N=9)	No data available for 3 whole points in private collection
West Athens Hill Areas A, B	47.0 ±10.4 (N=6)	27.1±6.5 (N=12)	7.0±1.4 (N=13)	8.6±5.6 (N=4)
West Athens Hill, Area C	N/A; none complete	35.5±6.5 (N=12)	7.1±1.4 (N=12)	N/A; none Complete
Kings Road	N/A; only one whole specimen	28.3±1.5 (N=3)	6±1 (N=3)	N/A; only one whole specimen
Swale	N/A; none complete	36.3±10.8 (N=17)	8.6±2.4 (N=16)	N/A; none complete
Corditaape	N/A; only one whole specimen	34.8±10.5 (N=5)	7.8±1.6 (N=5)	N/A; only one whole specimen
Michaud	57.3 (N=3)	24.2 (N=4)	5.2 (N=6)	No data
Vail	62.4±17.9 (N=29)	28.7±3.3 (N=29)	7.4±1.5 (N=29)	13±5.6 (N=29)

these tools, which are less easily defined than end scrapers. The Corditaape side scrapers, however, are rather smaller than those from the other sites.

Comparisons of Artifacts to Debitage

The ratio of counts of debitage items to counts of artifacts should theoretically indicate the status of chert-knapping relative to other activities at a site. High counts of debitage could signify a quarry-workshop, or at least proximity to a chert source. Low quantities could signify considerable distance from such a source, or perhaps little need for biface manufacture on briefly occupied limited-purpose sites. The quantities of recovered debitage would be affected by disturbance of a site, for instance by plowing or leveling, whether or not screens are used, whether or not the site is excavated or surface collected,

and so on.

Perusal of Table 40 shows that the artifact to debitage ratios vary considerably. They should be most reliable for excavated sites, such as Zappavigna, West Athens Hill, Vail, Lamb, and Templeton.

Measures of Site Productivity

As noted above, the counts of artifacts collected from particular sites mean little unless certain conditions are specified. Clearly, many factors can account for collection size, including the total number of artifacts originally deposited, whether or not a site has been plowed, whether or not parts of it have been severely disturbed or destroyed, how much of the site lies below the reach of the plow, whether or not it is stratified, whether or not it has been excavated rather than surface collected, how much of it has been excavated, the

Table 37. Comparisons of the size and weight of Stage 1 and 2 bifaces, in terms of means and standard deviations (N/A means not applicable).

Stage 1 Bifaces				
Site	Length (mm)	Width (g)	Thickness (mm)	Weight (g)
Zappavigna	57.3+/-18.7 (N = 4)	30.3+/-12 (N = 9)	12.3±4.5 (N = 13)	36.7±43 (N = 4)
West Athens Hill, Areas A and B	74.7±17.02 (N = 30)	47.7±8.34 (N = 45)	17.8±4.71 (N = 53)	83.5±55.15 (N = 29)
West Athens Hill, Area C	74.1±16.5 (N = 20)	50.8±12 (N = 55)	18.2±5.3 (N = 77)	79.5±49.7 (N = 12)
Kings Road	77.7 (N = 9)	49.1 (N = 36)	19.1 (N = 36)	No data
Swale	74.5±9.7 (N = 6)	46.7±11.2 (N = 19)	13.1±3.9 (N = 19)	61.2±43.4 (N = 6)
Corditaape (mixed Stages 1, 2)	56.4±14.5 (N = 10)	42.6±9.9 (N = 18)	16.3±5.7 9(N = 23)	51.2+/-31. (N = 10)
Potts (Stages 2, 3, 4; only 12 total)	N/A	N/A	N/A	N/A
Stage 2 Bifaces				
Site	Length	Width (g)	Thickness (mm)	Weight (g)
Zappavigna	N/A, no stage 2 bifaces identified			
West Athens Hill, Areas A and B	N/A	44.4±8.69 (N = 45)	13.1±2.73 (N = 52)	N/A
West Athens Hill, Area C	N/A (none complete)	50.2±±12.1 (N = 27)	12.1±2.3 (N = 31)	N/A (none complete)
Kings Road	58(N = 3)	43.5 (N = 14)	13.2 (N = 12)	No data

extent of collecting activity, whether some items are preferentially selected over others, the intensity of occupation, the length of occupation, and the nature of activities on the site. The most reliable productivity measure is the number of artifacts per square meter, based on data from excavated sites. It has less meaning for surface collected sites, no matter how intense or prolonged the collecting activity. Table 41 presents the relevant data for such a measure. The Dutchess Quarry Caves are not included due to the mixed deposits and the

sole occurrence of fluted points without associated tools.

In Table 41, Vail and West Athens Hill are the most productive of all the sites, ranging from 4.7 to 9.1 artifacts per square meter of excavation (not counting debitage). Next highest is Templeton, at 1.8 items per square meter. All the others produced less than 1 object per square meter.

The potential maximum number of artifacts is calculated at an astronomical 50,000 plus at the Vail site, in contrast to 5,850 at West

Table 38. Comparisons of end scraper size and weight between sites, in terms of means and standard deviations.

Site	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Port Mobil	No data	No data	No data	No data
Zappavigna	26.5±5.9 (N = 36)	23.1±4.4 (N = 36)	8.1±2.1 (N = 42)	5.5±2.7 (N = 35)
Twin Fields	29.7 (N = 42)	24.3 (N = 42)	6.7±3.1 (N = 42)	8.1 (N = 33)
West Athens Hill, Areas A, B	32.2±9.47 (N = 91)	27.0±10 (N = 92)	8.8±3.1 (N = 92)	7.1±3.1 (N = 37)
West Athens Hill, Area C	35.1±12.3 (N = 29)	23.7±6.0 (N = 30)	8.6±2.6 (N = 32)	8.8±11.5 (N = 28)
Kings Road	33.0±8.1 (N = 53)	24.3±3.8 (N = 54)	8.4±2.3 (N = 55)	7.3±4.0 (N = 52)
Swale	33.5±11.2 (N = 66)	25.6±5.4 (N = 83)	8.8±3.4 (N = 86)	9.6±12.2 (N = 66)
Corditaape	27.6±5.0 (N = 36)	21.7±3.2 (N = 36)	7.8±2.6 (N = 36)	4.9±1.8 (N = 89)
Potts	41.5±8.3 (N = 54)	31.0±4.6 (N = 54)	9.2±2.4 (N = 54)	11.8±4.6 (N = 31)
Vail	33.3±6.6 (N = 154)	25.1±4.7 (N = 154)	8.0±2.0 (N = 154)	No data
Michaud	30.3±8.1 (N = 10)	22.5±4.33 (N = 10)	5.8±7.0 (N = 11)	No data

Athens Hill Areas A and B and 5,060 at Potts. Next largest is Zappavigna at 1,278. By contrast, the lowest totals are for Twin Fields and Templeton, both 100 percent excavated, and Lamb, nearly 100 percent excavated. There is an apparent correlation with size, the smallest artifact totals coming from the smallest sites (Twin Fields, Templeton, and Lamb) and the largest totals from the largest sites (Vail, Potts, Zappavigna, and West Athens Hill).

The quantities of debitage items per square meter of excavation were highest at the Templeton site, next highest at West Athens Hill Area B, next at the Vail site, and lowest at the Potts and Lamb sites. It seems no coincidence that multiple loci of activity were evidenced at West Athens Hill, Potts, and Vail. No such internal patterning was convincingly demonstrated at Zappavigna.

Frequencies of Non-local Cherts in Chipped Stone Assemblages

Non-local stones used for the manufacture of artifacts are, in general, far more common in Paleoindian components than in most later periods. Such “exotics” do, however, occur to a minor degree in Early Archaic complexes of New York State, as well as in Susquehanna tradition assemblages (specifically, small quantities of Pennsylvania jasper and South Mountain, Pennsylvania rhyolite) and Middle Woodland complexes (including Vanport chert from Ohio). The higher incidence in New York Paleoindian contexts is usually assumed to reflect either wide trade relations with other Paleoindian bands living closer to such resources, or actual visits by the local bands to the bedrock outcrops. Both scenarios

Table 39. Comparisons of side scraper size and weight between sites, in terms of means and standard deviations (N/A means not applicable).

Site	Length (mm)	Width (mm)	Thickness (mm)	Weight (g)
Zappavigna	————N/A (only 3 items in this category)————			
West Athens Hill, Areas A and B	58.9±17.62 (N = 168)	39.41±9.43 (N = 172)	15.93±7.53 (N = 174)	47.5±43.1 (N = 125)
West Athens Hill, Area C	62.6±15.9 (N = 17)	43.5±14.9 (N = 17)	14.4±5.1 (N = 17)	39.8±31.5 (N = 14)
Kings Road	62.6 (note: identical to the above mean for Area C at West Athens Hill)	42.1 (N = 65)	15.8 (N = 65)	No data (N = 65)
Swale	59.9±24.2 (N = 37)	39.1±14.4 (N = 37)	12.3±7.2 (N = 37)	44.3±56.03 (N = 37)
Corditaape	43.6±15.5 (N = 14)	26.1±5.8 (N = 14)	6.6±2.1 (N = 14)	15.2±13.03 (N = 14)
Potts	65.1±16.9 (N = 29)	42.2±10.8 (N = 29)	9.9±2.5 (N = 29)	28.6±16.9 (N = 29)
Michaud	66.9±15.59 (N = 9)	37.7±15.7 (N = 9)	8.6±2.78 (N = 10)	No data

are probably valid. A major assumption is that the wide geographical reach of lithic resource procurement resulted from the large territorial ranges of the thinly distributed and populated groups. A corollary assumption is that the search for raw materials was embedded within the subsistence rounds of Paleoindian bands.

Groups moving around within their own, perhaps loosely bounded, territories must have occasionally met and interacted peacefully with other groups bearing similar cultural traditions and having the same need for high-quality cherts for their weapons and implements. Almost certainly, exchange for desired but locally unavailable raw materials was a major activity shared by and helping to link up different bands. Those living within relatively short distances of important sources such as the jasper quarries in present-day eastern Pennsylvania could have traveled to and

from those quarries with minimal difficulty. Those living farther away would have found it more convenient (less demanding of time and energy) to trade with the bands living in proximity to those quarries for the needed supplies of toolstone.

It is tempting to speculate whether other commodities were exchanged between bands during the late Pleistocene epoch; for example, food items such as dried fish, shellfish, or mammal meat (possibly even something like pemmican), edible plant foods such as berries, plant parts useful for tools and weapons, bird feathers, animal hide clothing, ornamental items of bone or wood, and so on. Such items could also have been used to barter for high-quality exotic cherts.

Data on the frequency of non-local cherts occurring in chipped stone assemblages from Paleoindian sites in central and eastern New York are presented in Table 42. The Port Mobil

Table 40. Artifact to debitage ratios and percentages for Paleoindian assemblages (N/A means not applicable).

Site	Number of artifacts	Number of cores and flakes	Debitage/artifact ratio	Percentage artifacts/debitage	Remarks
Port Mobil	No data	144	N/A	N/A	Much disturbed; also, no debitage reported
Zappavigna	110	1,550	14/1	.07	Sample from grid excavation
Twin Fields	114	No data	N/A	N/A	Multicomponent; despite complete excavation of plow zone and underlying zone, Paleoindian debitage could not be distinguished from later material
West Athens Hill Area B	970	10,408	11/1	.09	Sample from grid excavation
West Athens Hill Area C	1,228	Unknown	N/A	N/A	Sample from grid excavation. Debitage incompletely studied
Kings Road	390	6,570	17/1	.06	Debitage surface collected
Swale	241	914	3.8/1	.26	Debitage surface collected
Templeton	75	7,360	98/1	.01	100% excavation
Corditaape	167	1,400	8.4/1	.12	Debitage surface collected
Potts	711	2,930	4.1/1	.24	Excavation within grid plus surface collection over whole site
Lamb	82	494	6/1	.17	Nearly 100% excavation
Vail	2,732	4,378	1.6/1	.62	Sample mostly from grid excavation

site is not included in Table 42 because local jaspers were difficult to distinguish from non-local jaspers (Kraft 1977). The definition of “non-local” refers to a source or sources outside the immediate drainage system where a particular site is located. On most of the sites the non-local material is chiefly Pennsylvania jasper (Hardyston chert). Minority exotics include Upper Mercer, Ohio chert and the Western New York Onondaga chert type Divers Lake.

It is worth noting that the identification of “exotic cherts” is neither simple nor easy. Some are readily distinguished from local cherts, others are not. This is especially true of items made of materials from sources located at large distances from areas familiar to archaeologists. Even local stones may need petrographic or trace element examination for confident identification. Some assemblages described here produced artifacts manufactured from cherts lacking clear-cut attributes of color and texture that would enable their classification by simple

Table 41. Measurements of Paleoindian site productivity: comparisons of lithic assemblage size in relation to size of excavated area, to number of artifacts per square meter, to number of debitage items per square meter, to total areas of sites, and estimated total numbers of artifacts (N/A means not applicable).

Site	Number of artifacts	Excavated area (sq. m.)	Number of artifacts per sq. m.	Total area of site (sq. m.)	Estimated total number of artifacts	Number of cores and flakes	Number of debitage items per square meter
Port Mobil	144	N/A (disturbed area)	N/A	Unknown	N/A	No data	N/A
Twin Fields	114	500	.23 (computed using total site area)	230 (100% excavation)	114	No data	N/A
Zappavigna	110	154	.71	1800	1,278	1550	10
West Athens Hill Area B	970	207	4.7	700	3,290	10,408	50.2
West Athens Hill Area C	1,228	156	7.9	324	2,560	No data	N/A
Kings Road	390	N/A (surface collected)	N/A	400	N/A	6570	N/A
Swale	241	N/A (surface collected)	N/A	400	N/A	914	N/A
Templeton	75	93	1.8 (computed using total site area)	43 (100% excavation)	75	7360	171 (computed using total site area)
Davis	10	N/A (surface collected)	N/A	1,350	N/A	No data	N/A
Corditaape	167	N/A (surface collected)	N/A	6,730	N/A	1400	N/A
Potts	711	773	.92	5,500	5,060	2,930	3.8
Lamb	82	174	.47	300	111	494	2.8
Vail	2,732	300+	9.1	5,600	50,960	4,378	14.5

Table 42. Frequencies of artifacts made of non-local cherts in chipped stone assemblages from Paleoindian sites in central and eastern New York.

Site	Total Sample of Chipped Stone Artifacts	Number of Artifacts of Non-Local Cherts in the Sample	Percentage of Items made of Non-Local Cherts
Zappavigna	103	5	4.9
Twin Fields	121	16	13.2
West Athens Hill, Areas A and B	1,308	22	1.7
West Athens Hill, Area C	1,153	7	0.6
Kings Road	384	35	9.1
Swale	247	122	49.4
Davis	10	3	30
Corditaipe	161	34	21.1
Potts	708	8	1.1

visual inspection, even after years of experience. These are often “gray” cherts resembling materials from several different bedrock sources. This is the case, for example, with many items from the Corditaipe site. At least two dozen resisted confident assignment to Western Onondaga chert and may have been cherts from local Eastern Onondaga outcrops, and therefore are not included in the “exotic” categories in the tables.

As shown in Table 43, there are striking differences in the percentages of exotics in the assemblages. The largest frequencies are shown for the Twin Fields, Swale, Davis, and Corditaipe sites. The smallest are indicated for the Potts and West Athens Hill sites. Potts is a surprise because due to its central location one might expect significant amounts of Vanport chert, Upper Mercer chert, and other lithics from the Ohio region, some jasper from the Hardyston quarries, and larger quantities of Normanskill and other cherts from the Hudson valley. Most impressive is the very high amount of Pennsylvania jasper in the Swale collection, plus other red cherts perhaps obtained from the Munsungan quarries in Maine. One is tempted to speculate that the Swale material represents a pioneering group

from the Delaware Valley, but Swale is almost certainly part of the same encampment as the adjoining Kings Road site, which features a much lower incidence of red cherts (including one piece of Munsungan chert). The Port Mobil site is not included because local jaspers were difficult to distinguish from non-local jaspers (Kraft 1977).

As shown in Table 44, the highest percentages of non-local cherts occur in two artifact categories, end and side scrapers, but in all but two cases (Twin Fields, Davis) the end scrapers predominate. Scrapers were often reworked or resharpened, resulting in modification from their original sizes and shapes. These data indicate that scrapers were retained by their owners for longer periods than other tools; in other words, they were “curated” to a greater extent than other artifact categories. Either the exotic materials were considered to be superior to other materials for such implements, they were prized because the materials were of unusually high aesthetic appeal, or the tools were so broadly useful that they were kept close to and travelled with their owners, perhaps in animal skin bags. One thing is sure: the scrapers were far easier to make than bifaces, in particular

Table 43. Types of exotic lithic material in the chipped stone assemblages in central and eastern New York.

Site	Pennsylvania jasper, all varieties	Maroon jasper (including Munsungan jasper from Maine)	Vanport chert (Flint Ridge, Ohio "chalcedony")	Western New York Onondaga chert	Normanskill chert	Other	Total
Zappavigna	1?			4			5
Twin Fields	15	1					16
West Athens Hill Areas A, B	9			9		4	22
West Athens Hill, Area C	1			6			7
Kings Road	31	2	1			1	35
Swale	109	11	2				122
Davis		2			1		3
Corditaape	5			18	11		34
Potts	1	1			4	1	7

fluted points. On the other hand, points were an essential part of hunting weaponry, often broken or lost on the hunt and replaced, whereas the scrapers were less susceptible to breakage or loss and had a longer service life.

In support of the curation/reworking/rehabilitation hypothesis, the mean weight of 30 *end scrapers* from the Swale site, made of red and brown jasper, is 6.7 g (range 1.7 to 14.5 g), considerably less than the mean weight of 12.6 g (range 4 to 87.5 g) for 32 end scrapers of local material. Also, the mean weight of 23 Swale site *side scrapers* of exotic material is 25.5 g (range 1.5 to 243 g), much less than the mean of 90.7 g (range 7.3 to 216.4 g) for 15 side scrapers of local material.

On the other hand, the figures for the Kings Road site show a nearly identical average weight for *all* collected end scrapers, including those of local Normanskill chert, as compared with the *subsample* (n = 24) made of exotic stones, 7.3±4.0 vs. 7.5±4.7 g, respectively. End scrapers of exotic material in the Corditaape site assemblage have the same average weight as the scrapers of local

Onondaga chert: 4.8±1.7 to 4.9±1.8 g, respectively.

Examination of 13 end scrapers of exotic cherts from West Athens Hill does, however, show some support for the above hypothesis. This combined group from Areas A, B, and C has a mean weight of 6.5±2.4 g. This figure contrasts with the average of 7.1±3.1 g for the total sample of end scrapers of *all* materials from Areas A and B, and 8.9±11.7 g for the sample of *local* materials from Area C.

Patterns of Use-Wear Observed on Lithic Assemblages from Paleoindian Sites

It should be obvious that the principal forms of use-wear observed on stone tools from West Athens Hill and several other sites used in the analysis are edge-crushing, rounding/gloss, and edge-nibbling (see Table 45). Other variations include striations associated with rounding/gloss, or differential occurrence of the various types on different parts of the tools; for example, rounding and blunting on spurs or front corners of end scrapers, associated with crushing on the main bit or work-

Table 44. Frequencies of exotic lithic material by artifact types in the chipped stone assemblages in central and eastern New York.

Sites	Bifaces		End Scrapers		Side Scrapers		Other		Totals of Exotic Items	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
Zappavigna	1	20.0	4	80.0					5	100.0
Twin Fields	1	6.3	2	12.5	8	50.0	5	31.3	16	100.0
West Athens Hill Areas A and B	2	10.0	12	60.0	5	25.0	1	5.0	20	100.0
West Athens Hill Area C			4	57.1	2	28.6	1	14.3	7	100.0
Kings Road	2	5.7	25	71.4	5	14.3	3	8.6	35	100.0
Swale	5	4.1	56	46.3	21	17.4	39	32.2	121	100.0
Davis	1	33.3	1	33.3			1	33.3	3	100.0
Corditaape	2	5.9	24	70.6	6	17.6	2	5.9	34	100.0
Potts			5	62.5	1	12.5	2	25.0	8	100.0

ing edge. Sometimes the alterations are seen on lateral edges of end scrapers, or on the unretouched edges of side scrapers. Occasionally, polish is evident on dorsal surfaces of end scrapers, or on the faces of bifaces near lateral edges and tips. On utilized flakes, the primary form of alteration is nibbling on the longest, thinnest edges, with crushing or rounding/gloss less frequent.

As might be expected, the chief problem is interpreting the signs of use in terms of actual materials on which tools were applied, as well as the particular tasks for which they were made. Experimental approaches by various authors are the basis for our own sometimes tentative identifications (Keeley 1980; Semenov 1964; Wilmsen 1968).

Interpretation of Similarities and Differences Between Assemblages

Paleoindian lithic artifacts and their means of production exhibit general similarity across the Northeast and other parts of North America. There is, however, considerable variation on the major themes. Different assemblages seem to reflect a common technology

and a common mode of interaction with the end-of-Pleistocene environment. But in most cases, specific aspects of adaptation, such as animals hunted and trapped or plants collected, remain obscure given the spotty and variable evidence.

It is hard to suggest reasons for differences in the size and weight of fluted points and end scrapers from one site to another. Fluted points from the Lamb site in western New York and from the sites in Maine tend to be rather larger than those from the other sites in New York State. Possibly the game hunted at the Lamb site and the Maine sites was larger than that hunted at the Hudson valley sites, but in the absence of refuse animal bone this remains pure speculation. Similarly, it is interesting that end scrapers from most of the listed sites tend to be very similar in measured size and weight (except for scrapers from the Potts site that lie statistically outside the means from those from the other sites). The similarities must represent a range of optimal sizes for the tasks to which they were applied. This implies they were used in similar tasks, such as working hides, bone, or antler. The

Table 45. Wear patterns on chipped stone artifacts from Paleoindian sites in New York and New England.

Site	Bifaces	End scrapers (on bits)	Side scrapers (on retouched edges)	Other unifaces
Zappavigna	Fluted points show the usual basal and lower edge grinding. No wear present on stage 1 bifaces.	Crushing 1 Rounding/gloss 38	Rounding/gloss: 2	Retouched flakes: rounding/gloss 2, nibbling 1. Denticulates; rounding/gloss 2
Twin Fields	No data.	Crushing on several	No data	No data
West Athens Hill, Areas A and B	Fluted points show the usual basal and lower edge grinding. 15 of 53 Stage 1 bifaces show edge crushing and nibbling; 18 of 64 Stage 2 bifaces show edge crushing; 15 of 35 bifacial knives show rounding/gloss on edges; and most miscellaneous bifaces have crushing or nibbling.	Crushing on most	Crushing on most	Crushing on many flake knives and retouched flakes. Nibbling on utilized flakes.
West Athens Hill, Area C	Fluted points show the usual basal and lower edge grinding. Very little wear (nibbling, rounding/gloss) seen on other bifaces.	Crushing on 9, crushing and rounding/gloss on 1, rounding/gloss on 13.	Crushing on 4, crushing and rounding/gloss on 2, rounding/gloss on 8.	Crushing on 5 retouched flakes, rounding/gloss on 2.
Kings Road	Fluted points show the usual basal and lower edge grinding. Other bifaces manifest frequent edge crushing and rounding/gloss.	Predominantly crushing	Predominantly crushing	Predominantly crushing
Swale	Fluted points show the usual basal and lower edge grinding. Variable rounding/gloss on 9 bifaces of Stages 1, 2, 3; crushing and rounding/gloss on 3 items	Crushing; on 75 scrapers; 24 of them also have rounding/gloss; plus various combinations of striations; dorsal polish, and nibbling	Various combinations of crushing and rounding/gloss predominant (21); also some rounding/ gloss without crushing (5)	Crushing on 13 objects (flake knives, retouched flakes, end-side scrapers); crushing and rounding/gloss on 2 items; rounding/gloss on 2; nibbling on 1; crushing and nibbling on 1

Continued.

Table 45. continued.

Site	Bifaces	End scrapers (on bits)	Side scrapers (on retouched edges)	Other unifaces
Corditaape	Fluted points show the usual basal and lower edge grinding. 1 of 18 bifaces in process showed rounding/gloss on 1 edge.	Crushing on most but some show edge-nibbling, rounding/gloss, and striations	7 show rounding/gloss on edges; 2 show nibbling; others show crushing	Rounding/gloss on 2 flake knives; rounding/gloss and nibbling on a denticulate tool
Potts	Fluted points show the usual basal and edge grinding.	Crushing on most	Crushing on most	No data
Vail	Fluted points show the usual basal and edge grinding.	No scraper study except 27 showing phytoliths on working edges	No data	No data
Lamb	Fluted points (not fluted knives) show the usual basal and edge grinding.	No data	No data	No data
Templeton	The fluted point and "miniatures" were not ground on basal or lower lateral edges.	No data	Nibbling and polish on gravers and "spurs"	No data
Michaud	Fluted points show the usual basal and edge grinding.	No data	No data	No data

size was determined less by the original size of cores from bedrock sources than by the nature of the jobs as well as the mechanical fit to human hands and strength. Scrapers were almost certainly tied onto or inserted into hafts of bone, antler, or wood, since they would have been difficult to hold in the hand for prolonged use.

The percentage of artifacts in relation to debitage for excavated sites ranged from .01 at the Templeton site to .62 at the Vail site, with West Athens Hill toward the lower range at 0.09. Despite the considerable quarrying and reduction of chert on the hill, the ratio of debitage to artifacts of 11 to 1 is lower than at all the other sites except Lamb at 6 to 1, Potts at 4.1 to 1, and Vail at 1.6 to 1. One might speculate that the difference is explained by recovery methods: soils at West Athens Hill were troweled rather than screened. Perhaps many small flakes were missed that might have increased the sample, resulting in a higher ratio. Screens were employed in excavations at the Lamb, Potts, and Vail sites, where nevertheless the ratios were smaller than at West Athens Hill. Possibly, the specific kinds of reduction processes differed from site to site. An emphasis on thinning and retouch as opposed to production of preforms might result in the deposition of many small flakes, as exemplified at Lamb, Potts, and Templeton. A greater emphasis on primary reduction and manufacture of preforms would presumably produce fewer and larger flakes, relatively speaking. This seems to be the case at West Athens Hill. Other factors such as length of occupation, size of occupying groups, number of occupations, and nature of activities must also be considered.

Differences in site productivity (i.e., the number of artifacts per square meter of excavation) are also subject to several variables. As noted before, West Athens Hill Areas B and C and Vail show the highest values at 4.7, 7.9, and 9.1 items per square meter, Templeton is at 1.8, and the rest are under 1. On the other hand, the number of debitage items per square meter was highest at the Templeton,

Vail, and West Athens Hill sites. Possible explanations relate to the length of occupation, the size of occupying groups, the number of separate occupations, and the nature and relative importance of on-site activities. It seems a daunting task to untangle these causative factors in order to explain the similarities and differences.

Wear patterns in bifaces and unifaces are remarkably consistent from site to site. Apart from the preparation of fluted points for hafting by grinding the bases and lower lateral edges, not really a product of use-wear, bifaces show a preponderance of rounding/gloss on lateral (working) edges, and less crushing (step-flaking) or nibbling. End and side scrapers, on the other hand, display a predominance of edge-crushing, in some cases combined with rounding/gloss and striations. Rounding/gloss prevailed only at West Athens Hill Area C.

These patterns reflect a uniformity in the materials to which the tools were applied, across a wide geographic area. Again, despite the complexity of possible alterations due to the effects of different materials, it is suggested that rounding/gloss on end scrapers is primarily due to hide-working or currying, on bifaces due to meat-cutting. Edge-crushing, on the other hand, must be the result of pressure exerted on hard substances such as wood, bone, and antler. Presumably, therefore, biface knives and scrapers were essential equipment for the survival of Paleoindian bands, part of the technology developed to deal with resources available in the late-glacial environment.

Inferred Activities: No subsistence remains, nor indeed have any organic substances survived the agents of decay on the Paleoindian components in the local study area. Therefore, we are forced to depend on the lithic assemblages for inferences concerning the various tasks and activities performed at these sites. Functional aspects, rather than culture-historical attributes of artifacts, are essential to such analyses. The following combinations of functional types (see Table 46 and Figure 46) are

linked with high probability to specific activities:

- Hunting and butchering: finished projectile points, other finished bifaces such as knives, and utilized flakes.
- Fishing: netsinkers. not applicable in this case.
- Plant food processing: pitted stones, milling stones, mortars, pestles, mullers.
- Biface production: bifaces in process, hammerstones, anvilstones, hammer-anvilstones, grooved abraders.
- Hide-, bone-, and wood-working: end and side scrapers, other unifaces.

Internal Patterning: As noted above the apparent clustering of artifacts in Area B at West Athens Hill was hypothesized to represent family dwelling or workshop areas, but my latest analysis inclines me to doubt that more than perhaps 5 or 6 of the 13 originally proposed clusters may have had reality in pre-historic time. Any patterning that may have existed in Area A was destroyed by the bulldozing for the telephone company microwave tower foundation. No obvious patterning was observed in Area C. Some other northeastern Paleoindian sites have produced evidence for

horizontally discrete loci, not necessarily created at the same time. Examples include the 4 to 5 loci at the Corditaip site, the 7 or 8 at the Potts site, the 42 at Bull Brook, 3 or 4 at Whipple, and the 18 to 36 at Vail. Concerning the Vail site, Gramly (personal communication 2002), now believes that there were at most 6 or 7 occupations, on the basis of his analysis of conjoined fluted points from the primary campsite and the killing ground.

Such non-random distributions can be interpreted in several ways. One is that larger clusters like those at Bull Brook, Potts, Corditaip, and Vail represent occupations by individual bands. It may prove difficult to establish whether those bands were all present on site at the same time, or came and went at different times. If from simultaneous occupations, the clusters may represent subgroups, perhaps extended families, within large bands.

Place in Regional Settlement Systems: Data concerning settlement aspects of the above-listed habitation and quarry-workshop sites are augmented by analysis of the distribution of isolated finds of fluted points, as well as characteristic unifaces made of jasper and other exotics that characteristically represent Paleoindian occupancy (Funk 1993;

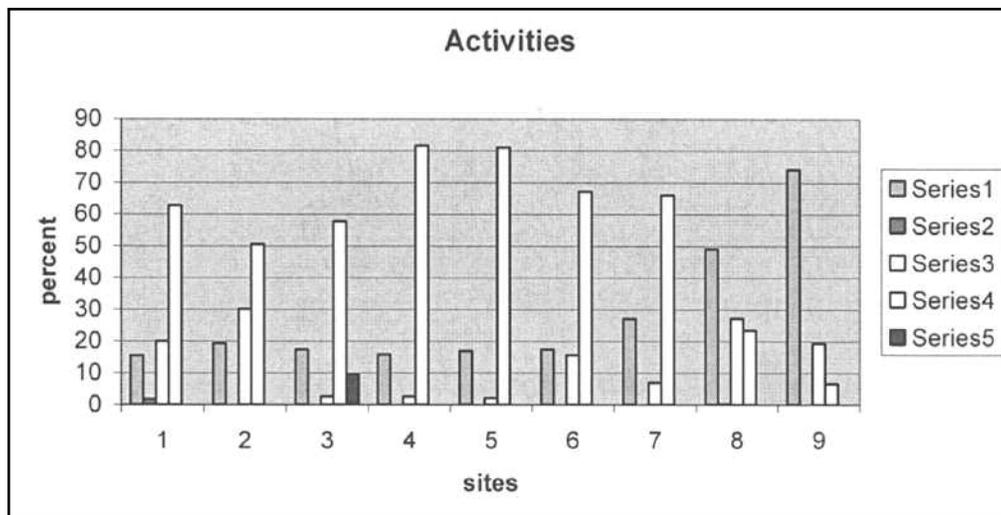


Figure 46. Bar graph comparing the relative importance of the hypothesized activities at Paleindian sites in central and eastern New York. Series (activity) and site numbers correspond to those in Table 46.

Table 46. Relative importance of activities at Paleoindian sites in central and eastern New York inferred from the frequencies of stone tools representing particular tasks.*

Activity	Zappavigna (1)		Kings Road (2)		Swale (3)		Twin Fields (4)		Potts (5)		Corditaape (6)		Port Mobil (7)		West Athens Hill Areas A, B (8)		West Athens Hill, Area C (9)	
	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
1. Hunting and Butchering	17	15.5	107	27.4	42	17.0	18	15.8	120	16.9	29	17.4	39	27.1	749	49.1	910	74.1
Fishing	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2. Plant food Processing	2?	1.8	0	0		0	0	0	0	0	0	0	0	0	3?	0.2	0	0
3. Biface Production	22	20.0	105	26.9	39	15.8	3	2.6	15	2.1	26	15.6	10	6.9	414	27.2	237	19.3
4. Hide and/or Woodworking	69	62.7	177	45.4	143	57.9	93	81.6	576	81.0	112	67.1	95	66.0	359	23.5	81	6.6
5. Other	0		1	0.3	23	9.3												
Totals	110	100.0	390	100.0	247	100.0	114	100.0	711	100.0	167	100.0	144	100.0	1,525	100.0	1,228	100.0

*Activity and site numbers correspond to numbers in Figure 46.

Gramly and Funk 1990; Ritchie 1957; Wellman 1982). A settlement pattern much like that of later cultures is indicated. Isolated finds and defined sites occupy the same landforms, in relation to many of the same resources, as Late Archaic/Terminal Archaic groups.

To summarize the data for isolated finds of fluted points in the Hudson valley (Ritchie 1957; Wellman 1982):

Albany County: 2, from the Pine Bush on the delta of glacial Lake Albany.

Greene County: 3, from high fields along the river.

Orange County: 1, near Allard's Corners.

Richmond County (Staten Island): 1.

Saratoga County: 4, including one from a high field along the river, another from the upland headwaters of the Snook Kill, a tributary of the Hudson.

Schenectady County: 1.

Ulster County: 5 (3 from the glacial terrace at or near the Twin Fields site).

Westchester County: 1 from the hilly interior.

These counts differ from a previous report (Wellman 1982) in that the points from excavated sites or systematically collected surface sites such as West Athens Hill, Kings Road, Port Mobil, and Twin Fields are not included.

The major stages of fluted point development are represented in the group illustrated by Ritchie (1957), including the Gainey-Debert (Ritchie 1957: Plates 3A and 3B, Figures C and D; Plates 2A and 2B, Figures F and G), Cumberland-Barnes (Plates 1A and 1B, Figure A; Plates 10A and 10B, Figure B); and Crowfield (Plate 6, Figure B; Plates 10A and 10B, Figure C).

Since and overview in *Archaeology of Eastern North America* (Wellman 1982), a few additional discoveries of fluted points have been reported for the Hudson valley. A complete re-inventory must await future study and publication. Two were found on the lowlands of Greene County during contract archaeology investigations by Hartgen Archaeological Associates (Karen S. Hartgen, personal communications 1993, 1997). A sur-

face site on a hill in Saratoga County produced four fluted points of relatively late styles (Funk and Walsh 1988). Also, three fluted points were recovered by Brennan (1977) and his associates from the Piping Rock site in Westchester County. Because these locales are considered *sites*, as opposed to *isolated finds*, those points are not listed in the above county inventory. Although this report is concerned mainly with early Paleoindian manifestations, we might also note that late Paleoindian artifacts bearing typological resemblances to the assemblage from the Reagen site in Vermont (Ritchie 1953, 1957) have been recovered from some parts of the study area (Funk 1976; Funk and Schambach 1964). Among these is a group of parallel-flaked lanceolate projectile points of "Plano" form found in a feature at the Lower Saranac River site near Lake Champlain and radiocarbon dated ca. 7000 B.P. (Karen S. Hartgen, personal communication 1993).

Thus, both sites and isolated finds in Orange County exemplify the same relation to the Black Dirt Area as later groups. Finds also tend to be located along major river systems and lakes elsewhere in New York (Ritchie 1957, 1965). Most of the sites, even the Dutchess Quarry Caves, contained artifacts of later cultures and demonstrate the overlap in activities of these very different periods across the landscape. In other words, Paleoindian sites and find-spots are not necessarily to be found at higher elevations well above, or far from, present-day drainage patterns. There is no evidence that these people required special environments. Paleoindians entered deglaciated terrain some time after the retreat of the last Wisconsinan ice, a terrain already evolved well along in the direction of its modern configuration. What was different in the terminal Pleistocene milieu were the regimens of temperature and precipitation, and the species of plants and animals living within the spruce-fir forests that were rapidly changing toward a pine-oak forest. Undoubtedly, however, some geomorphic change took place, for example, in meandering of rivers that would have

destroyed some Paleoindian sites, or in the form of colluvial action that would have buried some sites under sediment.

There have been few reports of Paleoindian isolated finds in uplands and mountainous areas, and no reports of *sites* per se. Perhaps 3 fluted points have been reported in the Adirondack Mountains; this count does not include 11 points found along or near the west shore of Lake Champlain including 5 from the Davis site (Wellman 1982). Small encampments of Archaic and Woodland periods do occur with some frequency on Adirondack lakes and streams, but few Paleoindian sites are on record for upland regions within the Glaciated Appalachian Plateau. Several retouched flake tools of brown Pennsylvania jasper, Paleoindian in style but without associated fluted points, were found on a farm in the uplands of the Delaware Valley near Delhi (reported by Frank Schambach and seen by the writer, ca. 1972). As archaeological survey and excavation projects continue and uplands become better known, with less bias toward lowland and major riverine locations, sites ranging in age from Early Archaic to Late Woodland have been turning up with regularity, and it is only a matter of time before Paleoindian sites, perhaps large and productive ones, are discovered in upland regions.

Fluted points are rare in collections from the east side of the Hudson valley, and no sites per se have been reported there unless the multicomponent Piping Rock site is accepted as such. The situation in the mid-twentieth century prompted Ritchie (1957: 11) to suggest that during warm-weather excursions of Paleoindians into the valley from southern regions, their "cultural equipment was unequal to the crossing of this wide and deep river." Similarly, Dincauze (2001) proposed that because of lower sea level during the Late Pleistocene, the southern reaches of the Hudson River flowed through a deep gorge that prevented Paleoindians from crossing from the west shore to the east shore.

Dincauze further proposed that Paleoindians entered New England by way of a northern route south of the retreating ice front, presumably crossing the narrower, shallower, less intimidating stretch of the river just south of Lake George and Lake Champlain. I am skeptical of this model, not only because some fluted points have been found in Westchester County, or because both points and sites are on record for immediately adjoining Connecticut, but because there has been relatively meager professional *and* amateur survey activity in those New York counties situated along the river's east side. I suspect that more fluted points and even substantial Paleoindian sites will eventually be found there. Furthermore, it is entirely possible that Paleoindians had crude but serviceable watercraft and would not have been fazed by the prospect of crossing the Hudson fjord (Engelbrecht and Seyfert 1994).

With so few sites currently known and almost no direct evidence of subsistence traits, it is premature to offer detailed models of New York Paleoindian settlement systems—placing sites in seasonal rounds, for example, and linking them up with inferences about the movements of bands. The following preliminary scheme of functional site types is offered:

Quarry-workshops located some distance from lakes, ponds, or running water: West Athens Hill.

Open-air workshops/camps on low flat ground near quarries and small streams: the flats around Flint Mine Hill, the Railroad site near West Athens Hill, the Kings Road and Swale sites near the Scott Farm quarries.

Open-air habitation sites near relatively large streams and good fishing resources: Port Mobil, Twin Fields, Corditaie, "Hallock."

Open-air habitation sites near small creeks and brooks: Zappavigna, Potts, Davis.

Sheltered sites (caves, rockshelters) located at some distance from running water: Dutchess Quarry Caves 1 and 8.

Summary of Intersite Comparisons:

Most local Paleoindian sites lie at low relief. The exceptions are West Athens Hill and the Dutchess Quarry Caves. The sites are, however, in varied topographic settings. The occupations were on ground that was level to gently sloping, except for the relatively steep slopes adjoining Areas B and C at West Athens Hill, on which some quarrying took place. Most sites are on glacially derived soils including the Lake Albany clays (exception: the Templeton site on a flood plain). Most are located in cultivated fields (again, the exceptions are West Athens Hill and the Dutchess Quarry Caves). Occupied areas range from small (the caves, 30 to 45 sq. m.) to fairly large (open-air sites up to 8,100 sq. m.). Most are located within 100 m of fresh water (the exceptions are the caves and West Athens Hill). Most are near (within 800 m or less) bedrock sources of good quality chert (the exceptions are Potts and Corditaip). Most New York sites lack evidence of Paleoindian subsistence practices (the Hiscock site and just possibly the Dutchess Quarry Caves may be the exceptions). Most pertain to the Gainey-Debert period of early Paleoindian, but there is some evidence of occupation during the Cumberland-Barnes period. Radiocarbon dates from about 11,000 to 10,400 B.P. are confined to the Hiscock and Arc sites in western New York State. Artifacts in the assemblages are generally similar, the basic bifacial and unifacial types are repeated over and over. However, the assemblages show considerable variation in *type frequencies*; hence perhaps, in the relative importance of tasks and activities. Most of the assemblages show strong similarities in the

size and weight of bifaces and unifaces, but artifacts in certain assemblages tend to be smaller than those in the majority. The Vail, Potts, and Swale sites show the highest ratios of artifacts to debitage. Productivity in terms of artifacts and debitage per square meter of excavation was highest at Templeton, Vail, and West Athens Hill. All the New York sites display exotic cherts among chipped stone items. The percentages vary, however, as do the types of exotic stones represented. The assemblages with the highest percentages of exotic stones were at Twin Fields; Kings Road/Swale, and Corditaip (the very small Davis site collection is not considered here), but Pennsylvania jasper was most heavily represented at Kings Road and Swale. On most sites, exotic materials are seen primarily in end scrapers, secondarily in side scrapers. Patterns of wear on unifaces consist chiefly of edge-crushing on the bits or working edges, with rounding/gloss secondary. Wear on bifaces consists mainly of rounding/gloss. The primary activities represented are hunting/butchering, biface manufacture, and hide-, bone-, or wood-working. There is little to no evidence for plant food processing. Internal patterning, in the form of discrete loci or clusters of artifacts—and sometimes features—was observed in just a few sites; West Athens Hill Area B, Potts, and Corditaip in New York, and Bull Brook, Vail, and Whipple in New England. The eastern New York sites are too few and too scattered, and subsistence data are too sparse to model subsistence-settlement systems in any detail. Nevertheless, known sites and isolated finds of fluted points are located in the same places on the landscape as the traces of later peoples.

THE POSITION OF WEST ATHENS HILL AMONG THE PALEOINDIAN SITES OF NEW YORK STATE

West Athens Hill is the only substantial quarry-workshop (with a possibly associated encampment) on record in New York State. Rare finds of fluted points on Flint Mine Hill do, however, indicate a Paleoindian presence there. It is also possible that sizable fluted point components await systematic excavation at the Mountain Top Quarries, Scott Farm quarries,⁷ and other chert-bearing stations in Greene County and the rest of the Hudson valley.

Apart from the caves on Mount Lookout, West Athens Hill is the only site elevated well above the surrounding terrain. It is an open site, not a cave or rockshelter, and is the largest of the studied sites, exceeding the Potts and Corditaie sites in area. As is the case with Potts, Vail, and Corditaie, it produced evidence of intrasite activity loci.

Slope on West Athens Hill is variable, but ground surfaces at the occupied loci were either level or gently sloping. Soils atop the hill are derived from glacial till, and this is typical of most of the other sites. The site is roughly 800 m (one-half mile) from the nearest source of drinking water. Nearly all the other sites are within 100 m of fresh water.

Like all the other central and eastern New York sites, *possibly* excepting the Dutchess

Quarry Caves 1 and 8 (Funk and Steadman 1994), West Athens Hill lacked subsistence remains. Also like the others, it failed to produce datable organic substances pertaining to the Paleoindian occupation; only the Hiscock site (Laub, et al. 1988) and the Arc site (Tankersley, et al. 1997) in western New York have been successfully radiocarbon dated.

The relation of occupying bands to local food resources is not known, but I suspect that they hunted the caribou and other late Pleistocene fauna, as hypothesized for the Swale and King Road sites. It is even possible that the people who occupied West Athens Hill were the same people who occupied the Kings Road and Swale sites. The fluted point styles indicate West Athens Hill was, like the other sites, occupied mainly in the Early Paleoindian Gainey-Debert period, but there is reason to believe it was also occupied in the Cumberland-Barnes period.

The artifact assemblage from West Athens Hill is typologically very similar to assemblages from other northeastern sites. The principal contrasts are in the large quantities of quarry-workshop debris and hammerstones from West Athens Hill. Oddly, the ratio of debitage to artifacts at the site is not unusually high, compared to the others (Table 40). Like

⁷ Both the Mountain Top and Scott Farm quarries have been extensively disturbed, the former by landscaping for a private home and construction of an apartment complex, the latter by removal of the most extensive chert-bearing deposits for "road metal" early in the 20th century. Nevertheless, substantial areas of both locations remain intact and could contain important workshops and campsites of the Paleoindian period.

those sites, no objects of bone, antler, wood or other organic materials survived alongside the stone tools.⁸ Along with the Vail site, West Athens Hill sports the highest artifact per square foot figures in the comparisons of productivity (Table 41).

Measurements of the size and weight of bifaces and unifaces from West Athens Hill are surprisingly close to measurements for most

of the other assemblages, suggesting functional and mechanical restrictions on those attributes. Another shared trait is the presence of non-local cherts. But the ratio of exotics to local material on the site is among the smallest of any of the sites.

Table 47 summarizes the various comparative factors discussed in previous pages.

⁸ Some of the bone tools from Dutchess Quarry Dave No. 1 (Funk and Steadman 1994) could have been associated with the Paleoindian occupation.

Table 47. Summary of data for Paleoindian sites mentioned in the text. N/A means not applicable.

Part One

Site	Local relief in feet	Local setting	Structure	Site area (sq. m.)	Distance to potable water (m)	Subsistence	Relation to chert sources	Inferred activities	Internal patterning	Settlement type
Port Mobil	10-50	Knolls and glacial terrace by Arthur Kill	Open site. Variable slope.	No data	<100	No data	Local vs. Pennsylvania jaspers	Hunting/ butchering, biface production, hide-, bone- or wood-working	No data	Multipurpose camp
Zappavigna	35	Ridge in rolling terrain	Open site. Slope 0-2 percent. Soil Mardin Gravelly Silt Loam.	1,800	<100	No data	Local Walkkill Valley sources and mid-Hudson cherts	Same as above	None apparent	Multipurpose camp
"Hallock"	10-20	Gentle slope down to Walkkill River	Open site. Slope 0-2 percent. Soil gravelly silt loam.	No data	800	No data	Chert in local bedrock	Hunting; no other data	No data	Hunting camp?
Dutchess Quarry Caves 1, 8	200	Hill in rolling terrain and Black Dirt Area	Caves. Level interior floors. Soil unclassified cave deposits.	Cave 1: 45. Cave 8: 30	800	Unreliable association with caribou bones	Chert in local bedrock	Hunting	None apparent	Short-term special purpose refuge
Twin Fields	50	Glacial terrace above creek	Open site. Level. Soil is Hoosic Gravelly Sandy Loam.	230	<100	No data	Local Walkkill Valley sources	Same as above (very minor biface production)	None apparent	Multi purpose camp
West Athens Hill Area B	250	High rock ridge near flats and Helderberg escarp-	Open site. Variable slope. Soil Cossayuna Gravelly Silt Loam.	700	800	No data	Chert outcrops on site	Quarrying chert, hunting/ butchering, biface production, hide-, bone-,	Possible small artifact clusters; houses or task areas?	Quarry- Workshop

Table 47. Part One, continued.

Part One

Site	Local relief in feet	Local setting	Structure	Site area (sq. m.)	Distance to potable water (m)	Subsistence	Relation to chert sources	Inferred activities	Internal patterning	Settlement type
		ment						or wood-working		
West Athens Hill Area C	200	Same as above	Open site. Slope 0-5 percent. Soil same as for Areas A and B.	324	800	No data	Same as above	Same as above	None apparent	Quarry-workshop
Kings Road	10-30	Clay flats near knolls and ridges	Open site. Level. Soil is Vergennes Clay.	400	<100	No data	Chert quarries within 1/2 mile (800 m)	Hunting/butchering, biface production, hide-, bone-, or wood-working	None apparent from surface indications	Multi-purpose camp
Swale	10-30	Same as above	Same as Kings Road	400	<100	No data	Same as above	Same as above	Same as above	Multi-purpose Camp
Davis	20-150	Terrace of Lake Cham-plain	Open site	1,350	<100	No data	Chert quarries within a few miles	Hunting/butchering, hide-, bone-, or wood-working	No data	Multi-purpose camp?
Potts	30-40	Drumlin in rolling topography on Lake Iroquois plain	Open site. Slope variable. Soil Sodus gravelly sandy loam.	5,500	<100	No data	Onondaga chert outcrops 25-30 miles distant	Hunting/butchering, biface production, hide-, bone-, or wood-working	Four to six loci	Multi-purpose camp
Corditaape	20	Outwash terrace along creek	Open site. Level. Soil a gravelly loam.	6,730	<100	No data	Onondaga chert outcrops within 5-7 miles	Same as above	Four loci	Multi-purpose camp
Lamb	10-20	Outwash plain next to kettle hole bog	Open site. Level. Soil a gravelly silt loam.	300	<100	No data	Ohio cherts	Hunting/butchering, biface production, hide-, bone-, or wood-working (very	None apparent	Pioneering hunting camp

Table 47. Part One, continued.

Part One

Site	Local relief in feet	Local setting	Structure	Site area (sq. m.)	Distance to potable water (m)	Subsistence	Relation to chert sources	Inferred activities	Internal patterning	Settlement type
Vail	10-30+	Valley bottom slope adjoining high mountains	Open site. Slope ca. 5 percent.	5,600	<100	No data	Nearest outcrops 15-30 miles to north	minor) Same as above	18-36 loci	Multi-purpose camp
Michaud	10-35	Outwash plain	Open site. Slope ca. 5 percent.	No data	<100	Calcined mammal bones	Various cherts in Maine	Same as above	Several "clusters"	Multi-purpose camp
Templeton	10-15	Flood plain terrace	Open site. Level. Soil is Wind-sor Loamy Fine Sand.	43	<100	Charred acorns	Local Stockbridge Marble cherts	Same as above	None apparent	Multi-purpose camp

Part Two

Site	Excavated area (sq.m.)	Debitage sample	Artifact sample	Artifacts/debitage	Productivity (artifacts per sq.m.of excavation)	Pct. non-local cherts	Mean weight end scrapers	Wear patterns on unifaces (predominant)	Assemblage diversity (no. of functional types/total artifacts)
Port Mobil	N/A	No data	144	N/A	N/A	No data	No data	No data	N/A
Zappavigna	154	1,550	110	.07	.71	4.9	5.5+/-2.7	Round-ing/gloss	.08 (9/110)
"Hallock"	Not applicable, surface collected	No data	Several fluted points	No data	N/A	No data	No data	N/A	N/A
Dutchess Quarry Caves 1, 8	Cave 1: ca. 27 Cave 8: Ca. 8	Almost nodebitage	Cave 1: 1 fluted point. Cave 8: 5 fluted points	N/A	N/A	N/A	N/A	N/A	N/A
Twin Fields	500	N/A	114	N/A	.23	13.2	6.7±3.1	Crushing	.08 (9/114)
West Athens Hill	207	10,408	970	.09	4.7	1.7	7.1±3.1	Crushing	.01 (11/970)

Table 47. Part Two, continued.

Part Two

Site	Excavated area (sq.m.)	Debitage sample	Artifact sample	Artifacts/debitage	Productivity (artifacts per sq.m.of excavation)	Pct. non-local cherts	Mean weight end scrapers	Wear patterns on unifaces (predominant)	Assemblage diversity (no. of functional types/total artifacts)
Area B									
West Athens Hill Area C	156	Debitage not completely studied	1,228	N/A	7.9	0.6	8.8±11.5	Rounding/gloss	.008 (10/1,228)
Kings Road	N/A; surface collected	6,570	390	0.6	N/A	9.1	7.3±4.0	Crushing	.03 (11/390)
Swale	N/A; surface collected	914	241	.26	N/A	51.8	9.6±12.2	Crushing, in combination with rounding/gloss	.04 (9/241)
Davis	N/A, surface collected	No data	10	N/A	N/A	30.0	No data	No data	N/A
Potts	773	2930	711	.24	.92	1.0	11.8±4.6	Crushing	.02 (11/711)
Corditaape	N/A; surface collected	1,400	167	.12	N/A	21.1	4.9±1.8	Crushing	.04 (7/167)
Lamb	174	494	82	.17	.47	ca. 100	No data	No data	.09 (8/82)
Vail	300+	5,720	4,195	.73	14.0	No data	No data	No scraper study except for 27 specimens showing phytoliths on working edges	.002 (9/1,195)
Michaud	No data	1,462	122	No data	No data	No data	No data	No data	.07 (9/122)
Templeton	93	7,360	75	.01	1.8	Zero	N/A	Nibbling and polish on graters and "spurs"	.15 (11/75)

A SPECULATIVE RECONSTRUCTION OF PALEOINDIAN QUARRY AND WORKSHOP ACTIVITY

On the basis of his detailed study of chert quarries and workshops in the Wallkill Valley, Phillip La Porta (personal communication 1999) has proposed a “folk geology” that enabled prehistoric denizens of the area to locate, test, and extract chert from regional outcrops. Millennia of experience in the Old World, and later in the New World, created a large and eminently practical body of traditional knowledge that, passed orally from one generation to another, would have enabled hunter-gatherers entering new territory to discern promising rock formations from the “lay of the land.”

Paleoindians were in unfamiliar territory upon first entering what is now the northeastern United States, yet they had traversed very similar terrain on their way through parts of North America lying to the west and south. They had perfected their survival skills in late-glacial environments, even before their ancestors crossed the Bering Strait land bridge from Siberia some 12,000–13,000 years ago. Upon arriving in the Hudson valley, Paleoindians were already familiar with the animals and plants needed for sustenance, and they would have been able to evaluate the potential of local bedrock exposures for cherts instead of wandering haphazardly around the landscape. They quickly located and exploited outcrops of the stones needed to make weapons and tools.

Fortunately, the Hudson valley abounds in a variety of high-quality cherts as well as other rocks and minerals useful for tools, also perhaps for pigments used in body paint, decorating bone and antler objects, and so on.

West Athens Hill was only one of many excellent sources of chert that was available to Paleoindians and their successors in the middle valley.

Having located promising bedrock sources of chert, the Indians would set about evaluating the suitability of the outcrops for their purposes. One consideration would be the relative ease of access to the chert: whether too deeply buried, too high on a mountain or cliff face, or requiring too much time and effort to mine. Others would include the amount of chert within an outcrop, the thickness of nodules or veins, the degree of weathering, and its general appearance. After extracting chert from the mother rock, the Indians would examine such attributes as the size of tabular pieces, vein plates, or nodules in terms of the size of artifacts to be produced; the quality of material in terms of homogeneity and the presence or absence of impurities; the presence or absence of cortex, seams or vesicles that might interfere with the flaking process and lead to premature breakage; and less crucial “aesthetic” factors such as color, texture, and luster.

Once selected, a bedrock source would be exploited by attacking the veins or nodules using cobble hammers, as at West Athens Hill, or large, discoidal quartzite hammers or wedges such as those reported by La Porta on the Wallkill Valley quarries.

The organization of people for quarrying would not necessarily be highly formalized. Like the great majority of ethnographically known hunters and gatherers, Paleoindian bands were undoubtedly egalitarian, organ-

ized by age and sex statuses, with very little specialization of any kind, and it seems likely that men, women, and children all participated in different activities. Men, with their larger muscles, would doubtless have handled the tasks requiring the most strength, such as extraction from the rock matrix, moving large rocks, and the lifting and carrying of heavy chert samples. Women and children may have done some of the extraction less demanding of strength and taken part in most other quarrying activities, including: raking away tailings from the quarry face, selecting blocks and plates that would best serve as cores, rejecting less suitable materials, and packing and transporting of lighter chert samples.

At ateliers, whether on top of West Athens Hill or down on the flats, a comfortably level ground surface would be used for artifact production as well as other tasks. Perhaps men, women, and even older children were proficient at all stages of the reduction process. These skills were crucial to the survival of hunters and gatherers. Even though it is usu-

ally assumed that men did most of the hunting, and therefore were most proficient at making fluted points, bifacial knives, and other tools, it is possible that some women were equal, or even superior, to some men in chert-knapping skill (some women may also have been superior to some men in their hunting skills). A sexual division of labor would not necessarily preclude the occasional participation of women in "male" activities (or vice versa).

We might also consider the possible role of ritual accompanying the process of quarrying, selecting, and knapping chert. La Porta (personal communication 1999) has observed elaborate rituals taking place in concert with the quarrying of limestone in India and considers this activity to be analogous to the mining of chert in the New World. Historically, chert (flint) has had symbolic meaning in the myths and rituals of people in various parts of the world, including the Iroquois (George Hamell 1982, personal communication, 1990).

GENERAL CONCLUSIONS

One might speculate about the possibility of pre-fluted point occupations in the Northeast. It has proved very difficult to establish the reality of occupations older than about 11,500 years (uncalibrated) throughout the Americas. No one has yet succeeded in finding and describing "Pre-Clovis" manifestations to the satisfaction of the entire archaeological profession. The debate goes on (Bryan 1978; Dillehay and Meltzer 1991; Shutler 1983; West 1983, 1996). But if remains of such cultures exist within the glaciated Northeast, they could not be older than the beginning of deglaciation in any particular location, unless Pre-Wisconsin in age and confined to caves or deep fissures overridden by the ice. In the middle Hudson valley, deglaciation occurred around 15,000 radiocarbon years ago (Dineen 1996). Like later cultures "Early Lithic" complexes would have needed to acquire chert for the manufacture of their weapons and tools. Therefore, chert-rich locations like West Athens Hill, Flint Mine Hill, Scott Farm Quarry, the Mountain Top Quarries, and others, including the Munsungan sites in Maine, might be good places to look for traces of Pre-Clovis assemblages. Unfortunately, no evidence of such assemblages has been reported from these sites or other chert quarries in the Northeast.

Some writers have speculated that "Early Lithic" industries would look rather different from the familiar fluted point complexes. For example, Alan L. Bryan (personal communication 1980) proposed that bifaces would be much less important than in Paleoindian assemblages, even absent in most cases. Instead, the older assemblages would consist chiefly of various unifacial chopping, cutting,

piercing, and scraping tools. I doubt, however, that pre-fluted point people could get along without bifaces for hunting, butchering, and other tasks. Further, it seems unlikely that the first New World occupations would have given up the bifacial technology inherited from their Siberian predecessors, who have been dated as far back as 25,000 years, only to resume making bifaces by 11,000 years ago (West 1996).

The "Early Beringian" trait-complex of Alaska and the Yukon described by West (1996) represents a territorial expansion of the Dyuktai complex from northeastern Siberia and its principal manifestation is known as Denali. These traits were carried by people moving across the Bering Strait Land Bridge, an area of ocean bottom that was exposed to the sky during the drop in sea level caused by the accretion of the Wisconsin ice sheets that covered large areas of the globe. The lithic types included: bifaces of bipointed, ovate, or straight-based forms; end scrapers; side scrapers; limaces; burins; pieces esquillees; and wedge-shaped and conical blade cores. These complexes were ultimately derived from the Eurasian Upper Paleolithic (close relatives consisted of the Aurignician, Magdalenian, and Solutrean cultures). Radiocarbon dates strongly indicate that the initial occupation of eastern Beringia (Alaska) was no older than about 12,000 years. The once-popular belief that the first people to venture into the New World dated back 15,000–20,000 years or more has not been supported by recent research in the Arctic (Hopkins 1996; West 1996).

Fluted points are rare in the early Alaskan assemblages and where they do occur, apparently pertain to the initial Holocene epoch,

although an occupation very similar to the Agate Basin complex of the Great Plains, featuring lanceolate, parallel flaked projectile points, has been dated ca. 10,000-11,000 B.P. Geological and paleoecological data support the existence of an ice-free corridor between the Cordilleran and Laurentide ice lobes in western Canada from about 10,000 to 13,000 years ago. West (1996) postulates a rapid migration of Early Beringians down the corridor into the area that is now the United States. He further assumes that that vast territory had never before been occupied by humans. They were probably hunting large and small mammals, including mammoth, caribou, red deer, musk ox, and horse. At some time in their travels they developed a fluted point technology that spread rapidly throughout the continent.

It is possible that the earliest immigrants into our area possessed the basic Denali tool kit, including bifaces that had not yet been transformed by knappers into fluted points (fluting was actually a logical application of the Early Beringian sophisticated blade technology).⁹ This very early period of occupation probably would not have lasted more than a few decades, and sites would be few and far between. Unless archaeologists are fortunate enough to encounter assemblages with Early Beringian non-fluted bifaces and unifaces from the time of ca. 12,000 to 11,000 years ago, it may prove very difficult to demonstrate the reality of pre-fluted point occupations south of the Canadian border.

It remains possible that hidden among the numerous bifaces from West Athens Hill, Flint Mine Hill, and other investigated quarries are some bifaces derived from pre-fluted point components. Ovate and lanceolate bifaces, especially those in process, found on camps and workshops located in surrounding lowlands, would not attract much attention because lacking fluting, parallel flaking, stemmed basal portions, or other distinctive

attributes, they would appear indistinguishable from the products of later industries. Furthermore, "Early Lithic" unifaces might be hard to distinguish from Paleoindian unifaces.

We do know that no more than 3,000 or 4,000 thousand years after the final recession of the Wisconsin glacial ice from the mid-Hudson valley, but shortly before the final draining of glacial lake Fort Ann and its successors (ca. 10,300 radiocarbon years ago) (Dineen 1996), small bands of Paleoindians entered the area and discovered the excellent chert resources in the rock exposures of present-day Greene County. They established a succession of quarry-workshops and also, perhaps, short-term, limited-purpose camp sites atop West Athens Hill. By far the main attraction of the hilltop was the high-quality Normanskill chert in bedrock outcrops. Since this occupation dates from the final Pleistocene, it seems likely that vegetation was rather sparse on the rocky hill, where the modern humic cover had not yet developed. At best, perhaps, scattered conifers, dwarf willows, sedges, and grasses had obtained a foothold. Thus, the view in any direction may have been almost entirely unobstructed by trees, and the summit of the hill would have provided an ideal vantage point for observing the movements of game in the surrounding terrain, including the adjoining Hans Vosen Kill Valley.

At one time or another, the whole summit area of West Athens Hill was exploited. The debris of quarrying and chert-knapping covers the top and upper slopes of the ridge. The evidence from Area B was originally interpreted to mean that human activities were concentrated in rather small loci, either workshops or nuclear family domiciles. The artifact types in each locus seemed to reflect a wide range of behavior, relating to the hunt, the butchering of game, the mining and working of chert, and possibly the processing of bone, hides, and wood. But my reanalysis shows the

⁹ It should be noted that true blades and polyhedral or prismatic cores are extremely rare in eastern Paleoindian assemblages, though they have been reported for Clovis in the western United States.

so-called “clusters” to be much less convincing and less well defined than I once believed, in part because of prior disturbance in middle units of the excavation grid. Apart from the problem of the clusters, our data do not indicate spatially separated zones of specialized activities on the site, such as heat-treatment of chert, butchering of game, processing of hides, manufacturing of dart shafts, and so forth.

It is quite certain that the West Athens Hill site was a prehistoric chert quarry. But the precise nature, sequence, and scheduling of the extraction process and the organization of work parties remain unknown. The bathtub-shaped pit atop Area A, containing 16 cobble hammerstones, suggests that promising veins were worked to exhaustion by digging downward. In other areas, the Indians attacked the exposed strata still visible today on the side slopes of the summit. Cobble hammerstones, most not of particularly large size, apparently sufficed to separate the good-quality material from the matrix. In Area C, chert-rich bedrock sections projected up above the ground surface or lay flat just under leaf litter. The pictured outcrop (see Figures 13 and 15) had a scalloped edge that resulted from knocking off large chunks of chert. There were also small, oval-scarred areas on the top from use as a platform for quartering blocks. The quarry technology described for the Wallkill Valley chert resources by La Porta (personal communications, 1990–1999), including large, discoidal quartzite “picks” or “wedges,” is not in evidence at West Athens Hill. However, one such object of unknown cultural and temporal provenience was found by Thomas Weinman on the surface at the Scott Farm Quarry.

The West Athens Hill site was also a workshop, where bifaces were roughed out and in some cases finished. Clearly, fluted points were manufactured on site, as shown by the moderate number of fluted points in process in addition to finished fluted points. Along with broken finished points, this implies that weapons such as darts or spears with point tips broken off during the hunt, but the bases still attached, were brought to the site, the

basal fragments discarded, and newly made points attached. But if this was a regular occurrence, then why are there also a fair number of tip and midsection portions of finished fluted points? Why would tips and midsections of broken points be brought to the quarry-workshop along with the bases, instead of left in the field? The Stage 4 fragments do not appear to have broken during efforts at edge retouch or end thinning; the fractures apparently resulted from force exerted against the faces and tips of the bifaces. Perhaps some fluted points were broken on site because they were secondarily used as knives.

Stage 3 and 4 bifaces, other than fluted points, were only moderately abundant in Areas A and B, and rare in Area C at West Athens Hill. These include finished biface knives. All these knives are fragmentary and some were possibly broken in use at campsites and brought to the site, still in hafts, to be replaced. This suggests that many advanced bifaces were carried off site and finished at other localities. But on the other hand, most of the knife fragments are tips rather than bases. It seems illogical for tips as well as hafted bases to be brought to the site, rather than left at the place where breakage occurred. It appears instead that most knives were manufactured, used, broken, and discarded on the site. This inference, and the presence of the tip and mid-sections of finished, broken Stage 4 fluted points, pose a problem unless the West Athens Hill site was a multipurpose encampment as well as a quarry-workshop.

More than quarrying and biface production also seems indicated by the abundance of scrapers. Unifaces were probably also produced on site, although this has not been systematically investigated in the debitage. The wear on scrapers from Areas A and B consists mostly of edge-crushing, very possibly from use on hardwood and bone in the manufacture of dart shafts and bone tools. Scrapers from Area C show a different pattern, chiefly rounding and gloss on the working edges; this may indicate use on softer materials such as

animal hides, soft wood, or bark. Furthermore, the apparent artifact clusters in Area B (those that upon restudy appear to retain some validity) may represent restricted activity loci, in each of which the same basic activities were performed. Even in the absence of features and post molds it is difficult to escape the notion that the clusters were family dwelling and working areas. On the other hand, both clusters and features were absent in Area C.

If the lack of features means the Indians did not camp on site, we must envision the possibility that they camped nearby somewhere on the flats, scaling the hill to quarry chert, make bifaces, refit darts with new chipped stone points, manufacture bone and antler tools and weapon shafts, and work hides. Based on surviving evidence, no features were constructed, nor food cooked, and so on. Furthermore, we must assume that, when finished with their tasks, they walked back down the hill to their campsites, where they built fires, cooked food including meat from successful hunts, and carried out other tasks not necessarily accomplished on top of the hill. But this scenario seems eminently impractical. If the camps were on the flats not far from the hill, the trip up or down probably took 15 minutes, a 30-minute round trip. Once chert was acquired or bifaces roughed out, why stay on the hill for all the other inferred tasks rather than return to camp? It would seem that heat treatment of chert, finishing of points and other tools, hunting, butchering, hide-working, wood-working and other activities, would most efficiently be conducted on or near a camp, not on a hilltop quarry visited for short periods. But if people were living, quarrying, and knapping chert and performing other tasks on top of the hill, why aren't there any hearth features? I am unable to offer a convincing answer.

The sediments on the hilltop should show reddened patches from oxidation of iron salts by fires—but no convincing reddening was observed. Basin- or saucer-shaped features indisputably of human construction were also

absent. There should be numerous rock fragments displaying both reddening and angular edges from exposure to high temperatures. Again, a very small number of indisputable fire-cracked rocks were found. These could be from Archaic and Transitional occupations rather than Paleoindian, however. There should also be charcoal from fires in the undisturbed Area B deposits, but none was found apart from the historic charcoal in Feature 1 and in other concentrations in Area B believed to be from burned tree stumps.

Utilization of West Athens Hill by Paleoindian bands or work parties was probably confined to no more than a few days per visit, perhaps occasionally only a few hours, and could have occurred at any time of the year. The notion of very brief and sporadic visits seems to be supported by consideration of the situation in Area B. There the artifact clusters were limited in number and size, and if my original interpretation of the stratigraphic data is correct, only from three to five loci in the excavated area could have been occupied simultaneously. These figures should probably be lower, since not all the clusters from one stratigraphic set were necessarily coeval. If the occupations had been long and intensive, and repeated over decades or even centuries, the locations of activities would have shifted around within the area, more objects would have been deposited, and more overlapping would have occurred, with consequent "smearing" of the artifact distribution. A limited amount of such overlapping may have occurred in the case of Clusters 4 and 11. Individual bands did not necessarily return to West Athens Hill every time they needed some chert, since there were equally fine sources available nearby at places like Flint Mine Hill (Brumbach and Weinstein 1999; Parker 1924), the Mountain Top Quarries, and the Scott Farm Quarries.

The exotic materials used for some chipped stone artifacts, including Pennsylvania jasper, Vanport chert (Flint Ridge "chalcedony") Upper Mercer chert, and western Onondaga chert are a clue to the high mobili-

ty of the Paleoindians who used the site and they again suggest that hilltop activities were not limited to quarrying and lithic reduction. This does not mean, however, that in all cases visits were actually made by these people to the sources of the stones in Pennsylvania or Ohio. It is equally reasonable to suppose that, for example, a band roving the lower Hudson valley on its way to the middle valley would occasionally encounter a band from eastern Pennsylvania, with the result that chert and jasper specimens would be exchanged and carried farther from their points of origin.

Where might other Paleoindian sites be found? Since only West Athens Hill, Kings Road, and Swale are on record for the large area from the northern Hudson valley south to Twin Fields in Ulster County, and none are on record in counties east of the river, it is premature to construct a model of Paleoindian subsistence-settlement systems and seasonal rounds. It would be sheer fantasy to propose such functional types as fishing, fowling, berry picking, and chert-knapping stations as integral parts of the system that comprised the West Athens Hill quarry-workshop and the possible Kings Road/Swale caribou hunting encampment. Nevertheless, we should expect more variability in settlement types than indicated by the list of known sites, most of which are assumed to be hunting/butchering/biface-producing encampments. Such assumptions should be provisional in view of the major gaps in our knowledge.

But where might additional Paleoindian sites be found in Greene County? The available data show that sites and isolated finds of fluted points occur in much the same places as subsequent Archaic peoples. In other words, they are all over the landscape. Some Paleoindian sites including quarry-workshops might be found west of the Helderberg Escarpment, where there are a number of small quarry-workshops of largely unknown cultural provenience. Some of these sites were systematically investigated during surveys along the Iroquois Pipeline right-of-way,

which passed through Greene County on its way to the Hudson River and Connecticut (Cassedy 1996), but no Paleoindian components or stray fluted points were found there.

Extensive workshops are to be found atop other chert-bearing ridges in Greene County, including the Mountain Top Quarries, Scott Farm Quarry, and Flint Mine Hill. Early stage bifaces have been unearthed from Scott Farm and Flint Mine Hill (Brumbach and Weinstein 1999; Weinman and Weinman 1969, 1977). Two fluted points in process have been recovered from the highest portions of Flint Mine Hill. But the extent to which Paleoindians lived as well as worked atop these ridges remains to be established. As at West Athens Hill, no features were observed in the excavations of the State University at Albany on Flint Mine Hill (Brumbach and Weinstein 1999) or the Pleasantdale quarry near Troy (Brumbach 1987). Certainly there is much to be learned through research on chert quarries that were exploited by Native American groups of all prehistoric periods.

At least two fluted points were found by collectors at multicomponent workshops on the clay flats surrounding Flint Mine Hill. One also turned up in testing an area at the nearby Coxsackie Correctional Facility, and another at the location of a compressor station for the Iroquois Natural Gas Pipeline (Karen S. Hartgen, personal communications 1993, 1997). It seems probable that additional sites comparable to Kings Road/Swale exist in other places on the Athens Flat. Yet others may exist in the largely unsurveyed terrain of low hills and occasional chert-bearing outcrops east of the flat and west of the river. So far neither fluted points nor fluted point sites have been reported at low-lying terrain along the river, as for example at Four Mile Point (Funk 1976; Schambach 1962). It seems clear that in the absence of an effective predictive model of site locations, new Paleoindian sites may only be discovered by extensive coverage of Greene County on foot.

What happened to the people who occupied West Athens Hill? The same groups who exploited the chert outcrops there must also have visited other sources such as Flint Mine Hill and Scott Farm. Also, different groups must have visited the site at different times. Presumably, the bands were not permanent residents but usually moved on to new hunting grounds, like the fictional people in the Prologue to this report. Newcomers must often have entered the area from adjoining regions like the Delaware Valley. Eventually, the regional cultural configuration changed until its artifact traits were no longer identifiable as Paleoindian, a pattern repeated across North America by around 10,000 radiocarbon years ago. This means that projectile points were no longer of fluted lanceolate form, although the other identifying traits such as spurred end scrapers and large retouched flake side scrapers probably persisted into immediately following complexes. This episode of cultural change may have been stimulated by the climatic and biotic changes that accompanied retreat of the Wisconsin ice sheets. The ultimate result was the series of manifestations known as "Archaic" that represented adaptations of eastern New York populations to early Holocene ecological conditions.

Almost certainly, the area of Greene County was never completely depopulated after the close of the Paleoindian era. The same goes for the rest of the Northeast. But there are 2,000 "missing" years in the extant archaeological record for Greene County. The next-oldest occupation we can be sure about consists of bifurcated-base projectile points from Area B at West Athens Hill and in collections from other local sites. These types have been radiocarbon dated elsewhere at ca. 8,000 B.P. (Broyles 1971; Chapman 1977; Justice 1987).

There is little information on the pre-bifurcate occupations of the Hudson valley. In the Southeast, on Staten Island, and in the Upper Susquehanna Valley, the preceding horizon is known to comprise Kirk Corner-Notched

points and other notched forms, dated as far back as 9,500 years (Broyles 1971; Funk 1976, 1983, 1993; Ritchie and Funk 1971, 1973). But the interval between Paleoindian and Kirk remains a mystery in the Northeast. In the Midwest, Southeast, and parts of Canada, the transition from fluted points to later Archaic horizons is represented by late Paleoindian unfluted lanceolate projectile point styles, but there is meager evidence for a lanceolate point horizon in New York and New England (Benmouyal 1987; Funk 1978, 1983; Funk and Schambach 1964; Gramly and Funk 1990; Ritchie 1953, 1957; Wright 1972). Bridging the gap after the lanceolates in the Southeast and Midwest is the Dalton complex, defined chiefly by a group of distinctive point styles collectively known as "Daltons" and some associated traits. Daltons often display long basal thinning flake scars similar to fluting, and were probably derived from the fluted point technological tradition, although the blade form varies. The culture is radiocarbon dated ca. 9000–10,000 B.P. (Gramly and Funk 1991; Gramly 2002; Goodyear 1982).

But a Dalton horizon has not been identified in the Northeast and no convincing occupational remains of comparable age have come to light. Dalton points are rarely seen in northeastern surface collections. Possible alternative candidates have been suggested (Funk 1991). Until concrete evidence is available for something like Dalton, I offer the hypothesis that regional Paleoindian bifaces evolved first, into a lanceolate point tradition similar to Crowfield and Plano, then into a complex featuring as yet unidentified projectile points, perhaps triangular or lanceolate triangular in form but not yet recognized in surface collections because they resemble triangular points of later Archaic and Woodland periods. Convincing evidence of such occupations has yet to be found in context on single-component or stratified multicomponent sites. But triangular points of variable form are occasionally recovered from the deep Archaic levels of stratified sites, including caves and rockshelters. Whatever their identity, the earli-

est northeastern Archaic occupations remain elusive. Perhaps Indian populations were relatively small because there were environmental constraints on the adaptations of hunters and gatherers in the early Holocene period; hence there would be relatively few sites distributed over the landscape, and the existing sites might be small, poor in occupational debris, and hard to find (Funk 1996).

It is assumed that the complexes that followed, and presumably evolved from, the hypothetical Dalton-like horizon were represented by the Kirk, and possibly Kessel, St. Charles, and other Early Archaic projectile point types first described in the Southeast (Justice 1987). Unfortunately, despite the best efforts of archaeologists, key projectile point types are weakly represented in surface collections, and no single-component or stratified stations containing occupational remains of these periods have been found and excavated in the Hudson drainage. Kirk components were, however, excavated and radiocarbon dated ca. 9,000 B.P. in the Upper Susquehanna Valley. The somewhat better known bifurcated-base complexes succeeded the Kirk horizon (cf. Ferguson 1995; Funk 1993, 1996). The following Middle Archaic Neville horizon of about 7,000 years ago is fairly well understood, largely as a result of investigations by Eisenberg (1991) at the Mohonk Rockshelter, situated atop the Shawangunk Mountain Ridge near New Paltz, and by research in other parts of the Hudson valley (cf. Dincauze 1976; Funk 1989, 1991a, 1991b, 1996).

Despite the partial disturbance of West Athens Hill by construction of an access road and foundation for the mobile telephone relay tower and the limited and sporadic but ongoing looting by collectors, a considerable area of the deposits remains intact. Unquestionably, the site has the potential to yield additional information on Paleoindian occupations of the Hudson drainage basin. Therefore, it is hoped that ways will be found to protect the summit from development and prevent further mining of the hillsides. Several times in past years the writer and his colleagues tried to arrange for the State of New York to purchase the property and provide some measure of protection. Unfortunately, those attempts failed.

Since West Athens Hill is listed on the National Register of Historic Places, it is subject to Section 106 Review if threatened by federally funded or licensed construction projects. This review would ensure that serious consideration be given to the site's various qualities, including but not necessarily limited to the significant prehistoric components. The outcome would be either a limited and systematic excavation of areas to be adversely impacted, or preferentially complete preservation of the site from any disturbance by federal government actions. But private home building remains a possibility and looters continue to damage the site. Unfortunately, we will never have complete information on the types and quantities of artifacts removed from West Athens Hill by collectors over the last 40 years.

ACKNOWLEDGMENTS

The writer was assisted in the 1966 excavations by four Science Research Aides: H. David Tuggle, J. Cynthia Weber, Daniel Danker, and R. Michael Gramly. The crew in August 1969 included Ralph M. Houck, J. William Bouchard, Neal Trubowitz, and Beth Wellman. Wellman was a staff archaeologist at the State Museum and still is. In 1970, the team consisted of Houck, Bouchard, Wellman, and Ronald C. Corbyn.

Many volunteers from the New York State Archaeological Association contributed their labor to the excavations on this important site. Of this group, the dedication of R. Arthur Johnson was particularly outstanding. The writer is grateful to all of these people for their valuable assistance.

Assistance in interpreting the sediments at the site was provided by glacial geologist G. Gordon Connally, then in the Department of Earth Sciences at the State University at Buffalo. M. Raymond Buyce, Curator of Mineralogy, Geological Survey, New York State Museum, analyzed the collected soil samples. Donald M. Lewis, Palynologist in the Biological Survey, processed the pollen samples, and Edward Landing, State Paleontologist, also in the Geological Survey, examined the possible petroglyph from Area B.

David R. Wilcox, Laboratory Worker (until 1968), and his successor, Beth Wellman, were of great assistance in analyzing and classifying the materials collected at West Athens Hill.

Wellman and Anthropology Curator Charles E. Gillette catalogued the collections. As previously noted, Wellman carried out the tedious chore of counting and classifying the thousands of cores and flakes recovered from Areas A and B.

I am also indebted to officials of the New York Telephone Company (the company has since changed its name, first to Bell Atlantic and presently Verizon), who granted permission for the investigations in 1966, 1969, and 1970.

Comparative analysis was facilitated by access to important collections of Paleoindian artifacts from other sites. Thomas P. Weinman loaned me his materials from the Kings Road and Swale sites, and Joseph Diamond, Department of Anthropology, State University of New York at New Paltz, made available the collection recovered from the Twin Fields site by the late Leonard Eisenberg. R. Michael Gramly, then at the Buffalo Museum of Natural History, donated the materials he excavated at the Potts site to the New York State Museum. The collection from the Corditaie site was donated to the Museum by the discoverer, Noel Strobino.

Finally, I wish to express my appreciation to the New York State Museum for providing budgetary support for the research, including field equipment, field vehicles, travel expenses, and laboratory facilities.

APPENDIX

DESCRIPTIONS OF CHERTS COMMONLY FOUND ON PREHISTORIC SITES IN EASTERN NEW YORK

The cherts of the middle Hudson valley have been characterized by several researchers (Hammer 1976; Kuhn and Lanford 1987; Lavin and Prothero 1981; Wray 1948). Methods of analysis vary, but the chief approaches are visual examination with a petrographic microscope and trace element analysis using x-ray fluorescence. Here the emphasis is on visual qualities. Fine structure emerges under the microscope, including crystals and particles of varying composition as well as fossils. The following characterizations are selective paraphrases of those published in Wray (1948), Hammer (1976), and Lavin and Prothero (1981).

Little Falls or Knauderack chert. Upper Cambrian in age. Colors are tan with milky blue inclusions, grading into milky medium gray, Munsell N4 to N6. May be mottled with limestone and quartz inclusions. Some varieties tend to blue, gray and white, dark brown, and even red.

Petrographic analysis indicates a very fine-grained, even textured chert with abundant well-rounded clastic quartz grains, sometimes showing undulose extinction. Muscovite flakes and small amounts of opaques—usually hematite—are present. Large euhedral dolomite rhombs and their pseudomorphs, and ghosts of ooids and fossils, are often present; all are commonly rimmed with hematite. Hematite also occurs in beds. Small patches of chalcedony are often present. Well-defined relict bedding is visible in some specimens. Intra-outcrop variation is minimal.

Fort Ann chert. Also of Cambrian age.

Colors are creamy blue, dark pearly blue, dark cobalt blue, Munsell value 5. Slight vitreous luster, weathers gray with yellow-brown stains.

Whitehall/Ticonderoga chert. Similar to Fort Ann chert. Also called **Beekmantown chert** or **Mount Independence chert**. Blue-black to black.

Deepkill chert. Lower Ordovician in age; underlies the Normanskill formation. Distinguished by its predominantly apple-green color, and its tendency to weather brownish. There are also gray, blue-gray, and red varieties. The Deepkill formation is the oldest chert-bearing shale in New York State.

Normanskill chert. As explained above, this term has been used by archaeologists as a general term for the material that characterizes the **Mount Merino** subunit of the series and predominates in the outcrops at Flint Mine Hill, West Athens Hill, Scott Farm, and other places in Greene County. Also Lower Ordovician in age. The colors are primarily green, green and black, black, blueish green, and dark olive green. It sometimes occurs in red, red with black, grayish green, and dark gray. Munsell colors include: 5BG 4/1, 5BG 3/1, 5GY 3/1, 5GY 4/1, 5GY 5/1, 5B 4/1, 5G 3/2, 5Y 3/1, and 2.5 YR 3/2. Texture is smooth, luster varies from dull to waxy. Mostly weathers white or brown.

The **Indian River** subunit of the Normanskill series also produces gray, green, and black cherts, and less often, red cherts. The **Austin Glen** member is not known to contain cherts.

Snake Hill chert. Middle Ordovician. Restricted to Saratoga County. Actually an indurated siliceous shale. Greenish gray in color, white weathering. It is splintery and not of good quality for flaked stone tools, though it was sometimes quarried and used by Indians living in the area.

Helderberg cherts. Lower Devonian in age. Hammer (1976:50) lumps the four chert-bearing members of this sequence (Kalkberg, New Scotland, Becraft, and Alsen) together. "All of these cherts are black or very dark blueish black with a characteristic white dendritic scaling which occurs parallel to the original bedding plane. The cherts are smooth and waxy and may have pockmarks or pure inclusions scattered throughout; Munsell N2 to 5BG 2, 5BG 1." They weather to a thin, gray-to-white coating.

Within this group, Lavin and Prothero (1981) describe Alsen chert as having numerous well-preserved Lower Devonian fossils of corals, bryozoans and brachiopods, usually showing replacement to chalcedony. Dolomite is present, usually as numerous small rhombs, but few to numerous large rhombs may also occur. Pyrites and small amounts of carbonaceous matter are also present. Intra-outcrop variation is minimal.

New Scotland chert is a strongly chalcedonized carbonaceous chert. Large angular, anhedral grains of clastic quartz occur. Ghosts of carbonate clasts, dolomite rhombs, pyrites, and abundant fossils including trilobites, brachiopods, and corals are present. Iron oxides, chalcedony spherules, opal and segregated zones of clean chalcedony, and opaque-laden carbonate-rich chert may sometimes occur.

Kalkberg chert is very fine-grained and uniform in texture. It is predominantly a silicified limestone with carbonates comprising 30–55 % of each slide. Dolomite rhombs, when developed, are usually small. Pyrites and carbonaceous matter are present. The latter clouds calcite and forms ghosts, styloitic seams, and pelletoids. Anhedral, angular clastic quartz is often present; it is much finer-grained than quartz in the New Scotland spec-

imens. Fossils (trilobites, brachiopods), fracture planes recrystallized with calcite, sparry calcite pseudomorphs of fossils, dusty calcareous aggregates, and opaques (including iron oxide) may sometimes occur. There is only a minor development of fibrous chalcedony; strongly chalcedonized chert and chalcedony veins are uncommon.

Glenerie chert. Lower Devonian. Colors blue to shiny black, dull, Munsell N2. Vitreous and granular. Weathers to drab gray, often with reddish stains.

Oriskany chert. Also Devonian in age. Dull black with quartz grains included, Munsell N2.

Esopus chert. Lower Devonian. Color dull, dark and muddy black or gray, Munsell N3. Weathers to a slight grayish cast.

Eastern Onondaga chert. Middle Devonian. "Color ranges from dark brownish blue to blueish black to black, Munsell N2 to N3, value 2 to 4. The chert is hard, smooth, and waxy" (Hammer 1976:48).

The bedrock sources of central and western New York Onondaga cherts are outside the Hudson-Mohawk drainage, but are described below because they often occur in Paleoindian chipped stone assemblages of the region.

Central Onondaga chert. Middle Devonian. A cloudy dark to brownish blue chert. Smooth and waxy, Munsell value 4 to 5.

Western Onondaga chert. Middle Devonian. Color from tan, khaki, through light gray to milky blueish white, Munsell 5YR4, N6, N5. Texture smooth and waxy, colors mottled and cloudy.

The Onondaga cherts are generally fine-grained. Dolomite is common as is fine patches and/or rhombs. Both large and small rhombs occur. Pyrites are always present. Fossils of brachiopods, corals, crinoids, and bryozoans are often well-preserved. Chert is strongly chalcedonized. But fibrous chalcedony frequently occurs as veinlets, seams, patches, and spherules.

Kuhn and Lanford (1987) studied samples of Kalkberg, Normanskill, and Beekmantown

cherts using x-ray fluorescence. Relative proportions of iron, rubidium, strontium, and zirconium were examined, and with the aid of statistical programs, the investigators were able to differentiate the samples from the three main bedrock sources. The technique showed promise as a means of identifying chert samples from archaeological sites, but there were some problems with correctly discriminating

Helderberg cherts from Normanskill cherts due to very similar trace element profiles.

Cherts from Cambrian and Ordovician formations in the Wallkill drainage of New York and New Jersey have been studied by La Porta (1996). They are rarely seen in archaeological collections from the middle Hudson valley and will not be described here.

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